

Statement of Teaching Philosophy

Timothy D. Scarborough

My approach to science education is based on the belief that in order to learn, a student must participate actively in their education. Passively watching someone else solve problems does not adequately prepare a student to ask the proper questions to solve a problem themselves. Lectures prepare a student to approach problems thoughtfully, but much of the learning comes from actively doing the work. Much of this strategy is backed up by Physics Education Research (PER). Although the relative infancy of much of this research makes it heavily based on context, recently developed resources such as *Physical Review Physics Education Research* and comPADRE offer significant information to create an informed teaching plan. I will plan to incorporate techniques from PER into my teaching style, while recognizing that excellence in teaching will come only as I gain experience.

For introductory courses, I believe that perhaps the most important thing is to keep students engaged, which I intend to approach in two ways. First, demonstrations are a useful tool toward this purpose, but they function best when they are fun; I still remember the first time I saw a feather fall with a bowling ball or a spinning magnetic top levitate. While an introductory class may not be easy to inspire, a sense of awe can have a strong effect toward student engagement while employing simple introductory physics ideas. In addition to demonstrations, I believe high levels of feedback to be a sound approach toward student involvement. To this end, I have previously found “clicker” questions to be particularly useful, as they provide an instructor with real-time responses about whether students are understanding the material. In addition, they add an interactive element which keeps students engaged in the lectures.

For upper-level courses, I will expect students to become more involved in their own education, while continuing to emphasize feedback. Just-in-time teaching (JiTT) [**Gavrin**] is a method of assessing students' understanding of a topic before a lecture, usually through online questionnaires in which students are quizzed about required pre-class reading. The results allow an instructor to tailor the lectures to the topics with which a class may be struggling. During graduate school I had multiple classes use a degree of JiTT and found it useful to enter a lecture where the instructor knew what the class collectively understood and what it did not; it also proactively gets the students thinking about the material before a class. In addition to JiTT, I also believe in the value of Peer Instruction [**Smith**], which introduces small-group discussions of conceptual questions interspersed throughout the lectures. This adds an element of interaction, and gets the students speaking the lingo, building arguments and, above all else, actively thinking in the classroom instead of just copying derivations. Upper-level classes are intended for students who have interest in science-related careers, and I believe that getting them actively involved in their education is the best way to train students at this level.

While introductory-level labs will always have a formulaic element to them, I have found that my best laboratory learning experiences were in a more free-form, open-ended setting with the instructor only loosely advising the project. The best upper-level lab course I took consisted of small-group projects with little structure; as an example, I was given a scanning tunneling microscope and told to “try to do something interesting with it”. The instructor in this case would

discuss and advise on the project's oversight, but without leading the students to a predetermined outcome. This approach emphasized determining the capabilities and limitations of an apparatus, then *making* things and *designing* experiments and *leading* the discussions instead of following a cookie-cutter formula toward a known outcome. It is only through doing that a student can develop laboratory skills, and this is best achieved without an instruction manual.

I am capable of teaching courses in all areas of introductory physics across the undergraduate and graduate level, although I would be particularly comfortable with optics, quantum mechanics, and electrodynamics. I can offer specialized courses in laser theory and design, AMOP physics, chemical physics and surface physics.

As I find my way through my early years as a professor, I have no doubt that my teaching methodologies and practices will change; it is nearly unanimous among early-career instructors with whom I've spoken that nobody gets it right from the start. As I develop as a teacher I plan to make use of the APS New Faculty Workshop as well as biannual American Association of Physics Teachers Meetings, which come highly recommended to me. However, the aspect of teaching of which I am most certain is that an enthusiastic teacher is always better than someone just going through the motions. Not every student will have a passion for science, but they should at least be able to see that I do. I have always enjoyed the teaching that I've done in the past, and I look forward to making it a larger part of my work moving forward as a professor.

References

- [Gavrin] A. Gavrin, "Using Just-in-Time Teaching in the Physical Sciences," in *Just-in-Time Teaching: Across the Disciplines, Across the Academy*, S. Simkins and M. Maier (Eds.), Sterling, VA: Stylus Publishing (2010).
- [Smith] M. Smith *et al.*, "Why Peer Discussion Improves Student Performance on In-Class Concept Questions," *Science* **232** (2009).

Attached below are reviews and comments from students, included as an example of capability and potential for teaching excellence. The first page is an example of the review sheet, and the subsequent pages are responses to this review.

INSTRUCTIONS:

1. Use number 2 pencil only.
2. Erase mistakes completely.
3. Mark ticket number of class in box in upper-right, example : ticket no. 2120.

