

# Graduate Student Teacher Education

## Orientation and TA training

Report Prepared By  
Kelly Myer Polacek

Biological Sciences Department  
California Polytechnic State University  
San Luis Obispo, California

December 10, 1999

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## **ABSTRACT**

Graduate student Teaching Associates (TAs) in the Biological Sciences department at Cal Poly teach a significant number of introductory biological sciences courses. Most incoming graduate students have no formal education training. Previous research shows that utilizing TA training programs results in an increase in perceived student learning or higher TA performance evaluations. Using preexisting workshops and information provided by graduate student surveys, the Biological Sciences department implemented its first ever general graduate student orientation and teacher education workshop. The week-long workshop included meetings specific to both new and returning graduate students. Evaluations immediately following the education workshop indicated the workshop addressed the needs of teaching graduate students and provided them with techniques and skills to aid in the preparation and execution of lab exercises. Mid-quarter evaluations indicated that graduate students were indeed utilizing the techniques and skills provided during the conference. Additionally, graduate students expressed interest in continuing their teaching education by attending short, quarterly meetings that include workshopping and cover other topics not discussed during Fall Conference week. The Graduate Coordinating Committee in the Biological Sciences department was provided with an evaluation of the entire conference. Suggested options to enhance future TA training included offering an expanded teacher education workshop, designing a graduate-level biology course focused on teacher education, and compiling a graduate TA training manual. It was recommended that the orientation week offered during September 11-17, 1999 be implemented as an annual component of Fall Conference week and a mandatory part of the graduate student experience in the Biological Sciences department.

# INTRODUCTION

## Recent Trends in College Education

Recent trends in college science education include the incorporation of active participation, cooperative and inquiry-based learning in lecture and laboratory classrooms. Several reports of efforts to increase student learning in specific laboratory courses have been successful. At Weber State University, Ahern-Rindell designed her 400-level genetics course to include a long-term DNA fingerprinting project utilizing guided inquiry-based cooperative learning (1999). Additionally her course included a weekly student-led discussion of a supplemental text which students remarked increased their opportunities to think critically. She suggests that her experience in cooperative and inquiry-based learning was successful, and that the most challenging aspect of incorporating this type of teaching is avoiding directly providing students with knowledge and allowing to the students to learn the information on their own (Ahern-Rindell, 1999). Colosi and Zales report that jigsaw cooperative learning increased involvement in lab exercises and communication among their general biology students (1998). Klionsky taught the first half of his introductory biology course in a traditional format and the remaining half in a cooperative structure. He reports his students performed better on exam questions in which the relevant material was discussed in small groups rather than lecture format (1998). Using cooperative groups of five in which each student assumed a specified role, Trautwein et al. have increased student preparedness prior to anatomy class and increased student performance on exams (1997).

These efforts aimed at increasing student learning using formats other than lecture have proven an efficient means for obtaining this goal. Although authors from the previous papers were experienced professors, each reported meeting several challenges in implementing these teaching pedagogies. Even for professional educators the implementation of active participation, cooperative and inquiry-based learning was difficult. It is unlikely that anyone unaware of these methodologies would incorporate these techniques into his/her classroom without some kind of formal training.

## **The Biological Sciences Department Graduate Program, California Polytechnic State University, San Luis Obispo**

The Biological Sciences department graduate program offers its student a variety of experiences. Students can research and defend a thesis or develop an independent, biologically-related project. Like many large universities, the Biological

Sciences department is proud to offer its graduate students opportunities to teach at the undergraduate level. A 1997 survey by Rushin et al. indicated that 97% of the universities responding in the survey employ graduate student TAs in their biology classes. In the last seven years, the graduate program in the Biological Sciences department has grown from an average of 12 to 35 actively enrolled students each year. This recent expansion has been accompanied by an increase in the number of TAs within the department. The Biological Sciences department employs approximately 25 - 30% of the campus's TAs. On an annual basis, TAs in the Biological Sciences department teach 91%, 59% , and 29% of the sections offered in greatest number, BIO 105, BACT 221, and BOT 121, respectively (see Table 1 and appendix A1 for further analysis).

Table 1. Percent of lower division courses taught by graduate student TAs during the 1998-1999 academic year

Course	No. of Sections/yr.	% Taught by TAs
BACT 221	22	59
BACT 222	3	0
BIO 105	34	91
BIO 127	4	75
BIO 128	6	33
BIO 129	5	80
BIO 151	15	53
BIO 152	7	14
BIO 153	15	40
BIO 207	1	0
BIO 228	2	100
BIO 253	1	0
BOT 121	17	29
BOT 223	9	22

Because graduate students teach a large percentage of laboratory courses, it is often the TA who provides an introduction to science for the undergraduate (Nyquist and Wulff, 1996). For example, in the 1998-1999 academic year, 53% of the introductory biology courses for science majors (BIO 151) and 91% of the courses for non-science majors (BIO 105) were taught by graduate students. Many of these graduate students are recently graduated and have little or no previous teaching experience. Fedock et al. (1996) note that college level instructors tend to teach in the same format in which they were taught, usually a traditional lecture format. It is suggested that inexperienced TAs, without training to become aware of other teaching techniques, will also teach in this lecture format.

