PhD student teaching opportunity: First-time experience

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Abstract

The paper describes an experiment of commissioning five PhD students to each prepare a block of supplemental on-line teaching material of 1-2 hours total duration for five undergraduate courses. One objective of the endeavor was to support class teaching with specific on-line modules that review preparatory material that students may have forgotten or supplement material that normally is given to students as reading assignment. A second objective was to provide the students with teaching experience and evidence of that experience that they may use when they are considered for teaching positions. Fifteen PhD students submitted proposals for such modules, and five were selected. Several of the modules were good, and the experience was considered successful enough to continue with the program. Feedback from students suggested useful modifications that are to be implemented when the program is repeated.

Keywords

On-line teaching, PhD students, remedial modules.

Introduction

While it is evident that future engineering education will have substantial on-line contributions, it is not clear what combinations of classroom and on-line teaching will be adopted. Consequently, it makes sense to experiment with short on-line modules that can be used to help instructors with courses that are mostly taught in the traditional classroom setting. Such modules will ideally be needed by only a subset of the students taking the course, so that doing them in class for all students may be wasteful and boring to the other students. Examples of such material include review of preparatory material that students are expected to know from pre-requisite courses but may have forgotten. Or they may include additional examples of solved problems that are needed only by students who could not generalize well from the few examples done in class. Or they may include material that is normally given as a reading assignment for the benefit of students who absorb such material more effectively as a lecture rather than by reading it.

With this in mind, we issued last December a call for PhD students to submit proposals for preparing such modules (see Appendix A). Two incentives were mentioned in the call: $1,000 payment and the prospect of creating evidence of their teaching prowess for enhancing their future employment opportunities. Fifteen students submitted proposals, and five were selected by a committee composed of three professors. The committee considered the experience of the students as TAs, their indication of interest in faculty positions, and recommendations by the professors they were planning to team up with. The students selected are identified by their initials as AB, JC, MI, RN, and AP.

The modules were recorded during the spring semester of 2014 and the beginning of the summer at UF EDGE studios (EDGE stands for electronic delivery of graduate engineering, see www.ufedge.ufl.edu). In July the modules were evaluated and the five PhD students interviewed for feedback on the success of the endeavor and recommendations on what to change if the program is to be continued.

Modules

AB recorded three modules for students taking EML 3005 Mechanical Design. The first two modules were on hardness and measuring hardness by indentation, while the third module was on size effects on material strength. The modules ranged from 11-15 minutes and were entirely Power Point based.

JC prepared three modules of approximately 15 minutes each for Aircraft Design EAS4710 on the use of the extended vortex lattice software, AVL that can be used for aerodynamic analysis of aircraft. The first module deals with modeling fuselages, the second module with modeling wings and tails, and the third module deals with modeling control surfaces. The modules are completely slide based but with some limited writing on the slides.

MI had three modules on thermal management of electronic and mechanical systems for Mechanical Design, EML 3005 ranging in time from 24-27 minutes. The first two dealt with heat sink design for thermal management of electronic systems, and the third one with thermal management of brake pads.

RN prepared three modules for EML4220 Vibrations ranging in time from 13 to 19 minutes. The first module reviewed the multiplication of two matrices, the second module the calculation of phase between vectors, and the third module the Euler formula for expressing a complex number as an exponent.

AP prepared three modules for EGM3520 Mechanics of Materials ranging in time from 16 to 25 minutes. The first was on calculating centroids, the second on calculating moments of inertia, and the third continued the second with examples of calculating moments of inertia of composite areas.

The modules ranged widely in quality, usefulness and professionalism. One student created modules that were better than we would expect from most faculty members, two students created modules that were clearly useful, one student had modules that were not well done, and one student had very poor modules. The students reported that their time investments in the creation of the modules ranged between 15 to 60 hours. There was some correlation between the time invested and the quality of the product, but the background and preparation of the student in the material appeared to be at least as important. The students with more TA and teaching experience did better.

Similarly, the professors for whom the modules were prepared varied much in their involvement in providing feedback to the PhD students and encouraging their students to use the modules.

Lessons learned

Watching the modules and interviewing the students who made them led us to the following suggestions for improvements in the next round:

1. The two goals of providing remedial modules for undergraduate students and providing PhD students with a teaching opportunity were probably too ambitious. It would be better to focus on the second goal alone and possibly return to the first goal at some late date.
2. With that in mind, and in order to improve the quality of the modules it is better to limit the requirement to a single module of 15-20 minutes in length. The selection of topics could be widened with the only requirement that it would serve a need of other students or practicing engineers.
3. Additionally, to increase module quality and to expand student knowledge base and expertise in online instruction, students should be offered the opportunity to collaborate with a PhD student in the Educational Technology Program within the College of Education (COE). The collaborative learning approach—exchanges in resources and skills, examinations of understanding and knowledge, challenging, observing and providing feedback—should result in positive collective outcomes for both. First, the collaboration will assist engineering PhD students with the technical attributes of their module and/or to expand their knowledge of the practical aspects of how to design and teach online. Modules might take the form of a recorded lecture with the expansion of interactive exercises within an appropriate software environment or a digitized approach with content delivered solely in a software environment. Second, the collaboration will replicate client interactions and exchanges education PhD students will likely encounter in their professional roles in instructional design and technology, learning management system administration, and other positions in the domain of educational technology.
4. There should be a first draft with feedback to the PhD students to help them achieve quality modules.
5. With the shorter modules and the emphasis on quality, the awards could be reduced and the remainder of the money used for one or two prizes for the best modules.
6. The modules should include questions that would allow the students watching them to assess their understanding of the material. Some of the questions may also appear at the beginning of the presentation in order to tell students that if they already know the answer they may want to skip the module.
7. Modules should refer to written supplemental material that is either broadly available on the internet, or to material that will be available through the departmental web page in a link proximate to the module video link.

