# Teaching Portfolio

Uwe Muench

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## Contents



*The next version of the portfolio (revision 1.0) will be compiled in early 2001, including other videotaping feedback and the semester end evaluations of the recent semesters.

# 1. Teaching Responsibilities

At the University of Missouri-Columbia, I have the opportunity to teach some labs and lectures in my field of study, physics. At the University of Cologne, I was able to teach about areas in which I acquired an expertise outside my direct field of study, such as computer programs. I continue to teach about such fields or my Christian believes in Columbia, Missouri, in private settings (teaching and learning occurs everywhere).

My first formal teaching opportunity was related to my job as Computer Administration Assistant at the Regional Computing Center Cologne: I taught an introductory course for the computer program LaTeX. In a period of two and a half years (July 1995 until December 1997) I taught this one-week course five times. These courses were elective courses, each time attended by around 20 undergraduate students across disciplines.

Since I felt that additional courses besides this introductory course for this computer program should be offered, I organized a monthly workshop for DANTE (German TeX Users Group) between April 1996 and December 1997. Typically, these meetings drew between 10 and 15 people. Besides inviting guest speakers I taught in 12 sessions myself.

Since January 1998, I am a Teaching Assistant in the Department of Physics and Astronomy at the University of Missouri-Columbia. In the winter semester 1998 I graded weekly quizzes, homework, and exams in Physics 176 (University Physics) and Physics 21. In the summer semester 1998 I taught a Physics 21 lab (College Physics), and in the fall semester 1998 I taught two Physics 21 labs (College Physics) and one Physics lab 175 (University Physics). In the following winter semester 1999 my responsibilities included teaching three Physics labs 21 (College Physics) and coordinating the grading of the Physics 21 exams, while I assumed these responsibilities for Physics labs 22 (College Physics) in winter 2000. In the current fall semester 2000 I teach a mix of two Physics 22 labs and one Physics 21 lab. The laboratories in these courses are required, around 20 undergraduate students (mostly sophomores and juniors) are assigned to each lab section. I also had the opportunity to substitute for my advisor Bahram Mashhoon in three lectures of his graduate level course Physics 482 (Relativity and Gravitation),

an elective course with 6 graduate students. I also presented my research results in the Geometry-Relativity Seminar in front of around 20 faculty, graduate students and undergraduate students of the mathematics and physics departments of the University of Missouri-Columbia, and at the APS meeting in Long Beach, California, in April 2000.

I also taught in a small group (4–6 people) of Chi Alpha Campus Ministries several times about religious topics, and led one group in the winter semester 2000.

## 2. Statement of Teaching Philosophy

R. P. Feynman said, anything found in research is lost and not usable unless it is taught to others in a *comprehensible* way. For teaching physics understandibly, it has to be transformed in a way that students can actually learn effectively.

### Reflections on learning

I believe that it is essential to reflect on the question on how deep learning (instead of surface learning) occurs. First one has to realize that students bring many experiences about physics into the classroom. Some conclusions that are based on previous experiences are misleading common-sense descriptions of nature. Before students can begin to learn a more appropriate physical model of nature it is necessary to address incorrect common beliefs in general and individually.

My own experience as well as research shows that making students aware of misconceptions and learning of new material seldom occurs in passive environments, where only so-called 'facts' are regurgitated. Therefore active participation is an elementary part of understanding, growth, and generating knowledge. Students also need opportunities to take active responsibility for their learning.

New skills, e.g. applying general principles to a specific problem, can only be understood by students when they are allowed to transform them into their terms. Such a transformation can be supported by providing the material in a variety of input formats on different language levels and from different sources. The variety of sources includes professors, teaching assistants, text books, visual media, the internet, and peers. Interactions amongst students also strengthen the newly learned material by providing opportunities to teach the new skills to others.

### Principles

Based on this description of the learning process one can conclude some principles for teaching. First of all teaching has to be student-centered. Care for each student and personal contact are necessary to notice individual misconceptions and for creating a safe and enjoyable learning environment. I believe that everybody can achieve the goals of the course, and I try to relay this to my students.