As of 1998, opportunities for Teaching Associate orientation were limited to two short meetings. The first meeting was a campus-wide TA orientation organized by

the Department of Research and Graduate Programs. This meeting was usually held during the week prior to the start of classes. It provided useful information regarding Racial and Sexual harassment and Disabled Students Services, but did not educate TAs in classroom management, instructional skills, active participation, cooperative and inquiry-based learning. Additionally, it was a campus-wide orientation and did not provide techniques specific to laboratory instruction. The second meeting was organized by the Biological Sciences department and was limited to a general graduate student meeting held for one hour during the first week of classes. This mandatory meeting included speakers regarding department provisions and protocol, computer services, and Graduate Coordinating Committee updates. This meeting was too short to provide a thorough orientation for new students and was repetitive in nature for returning students. This meeting also did not provide information specific to teaching in this department.

In 1998, recognizing the large amount of teaching performed by TAs in the department, the GCC designed "Guidelines for Teaching Associates in the Biological Sciences Department" (appendix B1). These guidelines detailed a more rigorous TA selection, preparation, supervision, and evaluation process and emphasized the need for a more formal TA training program. It was hoped that new criteria in each of these areas would be voted on and implemented by Fall 1999. Although no formal motions have been made at this time, the GCC recognizes the need to review and implement these guidelines.

## **Teaching Associate Training**

The stresses of the incoming graduate student can be exhaustive. Many new graduate students spend their first quarters becoming oriented with the department, researching thesis projects, and becoming familiar with the campus and the surrounding community. (On average, approximately 10-15% of the new graduate students in the Biological Sciences department are undergraduates of Cal Poly.) It is unlikely that new students have any time to engage in self-directed teacher education. A 1992 survey of the leading mathematics departments in the U.S. indicated that at least 94% (n = 36) provide teaching assistant orientation programs (Case and Blackwelder), however, graduate student TA training in biological sciences is not widely provided. Of 73 universities with a terminal masters, 61% of those provided no formal teacher education and only 12% required a pre-academic year training workshop (Rushin et al., 1997).

Universities that employ graduate students as TAs experience similar situations in which TAs are largely responsible for teaching introductory courses but inexperienced in both practical aspects of teaching (i.e. syllabus design, rubrics, office hours) as well as teaching and learning styles (active participation, cooperative learning, Blooms' taxonomy, evaluation and assessment). Some universities compensate by holding various teacher education seminars and workshops to familiarize TAs with courses within the department and recent developments in teaching. Extensive training occurs at Florida State University at Tallahassee where all biological science masters and doctoral candidates are required to teach at least two different courses (Rushin et al., 1997). The weeklong seminar provided at FSU includes information about learning styles, effective speaking, professionalism, teaching pedagogy, and provides video-tape critiquing and model instruction (Lumsden, 1993). The University of California, Santa Barbara offers a graduate level quarter-long course entitled "Biology 502: T.A. Teaching Techniques" (Alldrege, 1994). This course includes topics such as getting through the first day, TA expectations, leading discussions, writing and grading exams, and academic dishonesty. Information is compiled in a supplemental TA manual (Alldrege, 1994).

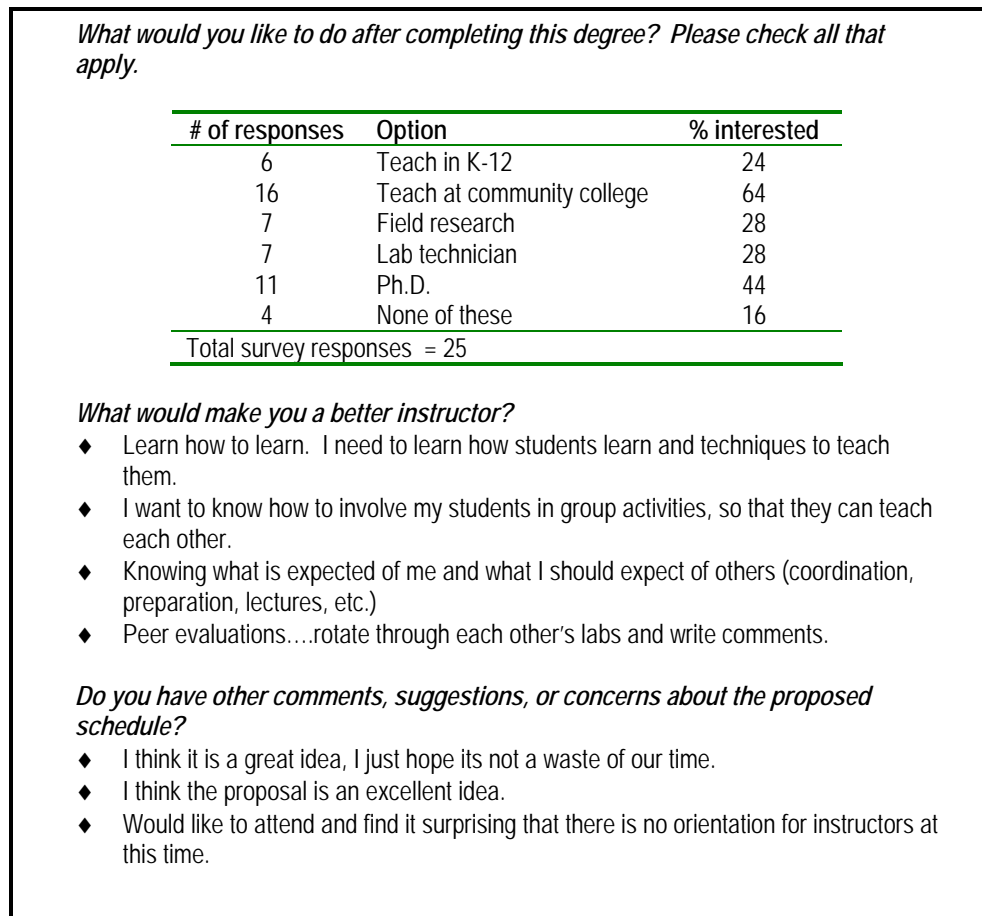
Universities that provide TA training report noteworthy improvements in the learning of the undergraduates of those courses. At the University of Missouri, student evaluations of TAs who have attended the TA training program receive performance scores of 87% of maximum, as compared to the average 71% from year prior when TA training was not available (Rushin et al., 1997). Improvements on a pre-existing TA training course in the Physics department at the University of Minnesota resulted in the students of that course feeling they learned significantly more in labs in which TAs had "training" as compared to other labs they had taken (Lawrenz et al., 1992).

