Pocket Learning: digital lecture snippets as STEM class supplements

Prepared for: CTEL Emerging Technology Small Grant Proposal
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Objective

One aspect of the modern students lifestyle is an increased reliance on mobile devices to access all aspects of their digital lifestyle. One challenge facing science, technology, engineering and mathematics (STEM) is the difficulty in adequately presenting increasingly content rich coursework while providing enough examples and alternate illustrations of concepts to meet the learning needs of students. To address both of these issues, a number of short multimedia mini-lectures will be developed that take advantage of pencasts, webcast, screen capture, and multimedia presentation (such as video or annotated powerpoint slides) that will be used to present examples and concepts. These short (<15min) ‘lecture snippets’ will initially focus on basic skills that are required across a number of STEM classes (general chemistry, algebra, and physics). These lecturettes will not replace in-class development of concepts, but, instead, will offer alternate approaches or additional worked examples. These digital recitations will be released in multiple formats (pdf, audio-only, mixed media and/or video), allowing the students to access the content asynchronously in their preferred format. The instructors in several courses will coordinate their curriculum and will supplement certain aspects of their lecture with these digital ‘recitations’, particularly those areas that see substantial overlap across the introductory STEM coursework such as unit conversion, proper calculator usage, and equation rearrangement. Student usage of the lecturettes as well as how they access them will be monitored through the use of readily available tools and the effectiveness of this mode of education will be measured through in class and out of class assessment. The lecturettes will specifically be targeted towards mobile devices, allowing students to carry the classroom in their pocket.

Goals

The short term goal of this proposed work is to assess the effectiveness of asynchronous content delivery in improving student success. The work will produce several content modules that will include the following: the lecturette, homework selections based on the demonstration, an assessment piece that can be used for self-assessment and monitoring of performance, as well as selected in-class test questions to gauge student performance. These will be utilized over the course of two semesters, followed by an evaluative period at the end of each semester and a second quantitative evaluation period to compare student utilization of the online content with success rates in the individual classes.
Statement of Need

One difficulty facing STEM educators, particularly those teaching at the introductory level, is that many of the courses are content rich and serve as the foundation for additional high level classes. This requires that the educator make critical choices between addressing topical material and modeling basic skills. Often the topical material takes precedent over providing a suitable number of examples or worked out problems that the student can use in an attempt to model the process. This is due to the requirements of curriculum and the ‘need’ to discuss topics that are central tent poles upon which other classes rely. While there are many debates regarding the consequences of a focus on content it is also important to spend time on helping the student develop basic skills that will allow them to be lifelong learners and succeed regardless of the type of class or issue.

The current e-Learning goals to offer a greater number of courses in a blended or online format present a special challenge for the STEM disciplines. The fact that mathematical notation takes a central role in many classes makes it difficult to have online material with sufficient didacticism to engage the students. Formula and conversion used in chemistry and physics are not readily reproduced in the online environment and students often lack the software or skills to reproduce formula or rearrangements to reasonably answer problems that have a non-numeric answer. Additionally, the problem solving and example based nature of many STEM topics are generally prone to large amount of student inquiry and socratic dialogues that help drive the lectures. While discussion boards can be used somewhat in these situations, again, the lack of easy representation of mathematical terms, chemical notation and physics equations hampers discussions in the non-classroom setting. Part of this difficulty is apparent in the relatively few offerings by the university for online, blended, or even ITV based classes in mathematics, chemistry or physics. Only five such courses are offered this spring, with most of these being offered in mathematics.

To address these concerns, meet the mission of the university while offering robust, pedagogically sound approaches to online and blended education, a new set of technologies have been tested and implemented in a small set of science classes that offer the students the opportunity to experience lectures asynchronously, maintaining much of the student/professor interaction of the live classroom, focusing on the written text and audio through lecture capture strategies. This lecture capture has taken advantage of pencasts and screencasts (which are multimedia extensions of the audio-centric podcast) to record and provide copies of the lectures to students in a way that allows them to access the material at their leisure. While this is not a true blended or online class, it provides the modern student with a way to access lecture material in a way besides directly attending class and pencasts and screencasts do offer potential for online or blended class utilization. How and when students access online lecture content is relatively unknown. The current tools provide by Blackboard are woefully inadequate in monitoring student access to online materials. The initial work undertaken was aimed at examining collaborative notetaking, but extensive amounts of data was collected about student access and habits in accessing online lecture material.

Several important early results from this study (which is still ongoing) are starting to become apparent. One initial result regards how students interact with digital lecture copies. While the class was offered as an evening class with a once-a-
week format (monday evenings), students would generally access the lecture copy primarily in the morning or early afternoon, with 60% of the views being done between 10 and 4pm, times normally reserved for other classes. Other salient information is that, while the entire lecture was posted (1.5-2hrs), students spent only a few minutes (averages between 1 and 5 minutes) at a time listening to the lecture recording. Supplemental surveys of the students show that the reason for this is the preferred method of the students to access the digital notes is in small doses. Of the students surveyed, 45% responded that they only focused on small, specific sections, either skimming the lecture, stopping to listen to specific sections, or jumping to specific examples for clarification. One drawback to the digital lecture copies is that students are tempted to skip or will skip classes. While the class structure made absenteeism difficult for students (assessments were given every class period), 13% of respondents admitted to skipping class and another 20% were tempted to not attend class due to the presence of complete digital records of the lecture.