Second, as teacher I have to keep in mind that the principles and also the language of physics is new to the student. I have to make sure that these new ideas and the new terminology are conveyed in an understandable manner. Since students have different

backgrounds and different learning styles, this requires repeated and varied presentations and relating the material to the students' lifes and backgrounds.

Third, to encourage successful and deep learning, I have to involve students and facilitate activities. I also have to make clear to my students that it is their choice if they want to join our adventure of learning and if they want to earn a good grade; I only can provide the opportunity. I give my students the responsibility for learning and I tell them so. I am available for them as guide. It is one of my goals to teach the students that "The more I can get you to think through the issues involved in a problem the less you will depend on me for how-to instructions". Students should grow to think critically, even in a natural science class.

Of course, I have to know the subject matter myself and I have to be prepared for each class period. Thereby, I am available as information source and discussion partner. On the other hand, I'm not afraid of showing students that sometimes I still have to learn something, too. Finally, students should also be motivated by seeing that the subject matter can be fun.

## Examples of activities

I try to implement these ideas and to create a safe learning environment by the following methods, for example. It is essential to begin with such a simple thing as learning the students' names. I also encourage students to correct my English pronunciation. Usually, they are proud to be able to teach me something, too.

I give frequent feedback to the students about their participation in the lab and about their lab reports. This way they can change their involvement in labs and they know where they stand in comparison to my learning goals. I also use the feedback to challenge students to think more about their lab reports by making comments appropriate to the level of expertise shown by the student. When students ask me questions during the lab, I usually don't just answer the question, but I try to lead the students to find the answer themselves.

I try to get feedback from the students with the 'two minute exam', where they answer the two questions "What's the most important thing you learned today?" and "What the biggest question you have right now?". This provides opportunities for the student to collect their thoughts and questions and this increases deep learning. We also get to know each others thoughts about the teaching and learning process better. I also utilize take-home quizzes to encourage students to think about problems using their own methods and means, for example by working as a group.

It is also important to provide interactive activities that involve all students in small groups. The quote "Tell me and I'll forget, Show me and I'll remember, Involve me and I'll understand." describes this in a short and memorable way. Additionally, I encourage participation in the classroom by frequent questions and I call quiet students directly to answer some of them. I also try to create a relaxed environment, where embarassment (for example, because of wrong answers) is avoided.

## 3. Course Materials

It is essential to provide students with thought-out material and hand-outs. My syllabus, for example, defines rules for the classroom and describes the grading method. Other hand-outs can be used as checklists for writing lab reports or as guideline for preparation before the next session.

- I included the syllabus that I used in the winter semester 1999 in appendix A.1. First, the necessary contact information is given. Then, I try to give the students an idea about my lab goals and I hint at my teaching philosophy. After the formal information about schedule and office hours, I outline my expectations and the corresponding grading scheme. In the current syllabus I conclude with some final miscellaneous remarks. In future versions I plan to include some clearer statements about plagiarism, since there seems to exist some confusion how to write individual lab reports after working together in groups for the experiment, and about discrimation and race. For the latter part I plan to use the statement from the American Anthropological Association and the "multicultural ground rules" as appendix, see appendix A.4.

- My hand-out 'Ingredients for a good lab report', see appendix A.2, is very successful in leading students to concentrate on the important parts of a lab report. Students also like to use this handout as checklist whether they included everything that is necessary for a good lab report.

- Quizzes in labs should not test theoretical knowledge learned in the accompanying lecture, but instead they should test goals for a lab. These are, for example, a thorough understanding of units, an understanding of graphing methods, and the logic of experiments. My example quiz in appendix A.3 tests these goals.

- I included a sample lab report (including my comments) in appendix A.5. The objective or purpose of the experiment is short, but concise. The device description is sketched and clearly labelled. One label incorrectly states that liquid nitrogen is 'dry ice'. I just corrected this without point deduction, since the name 'dry ice' wasn't discussed in lab. The graph and data tables are accurate and all units are included. The discussion is a little bit short, since one could find other sources of uncertainty. Since two main sources are identified and there is no hard rule how many sources of uncertainty should be mentioned in an introductory lab, I gave full credit for this part, also.