Given that:

- an increase in perceived student learning (Lawrenz et al., 1992) or higher TA performance evaluations (Rushin et al., 1997 ) occur(s) when TA training programs are utilized,
- that incoming graduate students have no formal education training and are not likely aware of techniques for increasing student learning,
- when applied in laboratory settings, active participation, cooperative and inquiry-based learning successfully increases student learning (Ahern-Rindell, 1999; Klionsky, 1998; Colosi and Zales, 1998), and
- TAs teach a significant amount of the introductory biological sciences courses at Cal Poly (see Table 1),

it was deemed necessary to provide a more extensive and focused teacher education in the Biological Sciences department. Information provided in graduate students surveys, suggestions of faculty, and existing TA training programs at other universities (Lumsden, 1993; Alldrege, 1994) were used as models in the design of a teaching workshop which addressed the TA preparation portion of the "Guidelines for Teaching Associates in the Biological Sciences Department" (appendix B1).

**Figure 1. Graduate student education survey, March 1999.**



# PREPARATION AND PLANNING

## Surveying Graduate Student Interest

In March 1999, a workshop was proposed that consisted of a one-day orientation which included a general graduate student orientation as well as a teacher education workshop. Prior to the workshop, currently enrolled graduate students were surveyed to determine their future goals beyond the Biological Sciences graduate program. A questionnaire (see appendix C1) asked graduate students to identify what would make them better instructors and list topics they wished to be discussed at the teacher education workshop. This information was used to design a workshop which addressed graduate student needs. Summaries of responses to three questions are shown in Figure 1. (Complete student responses are in appendix C1.)

When asked the question What is one piece of advice you would give to incoming TAs?, at least 28% (7 of 25) of students recommended that a new TA “sit in” on another lab, or get assistance from another TA prior to teaching a new class. At least 12% (3 of 25) responded by saying “know the material”. Although useful suggestions, these responses focused primarily on the TA gaining knowledge about the lab and its contents, and not on establishing an environment of maximum student learning. One student’s response to this question was “Always teach to the student’s abilities - to easy or conversely, too difficult of an approach to presenting the subject matter, will lose them quickly”. It was evident at the time of this orientation that very few graduate students actually knew how to determine students’ learning abilities, or modify their teaching styles to accommodate them.

## Preparing a Schedule: Challenges

In March 1999, the first draft of a schedule for the graduate student orientation and education workshop was proposed to the GCC and the graduate students (see appendix D1 for a complete copy of the original proposal). This original schedule consisted of a one-day orientation, including a session for general orientation and a separate teacher education workshop. This original proposal required meeting several challenges.

The first challenge was finding an appropriate time to host an orientation and education workshop. It was determined that Fall Conference week was the optimal time for this workshop. At this time it was believed that our goals could be accomplished in one day, considering one day was more orientation than had previously been offered graduate students. Historically, the graduate student meeting on the first Thursday of each quarter was either overwhelming to new students or repetitive

for returning students. The second challenge was providing appropriate information for both groups of students. This was accomplished by having two separate orientations, one in which the new students arrive early to receive basic information about the department (i.e. mailroom, keys, etc.) and a second, later, general meeting which all students attend. The third challenge was establishing and enforcing mandatory attendance. The GCC determined which scheduled events were mandatory. This was ultimately conveyed in color on the schedule sent to graduate students (see page 10; note the expanded schedule). Holding this orientation during a conference week designed for faculty preparation and departmental organization added to its importance.

Approval of this initial proposal was followed by reservations for facilities (the Biological Sciences Museum) and some speakers such as Dr. Don Maas, professor from the University Center for Teacher Education. Dr. Susan Opava, Dean of Research and Graduate Programs was informed of our efforts at establishing a departmental orientation and teacher education workshop. Dr. Holland, Biological Sciences Department Chair, was in full support of this project and required that the department staff be utilized as little as possible, due to their involvement in other the Fall Conference week events.

## **Schedule Revision**

Further discussions with graduate students, the GCC, and Dr. Elrod brought about suggestions for a revised schedule. Dr. Elrod and I prioritized several teaching topics and finalized a teaching workshop schedule that attempted to respond to the requests of graduate students as per their initial surveys. Since several graduate students recommended "sitting in" on a lab prior to teaching it, a morning of peer instruction was included in the schedule (see Peer Instruction). Although it had not been provided in years past, safety instruction was included in the schedule. Rose Bowker offered a day of computer training, with different items of instruction designed for both new and returning students (see appendix E1). It became apparent that the conference needed to be expanded. The GCC concurred and a new, week-long schedule was agreed upon (see page 10).