No.			
2	1	2	0
0	0	0	0
1	1	1	1
2	2	2	2

No.	0	1	2	3	4	5	6	7	8	9
	0	1	2	3	4	5	6	7	8	9
	0	1	2	3	4	5	6	7	8	9
	0	1	2	3	4	5	6	7	8	9

Indicate the correct response by filling in the appropriate circle completely.

Excel- lent	Very Good	Good	Fair	Poor	No Opin
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To the Student: This evaluation of the instructor by students will be used by the Department as one component in evaluating the instructor. It will also be used by the instructor to help improve his/her teaching. We urge you to give serious consideration to your responses.

This sheet will be given to the instructor only after grades are turned in at the end of the current semester.

Questions 1-8: Indicate your response to each of the eight statements below by filling in the appropriate numbered circle completely.

1. **KNOWLEDGE**—Your instructor knows the material and introduces many appropriate examples and illustrations.

1.	<input checked="" type="radio"/>	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> N/A
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2. **ORGANIZATION AND CLARITY**—Your instructor is well prepared for class, organized, clear in explanations, chooses the right things to emphasize, ties ideas together well, and provides effective direction for study.

2.	<input checked="" type="radio"/>	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> N/A
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3. **SENSITIVITY TO THE CLASS**—Your instructor is able to adjust his approach when the class is lost, bored or confused. He/she keeps a relaxed, tension-free atmosphere.

3.	<input checked="" type="radio"/>	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> N/A
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4. **INTEREST IN STUDENTS**—Your instructor is friendly, respects each individual student and each student's work. Students feel free to approach the instructor.

4.	<input checked="" type="radio"/>	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> N/A
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5. **ENTHUSIASM**—Your instructor seems to enjoy teaching and is enthusiastic about the subject.

5.	<input checked="" type="radio"/>	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> N/A
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6. **EFFECTIVENESS**—Your instructor gets the students interested in the subject and facilitates learning of the course material.

6.	<input checked="" type="radio"/>	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> N/A
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7. **TESTS AND GRADING**—The methods used to evaluate students have positive instructional value. Grading procedures are clear and seem to reflect the students' understanding and performance.

7.	<input checked="" type="radio"/>	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> N/A
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8. **OVERALL RATING**—Please evaluate the overall performance of the instructor.

8.	<input checked="" type="radio"/>	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> N/A
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Yes No

9. Did the instructor treat all students in this class fairly, respectfully, and without discrimination? If not, please elaborate on the reverse side of this sheet.

9.	<input type="radio"/> 1	<input checked="" type="radio"/>	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> N/A
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Yes No

10. Did all students treat the instructor fairly, respectfully, and without discrimination? If not, please elaborate on the reverse side of this sheet.

10.	<input type="radio"/> 1	<input checked="" type="radio"/>	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> N/A
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11. **ADDITIONAL COMMENTS**—If you wish to make additional comments on any aspects of the course, please use the reverse side of this sheet.

Exam Services
 University of Nebraska -- Lincoln
 GSA 3.0 - General Survey Analysis

Course: Phys 142
 Version: Sec 165 L
 Semester: Fall 2007

Instructor: Scarborough
 Survey Type: Evaluation
 Cards Read: 8

Question	Responses					n/a	Omits	Subtotal	Mean	Variance
	a	b	c	d	e					
1	Knowledge of Subject									
	5	1	0	0	0	0	2	6	1.17	0.14
%'s	83.3	16.7	0.0	0.0	0.0					
2	Organization and Clarity									
	5	1	0	0	0	0	2	6	1.17	0.14
%'s	83.3	16.7	0.0	0.0	0.0					
3	Sensitivity to the class									
	5	1	0	0	0	0	2	6	1.17	0.14
%'s	83.3	16.7	0.0	0.0	0.0					
4	Interested in students									
	5	1	0	0	0	0	2	6	1.17	0.14
%'s	83.3	16.7	0.0	0.0	0.0					
5	Enthusiasm									
	3	3	0	0	0	0	2	6	1.50	0.25
%'s	50.0	50.0	0.0	0.0	0.0					
6	Effectiveness in promoting learning									
	3	3	0	0	0	0	2	6	1.50	0.25
%'s	50.0	50.0	0.0	0.0	0.0					
7	Tests and Grading									
	1	4	1	0	0	0	2	6	2.00	0.33
%'s	16.7	66.7	16.7	0.0	0.0					
8	Overall Rating									
	5	1	0	0	0	0	2	6	1.17	0.14
%'s	83.3	16.7	0.0	0.0	0.0					
9	Instructor treat students fairly/respectfully/without discrimination									
	0	6	0	0	0	0	2	6	2.00	0.00
%'s	0.0	100.0	0.0	0.0	0.0					
10	Students treat instructor fairly/respectfully/without discrimination									
	0	6	0	0	0	0	2	6	2.00	0.00
%'s	0.0	100.0	0.0	0.0	0.0					

