# WEBFORMS TO ENHANCE STUDENT LEARNING ACROSS THE CURRICULUM

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The uses of technology in education are as varied as instructional styles but increased student involvement benefits almost every style. Therefore, we have provided platform-independent web-based software that is freely available to enhance student learning by increasing student engagement in the classroom. This paper will briefly discuss potential uses of this resource, student-learning gains, and methods of cross-disciplinary adoption of these techniques.

## TECHNOLOGICALLY BASED PEDAGOGICAL STRATEGIES

The pedagogical strategies that we employ are based on computer-based polling of student responses to instructor posed questions either 1) prior to class, using "WarmUps" or 2) during class using "BeyondQuestion." Both polling methods require that the student respond to questions in a web-based form much like forms used on Internet search engines. Similarly, the instructor writes the questions which students answer using password protected web-forms and then receives student responses in real-time via a web-page. All of the software was authored by one of us (WFJ) and is freely available from the authors for use at other educational institutions.

Computer polling prior to class, WarmUps, were first developed in the physics education research community as part of "Just-in Time Teaching" (Novak, Patterson, Garvin, & Christian, 1999). In that context, the initial use of the forms was to pose three questions prior to class based on the reading assignment for that day's class assignment. This meant that students had to answer questions about material that had not yet been covered in course lectures. The instructor then used the student responses to tailor the class to address student questions, mistakes, and understandings and thereby teach "Just-in Time." Clearly, this can be used outside the physics classroom. We developed a template to allow faculty to use this technique in their respective disciplines in ways that fit their subject matter and teaching style, even if they had no knowledge of authoring web forms.

In classrooms with key-pad systems (from Better Education, Inc., http://www.bedu.com or eInstruction, http://www.eInstruction.com) or computers available for each student, real-time polling of student understanding of material during class using multiple choice questions has also been used successfully in the physics education research community (Mazur, 1997). In this context, after covering a topic and providing a brief example, an instructor posed a conceptual question to "test" student understanding. All students, not just the same ones who answer questions in class every day, had to respond using a computer or a keypad system. The instructor received a histogram of student responses to the answers

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in real-time on a main computer and could adjust the lecture appropriately to address student confusion or move on to the next topic. The instructor often also had students discuss answers with each other to increase peer instruction and active engagement in the classroom. Again, we wanted this to be available to non-physics faculty and developed the program "BeyondQuestion" to address this need.

## CROSS-CAMPUS ADOPTION

The templates that we have available do not require much technological savvy. In order to enhance cross-campus adoption of these simple techniques to enhance student learning we applied for and received a multi-institution AT&T Teaching and Learning Network grant (Erskine, Eckerd, Converse, and King Colleges) to provide minimal faculty development funds (~$600/faculty member for up to 10 faculty/institution) to encourage faculty implementation of these techniques in the classroom. Faculty attended a one-day workshop to give them the technological training needed to use these techniques. Following this, faculty committed at least 35 hours over the course of the semester to develop their own questions and methods for use in their course or courses. Faculty participants were not simply science faculty, but were from a variety of disciplines (modern languages, humanities, social sciences, and the arts).

After a semester of use of these techniques, a survey of faculty supported by the grant found that they primarily used WarmUps and almost all found it to be a positive experience. Faculty reported a student response rate of 90% over the course of the semester. Furthermore, of the 20 respondents to our survey (of 30 faculty participants in the grant so far), all except one reported that they plan to use WarmUps again in a future course (or are using them now) because of the positive impact WarmUps have had in their class. On the negative side, the faculty reported that using WarmUps required more time on their part to compose, read, and grade student responses on a daily or weekly basis, but overall felt it was time well spent.

Similarly, the smaller number of faculty with the technology available to use an in-class polling system ("BeyondQuestion") report high levels of student engagement in the classroom and high satisfaction with the technique and plan to continue using it in future classes.

Student attitudes and responses to both techniques have also been generally positive. For WarmUp use at the institutions involved, on a scale of 1=positive to 5=negative, faculty estimated student response to the WarmUps to be 2.3. Faculty responses reflect student answers to a similar question in two physics classes taught by one of the authors (AJC). When asked that if they had the choice between a class with WarmUps or one without (for the same class, instructor, etc.) 75% of the student respondents said they would pick one with WarmUps despite the extra work required. Furthermore, end of the course

evaluations showed similar positive student attitudes about both BeyondQuestion and the use of WarmUps in class.

## STUDENT LEARNING GAINS

Specific student learning gains using in-class polling ("Beyond Question") in physics lectures is well-documented (Mazur, 1997, pp.15-17) and we expect that it would extend to other disciplines as well. We also found that by asking students to respond via computer to laboratory questions and then discuss answers with other laboratory groups who had different answers almost doubled the learning gains, as measured by a multiple choice pre-test and post-test for a given laboratory exercise (Cox & Junkin, 2000).

Pre-class questions also seem to increase student learning. In our survey, over 90% of the faculty respondents indicated that student learning was positively impacted by the use of WarmUps in their classes. The student respondents agreed: all said that WarmUps were either very helpful (69%) or somewhat helpful (31%) in their learning for the course. The primary reasons cited by both instructors and students were that the WarmUps forced students to read the text prior to class and keep up with the course materials. Certainly students who read the course texts and answer a meaningful question about the text will learn more as will students who stay current with the course materials. In both cases, the classroom time will be more useful for the students. Reading student answers before class allows the instructor to make class time more relevant.

## CONCLUSION

In conclusion, we have found that faculty in a variety of disciplines are willing and eager to use technology that has a proven record of enhancing student learning, has a user-friendly interface, and is platform-independent. Using the templates we've developed, we have found that "BeyondQuestion" and "WarmUps" fit that bill and enable faculty to make effective and efficient use of readily available technology with a positive impact on the learning environment in their classrooms.

## REFERENCES


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