## 4. Evaluation of Teaching

To improve teaching it has to be evaluated continually. I use as many available resources as I know for that. They include:

- the 'two minute paper': I ask my students to answer the questions 'What's the most important thing you learned today?' and 'What's your biggest question?' on

a sheet of paper or by email at the end of class. This gives me the opportunity to understand if I was able to relay the most important ideas and to address unanswered questions. Some examples of the 2-minute-paper, that were submitted by email, are included in appendix B.2. When some students complain about bad equipment, I'm leading them to the question of another student: '...because every experiment has error, how can the scientist feel that they proved without a doubt that...'. This is the place when my students understand that physical models are only true to a certain extent (the accuracy of measurement) and that, as Albert Einstein said: "No amount of experimentation can ever prove me right; a single experiment can prove me wrong."

- Besides many vocal 'Thank you,' that can't be documented, I got some written feedback on the last 2-minute-papers or by email, see appendix B.1.

- The staff member who was responsible for the lab setup left the university in February 1999. In his farewell letter to all TA's he especially mentions three TA's, including myself, who he wanted to thank in particular, see appendix B.3.

- 'Early Feedback' or 'Small Group Instructional Feedback': The Program for Excellence in Teaching at the University of Missouri-Columbia offers these two programs early in the semester. It gives students the opportunity either on anonymous forms or in a small group setting with an educational instructor to give feedback to me as instructor. Because of the anonymous nature of this feedback it is a very useful tool.

  I especially get high marks on my preparedness and my demonstrated knowledge, see appendix D.3. These marks are also improved from fall 1998 to winter 1999 (around 4.3 in the fall semester 1998 and 4.6 to 4.7 in the winter semester 1999 on a scale between 1 (low) and 5 (high)). My use of examples (improved from 3.68 (fall 98) to 3.95 (winter 1999)), my enthusiasm and my availabitity (no official office hour in the fall semester 1998: 4.0; with official office hour: 4.8 (winter 98)) is also above average. Also the questions about my English communication abilities are improved, especially the pronunciation score (raised from 3.3 to 3.9). This is obviously related to the pronunciation course that I took in fall 1998.

  For my communication of subject and for giving helpful hints, I get lower marks (around 3.0), see my section on improvement and planned changes.

  In students' comments, my enthusiasm is mentioned several times (for example: "What is best about the lab? Uwe's enthusiasm", "He is enthusiastic about physics"). Other strong points that are mentioned several times are that I am "personable and knowledgable". In general, I feel that the positive comments clearly increased on the winter semester 1999 early feedback over the fall semester 1998 early feedback. Some examples of positive comments are:

  > He is one of the best TA's I've come across.
  >
  > TA is very helpful and willing to answer questions.

Good at answering questions while lab is in process. Tries to go around and talk to everyone.

He is very concerned about making sure we understand the lab.

He is grading fair.

Uwe really tries and is improving.

Our feedback and responses are important to him.

The main problems that students raise are the fact that several lab session go over time and that the material is not always presented in the most structured way:

We always run over the time limit.

Labs need to be shortened.

Handwriting needs to improve, often difficult to read on he board.

Communicating ideas, he gets frustrated with himself.

Please see my section for planned improvements and changes.

- 'Semester End Evaluations': See appendix D.2.

  The comments on the semester end evaluations of the fall semester 1998 are essentially the same as those on the early feedback in fall 1998. In one lab I got the additional comment: "sometimes makes student feel stupid". Future semester end evaluation showed that this comment is due to a cultural difference (being too direct to a student, if an answer is incorrect), which I especially attacked in 2000, after realizing the origin of such comments. I'm waiting for the results of the semester end feedback of the fall semester 2000 in order to see how effectively I could remedy this problem.

- 'Videotaping': I was videotaped once in each semester I taught, and I visited the follow-up meetings to improve my teaching. Unfortunately, I received only one of these feedbacks in written form (see appendix D.1); I expect the four other written feedbacks soon.