These lessons led to a new call for proposals shown in Appendix B.

Appendix A: Call for proposals issued to MAE PhD students, December 2013

PhD Student Teaching Opportunity

The Department of Mechanical and Aerospace Engineering is pleased to announce an opportunity for classroom teaching to our current and recent PhD graduate students. This program is intended to provide supplemental learning material to our undergraduate or graduate courses, notably material that is considered review or background learning.

The expectation is that each applicant would be paired with a faculty member to develop approximately 2 to 3 hours, generally in 15 to 20 minute blocks, of supplemental teaching material. The material would be recorded during the first month of the semester, using our EDGE studios, and could be recorded live in front of enrolled students or individually, depending on the applicant's preference. After initial recording and student feedback, the expectation is that the lectures would be refined and re-recorded around mid-term, and then available for future use by our students in a digital archive.

The program is expected to provide our PhD students that are interested in academia with a substantive teaching experience, while providing our students with valuable on-line learning resources and also freeing our faculty members from using classroom time in review of prerequisite material. The on-line material could also be used by applicants for demonstrating their teaching competence and on-line teaching experience to faculty search committees.

Each student selected for this opportunity would receive a payment of $1,000, in addition to any current RA, TA or GSF payments. Funding for this program is being provided by Prof. Rafi Haftka as a donation to the Department. Prof. Haftka is also available as a teaching mentor to those selected to participate.

Applications are requested for the **Spring 2014** semester by **December 25**, although additional opportunities are expected and will be considered from later applications. Applications should include a brief statement of teaching interests, philosophy and career goals (one to two paragraphs), as well as a list of subject interests (e.g. thermal sciences, dynamics and controls, etc.) or specific courses of interest. The applicant is also welcome to propose a specific course and faculty member, although that is not a necessary requirement.

Please send applications to Prof. David Hahn, as well as any questions about this program: dwhahn@ufl.edu

Appendix B: Call for proposals issued to MAE PhD students, January 2015

PhD Student On-Line Teaching Competition

The Department of Mechanical and Aerospace Engineering is pleased to announce an exciting opportunity for current current and recent PhD graduate students.

The PhD Student On-Line Teaching Competition, sponsored by Dr. Rafi Haftka, is an opportunity to provide PhD students interested in academia with valuable on-line teaching experience. The product and/or material created swill assist competitors in demonstrating their teaching competence and on-line teaching expertise to future faculty search committees, in addition to providing supplemental learning material to our undergraduate or graduate courses. Final products may also take the form of relevant material that could be used by practicing professionals in engineering.

Each competitor is expected to develop a 15 to 20 minute module of on-line teaching material. Depending on the competitor's preference, recordings may be completed 1) in the EDGE studios during a live course in front of students or 2) in the EDGE studios individually without students present. Alternatively, material may be recorded on a personal computer using an appropriate software environment.

To assist students with the technical attributes of their module and/or to expand their knowledge of the practical aspects of how to design and teach online, the College of Education, Educational Technology Program, and MAE have created a collaborative opportunity with Educational Technology PhD students for this competition. If you are interested in this joint learning opportunity, please contact Dr. Albert Ritzhaupt at aritzhaupt@coe.ufl.edu, and reference the MAE PhD Student Online Teaching Competition.

Each competitor must submit an application no later than February 6th, 2015. Applications should include First, Last, UFID, and a brief statement of teaching interests, philosophy and career goals (one to two paragraphs), as well as a description of the topic to be covered and its intended audience (undergraduate, graduate, practicing professional).

- If applicable, EDGE studios recordings must be completed by February 27th, 2015 (live class meetings) or March 6th, 2015 (individual recordings).
- The first draft submission deadline is March 13th, 2015. Each competitor's product/material will be reviewed and feedback provided by Dr. Rafi Haftka and Dr. Karen Ehlers.
- The revised and final version submission deadline is April 10th, 2015.
- If the final submission is approved, the module will be uploaded on the Department's YouTube channel by April 22nd, 2015.

We expect to select up to 10 PhD students, who will receive a payment of $250, in addition to any current RA, TA or GSF payments. **In addition, MAE will award a $1,500 first place prize and $1,000 second place prize to the top two modules selected.** Note that students who are not selected based on their application, may still submit a video by April 10th for the prize competition.

Please send applications, as well as any questions regarding this competition, to Dr. Karen Ehlers, kehlers@ufl.edu.

Raphael T. Haftka received his BS and MS degrees at Technion, Israel Institute of Technology in 1965 and 1968, respectively, and his PhD at the University of California in San Diego in 1971, all in Aerospace Engineering. He worked at the Israeli Aircraft Industries and Structures Research Associates in Laguna Beach California, and was a post-doc at NASA Langley Research Center. Before coming to the University of Florida where he is a Distinguished Professor he taught at Technion in Israel, Illinois Institute of Technology and Virginia Tech. His research is in structural design under uncertainty and surrogate based global optimization. See also www2.mae.ufl.edu/haftka

Name of the paper's Second and Third Authors

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Karen J. Ehlers received her B.A in Anthropology, her M.Ed. in Educational Leadership, and her Ed.D. in Higher Education Administration from the University of Florida in 1996, 2000, and 2014, respectively. She has been serving students at the University of Florida for over 19 years in an array of Academic Affairs and Student Services roles. Her research interests include college success, first-year experience, students in transition, and educational technology in higher education.