Students also spend far less time on past lecture materials than originally envisioned. Students focused most on lecture material from only the previous week, neglecting for the most part lectures older than two weeks. Typical student activity would involve examination of the previous lecture immediately before the current week’s lecture. This is evident by a consistent spike in traffic for last-weeks topics on the day of a scheduled lecture and a secondary increase a week later. While this could be due to topical review by the students, it is likely as rush to finish the assignment that was typically due in class.
How students access online lecture material was also examined. In preliminary surveys of chemistry classes, 95% of the students responded that they had computers that they described as ‘their own’. Examination of the visit data for the class lectures also strongly suggests that greater than 30% of the students accessed the data from a portable notebook computer.

**People, Activities, Work Plan**

All of the preliminary results point to student preference for small bits of information that they can access at their discretion, whenever and wherever they prefer, not just in the limited class room setting. This presents a special opportunity to tailor course content to fit this emerging lifestyle. Additionally, to bolster STEM classes, certain key, overlapping student based skills need to be addressed in short, focused, recitation model sessions. In conjunction, developing a working model for blended or online STEM classes needs to be developed. To address all of these issues, a distributed set of online tools and digital capture technologies will be harnessed to produce a number of short multimedia mini-lectures, objects that can be thought of as digital recitations. These will be developed to take advantage of pencasts, webcast, screen capture, and multimedia presentation (such as video or annotated powerpoint slides) that will be used to present examples and concepts. These short (<15min) ‘lecture snippets’ or lecturettes will initially focus on basic skills that are required across a number of STEM classes (general chemistry, algebra, and physics). These learning packages will be developed, in part, for use on mobile devices (such as iPhone or iPod touch) or netbooks and include optional presentation formats (pdf, audio-only, mixed media and/or video). This will allow for the students to carry the classroom and learning environment with them in their pockets and access the skills and strategies for specific skills in an environment that frees them from the classroom.

Both Prof. Dan Stasko (Main Contact dstasko@maine.edu) and Prof. Paul Caron are active in the Natural and Applied Sciences program at USM LAC and due to close interaction are able to coordinate their efforts. Working together, teaching across a number of classes including Chemistry for Life Sciences, General Chemistry I & II, Introductory Physics, Algebra, and Statistics, it should be possible to focus on a small number of specific issues that crop up at the introductory level in all of these classes and develop a selection of lecturettes that target these areas, shifting material out of scheduled class time, into an online setting. It must be stressed that these lecturettes will not replace in-class development of concepts, but, instead, will offer alternate approaches or additional worked examples. The instructors will coordinate their curriculum and will supplement certain aspects of their lecture with these digital ‘recitations’, particularly those areas that see substantial overlap across the introductory STEM coursework such as unit conversion, proper calculator usage, and equation rearrangement, order of operations and the use of unit analysis in basic science classes. These digital recitations will be released in multiple formats, allowing the students to access the content asynchronously in their preferred format. In some cases, depending on the topic, video of board work or calculator usage will be utilized. Compression, distribution and student usage of the lecturettes as well as how they access them will be monitored with the help of CTEL.

**Project Timeframe, Outcomes, and Evaluation**

Due to the compressed nature of this award timeline, much of the work proposed will build on the lecture capture strategies in place. This proposed work will assess the effectiveness of asynchronous content delivery in improving
student success through in-class and out-of-class assessment. The work will produce 6-8 content modules that will include the following:

- the lecturette
- homework selections based on the demonstration
- an assessment piece that can be used for self-assessment and monitoring of performance
- as well as selected in-class test questions to gauge student performance.

Two initial modules will be created and tested during Winter Break 2009 for implementation in Spring 2010 General Chemistry and Applied Physics. Several additional modules (totaling between 6 and 8) will be created as the semester progresses and utilized in the classes. An evaluative period at the end of the semester will take place. This second quantitative evaluation period will compare student utilization of the online content with success rates in the individual classes. A secondary outcome will be tracking and usage data for students, to better understand students’ approaches to online coursework in a mixed mode environment.

**Dissemination**
A final report to CTEL will be prepared in late June, with project results published on the Web and discussed on campus. The initial groundwork with the lecture capture in the STEM class room is currently being analyzed and formatted for publication.

**Budget**
Personnel: (Total $1500) Prof. Caron, ($500) Prof. Stasko ($500), Media Technician ($500) The media technician will support the instructors by filming certain in-class lecturettes and demonstrations, editing and compressing the files to be utilized on media devices.

Items: (Total $1500) Camera, shotgun mic, tripod, digital media storage, editing software, screen capture software, ($1500) While Flip-cams and similar devices are inexpensive recording solutions, capturing board information or close-up demonstration in enough detail is difficult. Sound quality is also an issue in a live classroom, necessitating a special microphone.

Items: ($800) iPod Touch or other media devices 2x iPod Nano (Library use) Several portable media devices will be used to ensure that information is useable on the mobile platform and adequate. Two small media devices will also be housed in the Library for use by students that do not have mobile options.

Total $3800