The final schedule incorporated both campus-wide events (attendance recommended) and department events (attendance either mandatory or recommended). The conference included social events such as an early morning hike and breakfast. Tuesday's teacher education workshop included discussions of both professional and pedagogical issues relevant to teaching in the Biological Sciences department. Professional issues included syllabus professional appearance and

relationships, effective speaking, and department protocol (i.e. office hours and posting grades). Pedagogical discussions included effective exam preparation, Bloom's taxonomy, and grading. The education workshop consisted of 11 speakers, five of which were professors, two of which were tenure-track faculty, and three of which were graduate students.

## **Peer Instruction**

Gordon and Hoddinott (1994) describe an effective TA training program in which a representative TA serves as both a model instructor and facilitator of weekly discussions of topics such as learning styles and outcomes, and Bloom's taxonomy. We believed peer instruction in the form of model teaching would be an effective approach to teacher preparedness in the Biological Sciences department. Our peer instruction included a representative TAs acting as the instructor and the remaining teaching team acting as students in the course. This allowed for TAs to 1) experience being a student in the course they were to teach; 2) seek guidance from an experienced TA; and 3) work closely with their teaching teams.

Although peer instruction in all lab courses was desired, it was decided that any course with more than one new TA would be supplemented with peer instruction. In fall 1999, there were only three classes with multiple TAs that included new TAs. These were Biology 111, Biology 115, and Biology 151.

## **Course Coordinators**

Success of the workshop depended in part on the involvement and cooperation of course coordinators. Since graduate student TAs primarily teach laboratory courses, the orientation was designed to not only provide basic teacher education, but also provide hints and techniques useful to the laboratory setting. Much knowledge lies in the course coordinators, who often teach the lecture portion of the course, and may also teach a lab section. It seemed ideal to incorporate course coordinators' requests and suggestions into the education workshop. Course coordinator input was to supplement an education workshop that suited the courses specific to the Biological Sciences Department.

Course coordinators for courses scheduled during fall 1999 (see appendix F1), were sent a memo (see appendix G1) in May which requested the following information:

- Name of course.
- Usually offered during which quarters?

- Provide the name of an experienced TA to lead an introductory lab (peer instruction).
- What are the prerequisites to teach this course?
- Your message to potential instructors of this course.

The material requested in this memo was to be distributed at the education workshop to make both new and returning graduate students aware of various course requirements and availability. Additionally, the course coordinators were to help in the selection of representative TAs to lead peer instruction. Sadly, course coordinator input was limited. Only one course coordinator (Dr. Elrod, MCRO 221) responded to this memo. In fact, on a mid-quarter evaluation following the workshop, one student indicated he/she wished “the course coordinator [would have] presented the expectations of the TAs” (see appendix H1).

In addition, Dr. Holland agreed to allocate one hour during the Fall Conference department retreat and scheduled a mandatory meeting during which time each course coordinator met with his/her teaching teams (see appendix I1).

## **Funding**

No department funds had been allocated for this project. Dr. Holland supported spending approximately \$150 for supplies for the mailing (see pages 9-11 for actual inclusions) and for snacks and beverages during the conference (see appendix J1 for itemized budget).

## **Speakers**

Speakers for the education conference were sent confirmation memos on August 16, 1999 (see appendix K1 for example memo and actual copies of memos sent to each speaker. Please note some memos were typed individually; this was due to the large list of items discussed by Harriet Ross, and because Dr. DeJong volunteered to be a last-minute replacement speaker.) These memos included a return confirmation notice, which all speakers returned by the end of August, and a copy of the Tuesday Teacher Instruction Workshop schedule (see page 12). Additionally, a memo was sent to Larry Grimes who coordinated a safety seminar (see appendix L1 for topics covered).

## **Invitations and Publicity**

On August 19, 1999 a package of information was sent to all graduate students enrolled in the 1999-2000 school year (please see pages 9-11 for complete package contents). Each letter was individually addressed and signed by Dr. Holland. Approximately 49 packages were mailed. It was critical to have the entire week planned at this point, because this mailing served as the sole source of information

regarding the orientation for many graduate students. Teaching assignments were made early (August 20, 1999) which ensured all TAs knew the course each was teaching (see appendix M1). As chair of the GCC, Dr. Frey invited all Biological Sciences faculty and staff to meet the new graduate students during the allocated "Meet the Faculty" time, as well as attend the teacher instruction workshop (see appendix N1).

## **People Power**

Graduate student assistance was critical in preparing for the orientation week. Several graduate students volunteered for the following positions:

- Mail merge design. There was no current list of graduate students' names and addresses. A mailing list was created for mailing labels (disk included in back of text).
- Orientation folder preparation. Orientation folders were compiled for new and returning students. New student folders (glossy, monogrammed) were purchased at the Cal Poly bookstore. Folders were distributed on Monday at the general orientation (see memo in appendix O1 for a list of inclusions). See attached example folders at the back of this paper.
- Grad room coordinator. The grad room (33-286) is used as a work area as well as an office for those graduate students who are not teaching. The grad room needed attention. Pictures from social gatherings were hung in the lounge and several posters were hung in the work area.
- Food and beverage coordinator. A graduate student performed all food and beverage set-up and take-down on both Monday and Tuesday of orientation. Food and beverages were purchased from the budget.
- Research display coordinator. Several posters and theses were collected and displayed in the museum for perusal during scheduled breaks (see appendix O1 for copies of labels of displayed items).

See memos in appendix O1 for more complete descriptions of these tasks.

One week prior to the conference (9/8/99), reminder notices were sent to all teaching workshop speakers and contributors (see appendix P1). Additionally, memos were sent to representative TAs who were to lead the peer instruction planned for Friday (see appendix Q1).