  The evaluator of the videotaping in fall 1998 gave me high grades for all criteria. She especially mentions "good rapport with students" and the "students seemed to enjoy the experiment and asked questions during the activity." Recommendations for improvement include the suggestion to ask questions that will make the students think more and to write clearer on the blackboard.

- Peer reviews: In two semesters in 1998/1999 I was peer reviewed twice by a fellow physics TA, and five times by graduate teaching scholars from different disciplines (chemistry, psychology (twice each), and rural socialogy). All these peer reviews can be found in the appendices E.1 and E.2.

  Here are some examples of positive feedback:

Asking students was very good.

You responded much better to the students than last semester.

It was immediately evident that Uwe had more than a cursory relationship with his students. I believe that they feel very comfortable in Uwe's presence.

These students were actually enjoying the active participation.

It was obvious that Uwe was prepared, organized and very knowledgable.

I can tell you were prepared and you enjoy what you are teaching.

My peer reviewers also hinted at several things that I should pay attention to or might want to change:

Watch level of sarcasm.

I found the handwriting on the board hard to read.

Perhaps Uwe should call on some other folks more and be sure everyone was with him.

Pay attention to a possible gender bias.

Use more authority, avoid saying "I guess"; you have a slight laugh when students talk.

The feedbacks in the appendix are only samples of some of my feedbacks and include only part of the detailed statistics I received. The full feedback for all of my courses are available on request.

## 5. Teaching Improvement Activities and Awards

In the last section I described my activities to evaluate my teaching. Of course, such evaluations have to be accompanied by outside advice for improvement, theoretical background and knowing recent research on teaching physics and on general education.

Here I list the seminars, conferences, and programs that I visited to improve my teaching, and the award that I received acknowledging these efforts.

- I received the basic theoretical background and the foundation for my understanding of teaching and learning in the high school course 'pedagogy/educational theories' between 1987 and 1990. We covered amongst other topics different learning theories, developmental theories (e.g. Piaget), theories about deviant behavior, psychological models (e.g. Freud), and alternative school models (e.g. O'Neill's Summerhill school).

- In March 1998, the Eighth Teaching Renewal Conference took place at the University of Missouri-Columbia. Many interesting topics were covered, such as how to make large lecture classes interesting (Michael Porter) and how to encourage higher order learning (Barbara Walvoord). The presentation about the "Teaching Practicum" in the Psychology Department was very interesting and I was

extremely excited to learn that it was planned to have a similar program called the "Graduate Teaching Scholars" in the following school year.

- In August 1998 I completed the Effective College Teaching Institute, see appendix C.1. This is a one-week course for international TA's at the University of Missouri-Columbia. Besides some hints about language, general practices for good teaching were introduced and practiced in microteaching sessions. Most of the topics would apply for all TA's, not only international TA's, although I learned some cultural and educational differences between Germany and the United States.

- Between August 1998 and May 1999 I was selected as one of 14 Graduate Teaching Scholars in the first year of this program's existence. Besides monthly sessions we attended two retreats. The Graduate Teaching Scholars is a teaching and learning seminar that brings graduate students from a variety of disciplines together to address the process of teaching. For more information on this program, please see appendix C.2.

  I cannot stress the importance and the influence on my teaching enough. In every meeting I learned something new theoretically, I had new ideas to implement in my own labs, and my excitement about teaching was put on fire. The fact that the graduate teaching scholars are from different disciplines is very fruitful and encouraging. First, I could see other graduate students that showed great interest in teaching. Second, I learned about different administrative structures in other departments and new and different teaching methods of other scientific fields. Third, the feedback of my fellow TA's are more clearly focused on teaching, not on the amount or the topics covered.

  Without attending this program I would not have written a teaching portfolio, I would not as actively try to get student feedback or peer reviews, I would not consult the expertise of the Program for Excellence in Teaching, I would not know about physics education research, and I probably would have lost my enthusiasm and excitement about teaching by now, since I would not know how and where to improve.