TS note: in questions 9 and 10, 2 means "yes", and 4 means "no"

Exam Services
 University of Nebraska -- Lincoln
 GSA 3.0 - General Survey Analysis

Course: Phys 222
 Version: Sec 003
 Semester: Spring 2008

Instructor: Scarborough
 Survey Type: Evaluation
 Cards Read: 16

Question	Responses					n/a	Omits	Subtotal	Mean	Variance
	a	b	c	d	e					
1	Knowledge of Subject									
	15	1	0	0	0	0	0	16	1.06	0.06
%'s	93.8	6.3	0.0	0.0	0.0					
2	Organization and Clarity									
	13	3	0	0	0	0	0	16	1.19	0.15
%'s	81.3	18.8	0.0	0.0	0.0					
3	Sensitivity to the class									
	13	2	1	0	0	0	0	16	1.25	0.31
%'s	81.3	12.5	6.3	0.0	0.0					
4	Interested in students									
	14	2	0	0	0	0	0	16	1.13	0.11
%'s	87.5	12.5	0.0	0.0	0.0					
5	Enthusiasm									
	13	3	0	0	0	0	0	16	1.19	0.15
%'s	81.3	18.8	0.0	0.0	0.0					
6	Effectiveness in promoting learning									
	15	1	0	0	0	0	0	16	1.06	0.06
%'s	93.8	6.3	0.0	0.0	0.0					
7	Tests and Grading									
	10	4	1	1	0	0	0	16	1.56	0.75
%'s	62.5	25.0	6.3	6.3	0.0					
8	Overall Rating									
	15	1	0	0	0	0	0	16	1.06	0.06
%'s	93.8	6.3	0.0	0.0	0.0					
9	Instructor treat students fairly/respectfully/without discrimination									
	2	14	0	0	0	0	0	16	1.88	0.11
%'s	12.5	87.5	0.0	0.0	0.0					
10	Students treat instructor fairly/respectfully/without discrimination									
	2	14	0	0	0	0	0	16	1.88	0.11
%'s	12.5	87.5	0.0	0.0	0.0					

TS note: in questions 9 and 10, 2 means "yes", and 4 means "no"

Exam Services
University of Nebraska -- Lincoln
GSA 3.0 - General Survey Analysis

Course: Phys 142
Version: Sec 612
Semester: 2nd 5wk SS 2008

Instructor: Scarborough, T.
Survey Type: Evaluation
Cards Read: 9

Question	Responses					n/a	Omits	Subtotal	Mean	Variance
	a	b	c	d	e					
1	Knowledge of Subject									
	8	1	0	0	0	0	0	9	1.11	0.10
%'s	88.9	11.1	0.0	0.0	0.0					
2	Organization and Clarity									
	8	1	0	0	0	0	0	9	1.11	0.10
%'s	88.9	11.1	0.0	0.0	0.0					
3	Sensitivity to the class									
	6	3	0	0	0	0	0	9	1.33	0.22
%'s	66.7	33.3	0.0	0.0	0.0					
4	Interested in students									
	8	1	0	0	0	0	0	9	1.11	0.10
%'s	88.9	11.1	0.0	0.0	0.0					
5	Enthusiasm									
	8	1	0	0	0	0	0	9	1.11	0.10
%'s	88.9	11.1	0.0	0.0	0.0					
6	Effectiveness in promoting learning									
	6	3	0	0	0	0	0	9	1.33	0.22
%'s	66.7	33.3	0.0	0.0	0.0					
7	Tests and Grading									
	7	2	0	0	0	0	0	9	1.22	0.17
%'s	77.8	22.2	0.0	0.0	0.0					
8	Overall Rating									
	7	2	0	0	0	0	0	9	1.22	0.17
%'s	77.8	22.2	0.0	0.0	0.0					
9	Instructor treat students fairly/respectfully/without discrimination									
	2	7	0	0	0	0	0	9	1.78	0.17
%'s	22.2	77.8	0.0	0.0	0.0					
10	Students treat instructor fairly/respectfully/without discrimination									
	2	7	0	0	0	0	0	9	1.78	0.17
%'s	22.2	77.8	0.0	0.0	0.0					

TS note: in questions 9 and 10, 2 means "yes", and 4 means "no"

Exam Services
University of Nebraska -- Lincoln
GSA 3.0 - General Survey Analysis