## **THE CONFERENCE : SEPTEMBER 11 – 17, 1999**

### **Saturday, September 11, 1999**

Graduate student orientation at Cal Poly began on Saturday, September 11, 1999 at the Graduate Orientation Program hosted by the Department of Research and Graduate Programs (see appendix R1). This orientation was designed to introduce the campus to new and re-entry students. Seven of the twelve new Biological Sciences department graduate students attended. Three of five not in attendance were Cal Poly graduates.

### **Monday, September 13, 1999**

The department orientation began on Monday (see appendix S1) and opened with an icebreaker (see appendix T1). This was followed by a tour of the science buildings, including important offices and classrooms. Madolyn Nix introduced the department office, mailroom, supplies and copiers, and the policy on using department equipment and staff. Following the orientation tour, Drs. Frey, Kitts, Levine, and Nakamura provided one hour of advising for new graduate students, during which each student completed an informal plan of study (see appendix U1). Students were made aware of the revised graduate student guidelines and the timeline contained within it. All new students (12 of 12) attended Monday's orientation and advising. This resulted in graduate students feeling prepared for the first year of classes and more familiar of the time scale expected of them. It has been noted that graduate students from previous years never attempted an Informal Study Plan, and many have still not completed a formal one. This early planning helped the new graduate students become more aggressive in their masters programs. All of Monday's events adhered to the time schedule. One hour of advising was enough time for all new graduate students to have individual advising and planning of the Informal Plan of Study.

Faculty members were encouraged to meet the graduate students from 3:00 - 3:30 p.m. (see appendix S1). Several Biological Sciences faculty attended, as well as Dr. Phillip Bailey, Dean of the College of Science and Math, and Dr. Andrew Schaffner, professor from the Statistics department, who provides statistical consulting for members of the Biological Sciences department. Faculty introduced themselves, stated their research field and whether or not they were interested in having a graduate student thesis project.

At 3:30 p.m. the first general graduate student meeting of the 1999-2000 school year began. This meeting included updates from members of the GCC, the Campus Graduate Student Council, and Graduate Discussion Series (see appendix V1 for

description of Graduate Discussion Series). There are approximately 39 active and 30 continuing status graduate students in the Biological Sciences department. Active is defined as currently enrolled and/or teaching, and continuing status graduate students usually have completed coursework and are working on their theses. Monday's general graduate student meeting, although mandatory, was attended by approximately 70% (27 of 39) of the active graduate students. Absences were to have been approved by Dr. Frey, although only a few of the graduate students not attending contacted him prior to the conference.

## **Tuesday, September 14, 1999**

Graduate students appeared to enjoy the social events scheduled during orientation week. At least 10 people participated in the early morning hike and several more joined for breakfast. These events served as opportunities for new and returning students to socialize.

The Teacher Education Workshop was attended by at least 85% (33 of 39) of active graduate students and 2 new faculty. Permitted absences (3) included outside employment and jury duty. Students were surveyed immediately after the workshop to determine their first impression of the workshop's effectiveness (see appendix W1). The education workshop ran approximately 15 minutes over schedule. Almost 45% (12 of 28) of responses indicated that the 4.75-hour workshop was too long, and several (4 of 28) suggested the workshop be broken into two parts. Although it was not indicated on all evaluations, when asked, most persons recommended 2 shorter seminars. Additionally, some speakers felt rushed and did not thoroughly complete their presentation. Dr. Elrod's presentation incorporated several workshop activities in which attendants used Bloom's taxonomy to determine the level of exam questions. She intended to include other activities which were omitted due to time constraints. At least one person indicated that he/she would like further education workshops which include "getting into groups" to discuss exams questions. Several other graduate students commented that actual "workshopping" (i.e. performing an activity utilizing the skills being presented) was useful, and would attend similar workshops specifically in the areas of exam writing and grading. See Suggested Changes for possible modifications to the 2000-2001 workshop.

Several graduate students attended the Social Reception provided by Dr. Opava's office.

## **Wednesday - Friday, September 15-17, 1999**

On Wednesday, Rose Bowker led a computer workshop, and new graduate students attended the campus wide TA orientation. On Thursday, all teaching teams

met with their respective course coordinators for one hour at 4:00 p.m. In the past, some teaching teams have met for the first time during the first week of classes. This often left new TAs feeling overwhelmed in preparing for their courses. The mandatory course coordination meeting on Thursday gave TAs the weekend to prepare the first course meeting and design a syllabus. It is critical this first coordination meeting remain at least 3 days prior to the start of classes.

Friday's one-hour safety instruction was attended by almost all of the support staff and included a detailed safety orientation (see appendices L1 and A2 for list of topics covered and information distributed at the meeting). It is shocking to know there has been no introductory safety instruction for graduate students thus far.

The peer instruction proved an invaluable inclusion as well, however, most labs could not be completed in the 2 hours allotted. The week closed with a social gathering Saturday evening, September 18th, at the Waterbury's house.

The following week, speakers and contributors were thanked with a personal note and a certificate for a snack or beverage at Julian's (see appendix B2 for example of thank you and a list of persons thanked).