- In February 1999, the Ninth Teaching Renewal Conference took place at the University of Missouri-Columbia. Again, many interesting topics were covered, such as Technology in Education, Problem-Based Learning Workshops, and a session with students giving their perspective on teaching at this university.

  At this conference, we also had the opportunity to present the Graduate Teaching Scholars program, see appendix C.3.

- In April 1999, I was one of the recipients of the Donald K. Anderson Graduate Student Teaching Award 1998–1999 (appendix C.4). This award honors outstanding graduate student teachers for their contributions to the teaching mission of the university and publicly recognizes their outstanding performance in teaching. A quota of awards is set for each divison on the basis of the division's percentage on the total number of graduate teaching assistants appointed for the year.

- I'm a member of the American Association of Physics Teachers (AAPT) since April 1999. This gives me access to recent physics education research (published in the AAPT magazine "The Physics Teacher") and mailing lists about teaching physics.
- In July/August 1999, I was at the AAPT Summer Meeting in San Antonio, Texas. I attended workshops covering the University of Washington Tutorials, addressing student confidence and presenting toys that can be used for demonstration. The talks and posters at the conference were tremendously interesting and motivating.
- In February 2000, the Tenth Teaching Renewal Conference took place at the University of Missouri-Columbia. Again, many interesting topics were covered.
- In July 2000, I participated at the AAPT Summer Meeting in Guelph, Ontario, Canada. Again, I attended useful workshops (SCALE-up, Socratic Dialogue Inducing laboratories, and conceptual quantum mechanics), and absorbed wonderful talks and posters.

I plan to attend future seminars, conferences, and programs. Please see the next section for my future goals.

# 6. Implemented Changes, Future Plans and Goals for Improving

## Past and Future Changes in Teaching

The feedback of previous semesters indicated the following problems: time management, reaction to students' questions and structure of presentations.

I successfully changed my style of asking questions and how I react to incorrect student answers. To structure my presentation more, I included an outline of each lab session on the blackboard. I still try to improve, especially in mapping the structure of presented material out for the students. The time management was a problem, especially when introducing new computerized experiments. Even though some experiments are difficult to shorten, because they are based on the available equipment, I will use my experience to shape the experiments to a more effective and shorter way by keeping only useful parts of experiments.

To further improve my teaching, I plan to implement the following ideas:

- I will give more "road signs" and I will visualize the structure of the material.
- I will prepare guiding handouts for the students while not compromising my interactive way of teaching in a Socratic question and answer style. I also will reinforce learned material that will be used again by giving take-home quizzes (instead of in-lab quizzes) when those don't require excessive completion times. This will improve the familiarity with the material. I expect both measures to further cut down on the time for labs.

- Finally, I will continue to pay attention that my reaction to questions is not sarcastic.

### Planned Developmental Programs

In the following year I plan to attend the following programs and conferences:

- I will attend future AAPT conferences.
- Of course, I will continue all evaluation opportunities mentioned in section 4.
- I will attend the Teaching Renewal Conference 2001 in February 2001.

Of course, this portfolio will never be finished. I will continually reflect on my role as teacher and learner. All new insights will continue to shape and change my portfolio.

# A. Handouts and Student Results

## A.1. Syllabus

## A.2. Handout for Writing Lab Reports

## A.3. A Quiz

## A.4. Race Statements

## A.5. A Student's Lab Report

# B. Feedback and Recognitions

## B.1. Students' Written Feedback and Emails

## B.2. Students' Answers to 2-Minute-Paper

## B.3. Farewell from a Former Staff Member

## C. Developmental Programs and Awards

### C.1. Effective College Teaching Institute

### C.2. Graduate Teaching Scholars

### C.3. Teaching Renewal Conferences

### C.4. Donald K Anderson Graduate Student Teaching Award

## D. Students' Feedback

### D.1. Videotaping feedback

### D.2. Semester End Evaluation Fall 1998

### D.3. Early Feedback Winter 1999

# E. Peer reviews

## E.1. Feedback, Physics TA's

## E.2. Feedback, TA's from Other Departments