Course: Phys 142L
Version: Sec 611
Semester: Spring 2010

Instructor: Scarborough
Survey Type: Evaluations
Cards Read: 17

Question	Responses					n/a	Omits	Subtotal	Mean	Variance
	a	b	c	d	e					
1	Knowledge of Subject									
	13	4	0	0	0	0	0	17	1.24	0.18
%'s	76.5	23.5	0.0	0.0	0.0					
2	Organization and Clarity									
	14	3	0	0	0	0	0	17	1.18	0.15
%'s	82.4	17.6	0.0	0.0	0.0					
3	Sensitivity to the class									
	14	3	0	0	0	0	0	17	1.18	0.15
%'s	82.4	17.6	0.0	0.0	0.0					
4	Interested in students									
	15	2	0	0	0	0	0	17	1.12	0.10
%'s	88.2	11.8	0.0	0.0	0.0					
5	Enthusiasm									
	14	3	0	0	0	0	0	17	1.18	0.15
%'s	82.4	17.6	0.0	0.0	0.0					
6	Effectiveness in promoting learning									
	11	5	1	0	0	0	0	17	1.41	0.36
%'s	64.7	29.4	5.9	0.0	0.0					
7	Tests and Grading									
	13	2	1	1	0	0	0	17	1.41	0.71
%'s	76.5	11.8	5.9	5.9	0.0					
8	Overall Rating									
	14	3	0	0	0	0	0	17	1.18	0.15
%'s	82.4	17.6	0.0	0.0	0.0					
9	Instructor treat students fairly/respectfully/without discrimination									
	6	10	0	0	0	0	1	16	1.63	0.23
%'s	37.5	62.5	0.0	0.0	0.0					
10	Students treat instructor fairly/respectfully/without discrimination									
	6	10	0	0	0	0	1	16	1.63	0.23
%'s	37.5	62.5	0.0	0.0	0.0					

TS note: in questions 9 and 10, 2 means "yes", and 4 means "no"

DO NOT WRITE IN THIS AREA

Please use this side of the form for your personal comments on teacher effectiveness and general course value. Your instructor will not see your completed evaluation until after final grades are in for your course. Place your comments below:

He was the best TA for any science class I have ever taken.

DO NOT WRITE IN THIS AREA

Please use this side of the form for your personal comments on teacher effectiveness and general course value. Your instructor will not see your completed evaluation until after final grades are in for your course. Place your comments below:

He was probably the best lab TA I've had in all my classes. He did a great job and took the time to help students with things pertaining to lecture as well as lab.

DO NOT WRITE IN THIS AREA

Please use this side of the form for your personal comments on teacher effectiveness and general course value. Your instructor will not see your completed evaluation until after final grades are in for your course. Place your comments below:

this guy should become a professor!

DO NOT WRITE IN THIS AREA

Please use this side of the form for your personal comments on teacher effectiveness and general course value. Your instructor will not see your completed evaluation until after final grades are in for your course. Place your comments below:

I was apprehensive about taking a physics lab, but I was very happy with how it actually went. This T.A. teaches very well. Hopefully teaching is somewhere in his future.

DO NOT WRITE IN THIS AREA

Please use this side of the form for your personal comments on teacher effectiveness and general course value. Your instructor will not see your completed evaluation until after final grades are in for your course. Place your comments below:

Great Lab! Great Instructor, laid back and friendly which made him easily to talk to. Always extremely helpful. All around a great Lab Instructor. Thanks Tim!

It gave good balance to a crappy Lecture (PHYS 212)

DO NOT WRITE IN THIS AREA

Please use this side of the form for your personal comments on teacher effectiveness and general course value. Your instructor will not see your completed evaluation until after final grades are in for your course. Place your comments below:

great TA knew how to use equipment
and very knowledgeable on subject.
could answer any questions to
better understanding. Would have
made a better professor than
guyerman!

DO NOT WRITE IN THIS AREA

Please use this side of the form for your personal comments on teacher effectiveness and general course value. Your instructor will not see your completed evaluation until after final grades are in for your course. Place your comments below:

One of the best TAs I have had willing to help students even w/out asking. Knowledgeable on material and provides background and examples beyond the manual.

DO NOT WRITE IN THIS AREA

Please use this side of the form for your personal comments on teacher effectiveness and general course value. Your instructor will not see your completed evaluation until after final grades are in for your course. Place your comments below:

Quite possibly the best TA that I have ever had for a class made the lab useful & helped with understanding of both the class & lab.

DO NOT WRITE IN THIS AREA

Please use this side of the form for your personal comments on teacher effectiveness and general course value. Your instructor will not see your completed evaluation until after final grades are in for your course. Place your comments below:

Tim did a great job! I couldn't have asked for a better TA, let alone in a 5-week summer session!!

DO NOT WRITE IN THIS AREA

Please use this side of the form for your personal comments on teacher effectiveness and general course value. Your instructor will not see your completed evaluation until after final grades are in for your course. Place your comments below:

Tim was very helpful in Lab
and always made it a
fun atmosphere.
He's AWESOME!