Information provided throughout the week can be found in the following appendices:

Topic	Presenter	Appendix
Schedule, Saturday, September 11, 1999		R1
Schedule, Monday, September 13, 1999		S1
Schedule, TA Orientation, Wednesday, September 15, 1999	Dept. of Research & Graduate Programs	L2
Safety	Larry Grimes	A2
Computer workshop	Rose Bowker	E1
Teacher Education Workshop		
The syllabus	Alvin DeJong	E2
Department Protocol	Harriet Ross	F2
Preparation	Kelly Myer Polacek	G2
Active participation	Don Maas	H2
Effective speaking	Dennis Frey	I2
Bloom's taxonomy, exams, and grading	Sue Elrod	J2
Evaluations	Elrod and Polacek	K2

# EVALUATION

## Immediate Evaluation

Graduate students were surveyed immediately following the teacher education workshop to determine its effectiveness (see appendix W1 for questionnaire and student responses). A total of 28 completed evaluations were received. Following is a discussion highlighting representative answers to specific questions.

*Did the workshop address your needs as a teaching graduate student? Please explain.*

- *Shows how much there is to know, but needs to be spread out over several days. I'm sure I'll have questions later, but have not been able to really digest the info.*
- *Yes, however I felt some of the topics bordered on being too silly.*
- *It was helpful but most of the info was known – it was more geared toward new teaching grad students.*
- *Yes, it was very helpful. It served as a good tool to get me thinking about how I want to approach teaching.*
- *The teacher instruction workshop covered all the areas from method of teaching to grading. I felt extremely relieved after the workshop, with soooo much information to work on and guide me.*

Attendants were asked to rank how well the workshop addressed individual needs (one being least effective, five being most effective). Twenty-four of the 28 ranked the workshop in this way resulting in an average of 4.4. Although two students remarked that the workshop may have been geared toward new TAs, at least three returning TAs indicated that the workshop was useful for both new and returning TAs. Additionally, only three of the 28 responses to this question included reservations about the workshop itself or the information provided in it. No student responded “No” to this question.

*What difference, if any, will the workshop make in your work plans and performance?*

- *I am more aware of strategies for learning better and for conveying information efficiently to the classroom.*
- *Will improve on my ability to see if my teaching methods are useful or need some refining.*
- *I now have concrete examples of promoting active participation in my classes - great info!*
- *Should make a difference in getting feedback on effectiveness of my teaching techniques.*

Five students left this area blank on the questionnaire. No student indicated the workshop made no difference to him/her as a teacher. One student responded by saying “No major changes in plans but I feel I have a better theoretical framework in

education now." It appears that all students learned something during the conference that will change their approaches to teaching or increase overall understanding of education.

One noteworthy comment was "I will probably take this job much more seriously than I would have otherwise." By requiring this conference, it appears we increased the perceived level of seriousness the department has about its teaching staff and perhaps increased the dedication of the TAs to their courses.

*What part of the workshop was most valuable to you and why?*

Dr. Maas' talk focused primarily on incorporating active student participation into the classroom, which can be used by the teacher to assess student learning. Once student learning has been assessed, the teacher can modify and adjust his/her teacher to accommodate the students. Remarkably, 84% of responses (24 of 28) included some reference to the information on active participation provided by Dr. Maas as being most valuable. The following comment captures the essence of most student responses on this topic: "Don Maas was amazing. He helped with the areas I have been thinking about the most" (see appendix W1). Unless a TA has had formal education experience, it is unlikely that he/she uses any techniques, other than exams, to assess student learning. Exams are the traditional methods of assessing student learning; however, they usually occur infrequently and after so much information has been presented it is impossible to retrace through the learning. This overwhelming response to active participation indicated that TAs are interested in learning more about and incorporating this technique in their classrooms ultimately increasing student learning.

Because exams are a critical element in student assessment, Dr. Elrod's discussion on Bloom's taxonomy, exam format and design, student assessment and grading was of great importance. Thirty-two percent of responses (9 of 28) indicated that the information provided by Dr. Elrod was most valuable.

Seven percent of responses (2 of 28) indicated the effective speaking portion of the workshop was most valuable, and two indicated that lesson planning was most effective. Other student answers varied (see appendix W1 for a complete list of student responses).

## **Mid-Quarter Evaluation**

At the Graduate Discussion meeting held November 2, 1999, graduate students were surveyed to determine if the skills and techniques they learned during the workshop were actually being put to use (see appendix H1 for questionnaire and

student responses). A total of 25 evaluations were received. Following is a discussion highlighting representative answers to specific questions.

*Did the Teacher Education Workshop address your needs as a teaching graduate student? Please explain.*

- *It's actually more accurate to say it addressed a list of needs I didn't even know I had – pointed out areas in which I'm lacking.*
- *Yes, I had never taught before, so it was helpful to have an introduction instead of being thrown in.*
- *The workshop would probably be most useful for new TAs in the department, although a few aspects of the presentations would be great for all TAs no matter how much experience.*

The overall response to this question was positive. No student responded “no” to this question. Six students left this question blank. One student responded by saying “the workshop did not help me much” however, in other parts of the questionnaire, he/she noted techniques that he/she learned or had reinforced.

*Which of the following skills and techniques which were discussed at the workshop are you using? Please circle.*

Skill or technique	No. of Responses
A. Syllabus	7
B. Professionalism	10
C. Preparation (teaching to the objective)	11
D. Active Participation (keeping students on the hot seat)	11
E. Effective speaking (using the overhead, chalkboard & PowerPoint effectively)	11
F. Bloom's taxonomy	7
G. Exams and grading	10
H. Evaluations	0

Total responses = 25

Skills or techniques most utilized by graduate students were preparation, active participation and effective speaking. It likely that no student indicated utilizing information from the discussion on evaluations as no evaluations had occurred within the department at the time of this survey.

*For the above, please briefly explain how you have incorporated these skills and techniques into your preparation and/or classroom.*

- *I try to write tests that have all levels of questions.*
- *I think more about the objective rather than just trying to get the students through the lab. I also use Bloom's taxonomy (or try to) when writing quizzes.*
- *I try to convey a sense of authority to all my students. I try to make exams challenging and appropriate.*
- *Bloom's taxonomy is something I really wish I knew about my first quarter teaching. I had a general concept of how to write a fair quiz that was similar, but it really helped to see it broken*

*down into different levels of knowledge, etc... and percentage considered ideal.*

Seventeen students responded to this question. In general, each comment included some reference to a topic discussed during the education workshop.

*Have you tried utilizing any new skills or techniques, but given up because you were unsuccessful? Please explain.*

- *It's hard to remain aware all the time of how you're involving the students.*
- *Active participation; they haven't gone for it.*
- *Active participation has been the most difficult to incorporate.*
- *I've tried the "hot seat" method, but the students just tend to blank out.*

Five students responded "no" to this question. Those students who responded to this question (9 of 25) indicated some difficulty in incorporating the active participation, cooperative and inquiry-based learning techniques discussed during the workshop. This is not surprising, given the difficulty professional educators experienced during the implementation of these techniques in their classrooms (Ahern-Rindell, 1999; Colosi and Zales, 1998; Klionsky, 1998; Trautwein et al., 1997). These responses indicate that a one-time seminar does not provide enough information for TAs to successfully incorporate active participation in their classrooms. It is suggested a workshop in which TAs actually implement active participation in mock classroom settings could provide the type of training necessary to make TAs comfortable with this technique.

*Would you be interested in attending a short (i.e. 2 hr) meeting once per quarter to discuss other areas of teaching and learning which were not covered during our Teacher Education? If yes, what are you interested in learning about?*

- *Yes (18 responses)*
- *No (6 responses)*

Students indicated they would be interested in learning more about the following topics:

- class participation
- classroom management (of "chatty" classes)
- motivation
- using the chalkboard
- time management
- use of department software
- changing student attitudes towards science.

At least three students indicated they wanted to learn more about exam writing. Through casual communication, several students indicated they would attend seminars on properly handling situations with students, particularly in regards to absences, cheating, and plagiarism.

Given that 18 students indicated they would attend future workshops, it is suggested that a short, quarterly meeting be held sometime during the first week of classes. Ideally, the first workshop should include information on properly handling student situations. Subsequent workshops should include actual workshoping in which TAs utilize techniques and skills under the guidance of the presenter.

## **Evaluation of Peer Instruction**

Peer instruction proceeded as desired in BIO 111 and BIO 151, however, only peer instruction in BIO 151 was evaluated. Because BIO 115 was a new course offered for the first time fall quarter, and the course coordinator was absent in the late part of orientation week, the representative TA was unsure of a lab exercise to model and peer instruction did not occur in this course.

BIO 151 instructors were surveyed mid-quarter with an evaluation specific to the peer instruction portion of the conference (see appendix C2 for questionnaire and responses). TAs were asked to evaluate the effectiveness of this approach. The model TA for BIO 151 was Mark Demarest who was advised to respond to the survey both as a representative TA as well as a student. A total of 4 completed evaluations were received. Following is a discussion highlighting representative answers to specific questions.

*In what way did participating as a student of the lab during the workshop help you prepare for that lab exercise the following week?*

- *It allowed me to see the common mistakes that the students may have made during the lab (because I made them, too).*
- *This helped to get a feel for the type of organization needed to run the lab efficiently.*

Because TAs completed an entire lab exercise, they were able to troubleshoot specific areas of the lab with which students potentially may have had difficulties. New TAs were able to orient themselves with both the structure of the BIO 151 lab exercises and the classroom itself.

*Did it help you in preparation for other lab exercises?*

- *...It created a climate of camaraderie between the instructors early - we felt like we could ask each other questions and work together.*

This sense of unity within the teaching team was a goal of both this peer instruction and the Thursday course coordinator meeting. TAs who feel comfortable with other members of their teaching teams are more apt to seek guidance in preparing lab exercises.

*What particular teaching techniques or tools did Mark provide by modeling which were useful to you in your preparation for BIO 151 lab experiments?*

- *He used both overt and covert methods to stimulate active participation.*
- *The feedback was useful to me [Mark] – approaches that I took that worked well, and how to improve those that didn't.*

Only two students indicated that Mark's techniques were helpful. (Other responses were "None" and "Don't recall.") During casual conversation with Mark, he indicated that the modeling was interrupted by TA questions regarding material just presented. TAs were very concerned with clarifying difficult points of the lab. It is likely TAs paid less attention to Mark's teaching styles and more attention to the details of the lab at hand.

*We attempted to provide you with the opportunity of "being" a BIO 151 student to help you experience your students' perspective. Did we succeed? YES NO*

- *Yes (3 responses)*
- *No (1 response as follows:)*  
*"I think that this exercise was extraordinarily productive, and should be continued. However, it wasn't exactly as intended – namely, it didn't really "feel" like a normal class. The "students" were my peers, and I felt funny teaching them material they already knew. Also, their questions and comments were more from the perspective of an instructor than a student. In the end, though, I think this worked out even better. I went through the material as planned, and we discussed various aspects of the material and the lecture style and the approach as they came up. It was a great session, and because of it the traditionally difficult first day of class went much more smoothly and successfully. Several people commented that it's too bad we can't do this sort of thing before every lab."*

It should be noted that this segmented modeling session, in which modeling occurred for approximately 20 minutes followed by reflections and questions on the material just presented, appeared to be more useful for the TAs. This format allowed them to both be students in their classroom as well as use the representative TA as peer advisor.

*Do you reflect on that experience when preparing a lab exercise?*

YES NO

- Yes (4 responses)
- No (0 responses)

*Do you have suggestions on how this approach might be improved?*

- Perhaps more than one lab could be presented by more than one instructor. This might give perspective on different teaching styles and how different labs are organized.

TAs not only found this two-hour peer instruction useful, but suggested expanding it to include other challenging lab exercises and different models to compare teaching styles.

*Do you observe another instructor before teaching each lab throughout the quarter?*

YES NO

- Yes (4 responses)
- No (0 responses)

*If yes, comment on how this is helpful. If no, please explain why.*

- This is [essential] especially when first teaching a course. It has value even after you've taught the class numerous times.
- Very helpful. The labs were so complex that it really helped to see the materials in use before teaching the lab... It was also helpful to hear what types of questions the students would ask about the exercise.

Dr. DeJong, course coordinator for BIO 151, requires new TAs to sit in on each lab prior to teacher it. Both new and returning TAs find that this additional preparation is essential. One student commented that the peer instruction “was the best thing all week” adding that the opportunity to act as a student in her own class was an experience she had never had. Additionally, this student is a veteran TA who was new to the course this fall. She felt this opportunity to run through the first lab exercise prior to the first week of classes was invaluable. Peer instruction was particularly helpful since classes began on a Tuesday during fall quarter. This gave TAs who teach a Tuesday/Thursday class to observe the first lab experiment. Given the very positive feedback in these evaluations, it is apparent that peer instruction was invaluable. It is recommended peer instruction be kept as an integral part of the teacher education training, and be given a full three hours so that representative TAs can both explain the theory behind model peer instruction and actually execute and complete a lab experiment.

# DISCUSSION

## Overall Evaluation

Considering no graduate student orientation or teacher education had previously been offered in the Biological Sciences department, the first annual graduate student orientation was a great success. Fall conference week provided an ideal time for graduate students to learn about teaching pedagogies and prepare for classes. For this reason, it is suggested the GCC omit non-fall admissions from its admission policy. Graduate students admitted during winter, spring, and summer quarters miss individual advising, the teacher education workshop, in addition to the camaraderie shared by the graduate student cohort during this time.

The entire orientation week seemed beneficial to all who participated. Of particular value was advising provided to new on the first day of orientation week. This created a tone of seriousness regarding course planning and helped to create more focused graduate students. All elements of the teacher education workshop proved helpful to graduate students, and it is recommended that the workshop be expanded and perhaps more individualized for new and returning graduate students. Peer instruction was a novel inclusion to the TA training program and proved an invaluable experience to several TAs.

It is recommended that the orientation week offered during September 11-17, 1999 be implemented as an annual component of fall conference week and a mandatory part of the graduate student experience in the Biological Sciences department.

## Suggested Changes

Suggested changes for future orientation and teacher education include, but are not limited to, the following:

1. Divide the education workshop into two 4-6 hour seminars. Hold the first seminar on Tuesday and the second on Wednesday. Perhaps individualize for new and returning graduate students.
2. Increase the budget to cover all previous year's expenses as well as provide a catered lunch on Tuesday after or during the education workshop.
3. Find a way to involve course coordinators in TA education.
4. Include a ten-minute introduction of the new graduate students at the general meeting on Monday (see appendix S1).
5. Expand peer instruction to 3 or more hours.

6. Include more rigorous count of attendance.
7. Include a more rigorous evaluation which requires students not only comment on workshop, but also assess components numerically. This information could be analyzed statistically.
8. See appendix D2 for a proposed schedule for 2000-2001 academic year.

## **Future Directions for Teacher Education in the Biological Sciences department**

Following the suggested guidelines provided (see appendix D2) this orientation week and teacher education conference can be coordinated by a faculty member or by a graduate student. Coordination could be worth BIO 500 units or a possible stipend. Because we had no previous experience in coordinating a workshop of this magnitude, our evaluations, although useful, do not allow us to make direct comparisons pre-and post-workshop. A more rigorous and controlled evaluation, including quantitatively assessing graduate students' feelings regarding the use of active participation, cooperative and inquiry-based learning in lecture and laboratory classrooms, would constitute a thesis.

It seems feasible to have the Biological Sciences department offer a graduate level teacher education course (i.e. BIO x580 - Teaching Methods in Biological Sciences). This could be team taught to alleviate faculty commitment. Such a course would provide the ideal "workshop" environment allowing graduate students guided practice of the techniques they have learned.

At least one student suggested a TA manual would be helpful. The manual provided by Alldredge (1994) could serve as a model. The compilation of a TA training manual which includes hand outs from each speaker and supplemental literature (see annotated bibliography) could constitute a BIO 500 project.

Given that 18 students indicated they would attend quarterly meetings of various teaching and learning topics, particularly those including workshopping, it seems appropriate to begin offering these short seminars (see Mid-Quarter Evaluation). In Spring quarter, the department can offer a discussion on sticky student situations which can include information on excused and unexcused absences, plagiarism, cheating, and the university's policy on each of the subjects.

For reference in future years, it is recommended the Biological Sciences department purchase *The Professional Development of Graduate Teaching Assistants* Anker Publishing, Bolton MA, 1998. Additionally, the Biological Sciences department can continue to supplement innovative learning both within the department and

throughout the campus by requesting the library the subscribe to select education journals such as the *Journal of Science Teacher Education*, *Journal of Information on Innovative Higher Education*, and the *Journal of Information on College Teaching*.

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