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Strategic Planning Summer Working Group Report

Active Learning & Technology-enhanced Learning Committee

Initial report to the Faculty: August 2015

Section 1: Charge
Identify short and long term goals for active learning and technology-enhanced instruction on the campus. Develop plans to facilitate curricular improvements where there are opportunities and in conjunction with the Center for Innovative Teaching & Learning. Consider to what degree Mines can broadly adopt advanced pedagogy techniques and how to appropriately value and assess changes in pedagogy from both student and faculty perspectives.

Section 2: Relationship to Strategic Plan
The Strategic Plan identifies four goals to advance CMS. This Committee's efforts directly align to goals 1 and 2, identified below:

Goal 1: Enhance the distinctive identity and reputation of Mines
Identified Strategies Specific to Active Learning & Technology-enhanced Learning
   • Expand active-learning instruction (such as studio and project-based, rather than traditional lecture format) utilizing best-in-class pedagogical and technological practices.
   • Improve and expand opportunities for participation in professional practice and research throughout the entire undergraduate experience.

Goal 2: Build upon a student-centered campus culture of excellence, inclusion, diversity and community.

Section 3: Membership
Sam Spiegel, CITL - Chair
Michael Erickson, CCIT
Rene Falconer, Chemistry and Geochemistry
Tracy Gardner, Chemical and Biological Engineering
Gus Greivel, Applied Mathematics and Statistics
William Hoff, Electrical Engineering & Computer Science
Pat Kohl, Physics
Neal Sullivan, Mechanical Engineering

Section 4: Summary of deliberations
The committee has been charged with developing short- and long-term goals for active learning and technology-enhanced instruction on this campus. Active learning has come to mean different things to different people. We have explicitly chosen not to frame this charge in terms of rigidly defining active learning and developing metrics to track faculty adherence to this definition. Rather, we frame this charge in terms of overarching strategic goals. How do we best deliver a superior, distinctive education in a time when residential universities face intensifying pressure from lower cost alternatives (such as community colleges and online education)? We believe the most natural answer to this question will necessarily involve education that is active and/or project-based, assisted appropriately by technology.

As a broad definition, *Active Learning* is an approach to instruction that focuses the responsibility for learning on the students and requires active cognitive processing. It can be "anything that involves students in doing things and thinking about the things they are doing" (Bonwell & Eison, 1991, p. 2). However, the thinking should move beyond recall of information. Active learning should develop students' skills, attitudes, and content knowledge (all three) as they engage in higher-order thinking tasks such as analysis, synthesis, design, and evaluation. Active learning requires students to do the cognitive work by writing, discussing, analyzing, and/or solving problems. Actively learning is one of the features that can make the Mines educational experience unique and distinctive.

There are numerous instructional approaches and techniques to create active learning in the classroom. Some of these involve technology, but technology alone is not sufficient to create active learning. Often in active learning, students are engaged in working in pairs or small groups. The pairs and group work facilitates talking, reflecting, and thinking about the content.

Some techniques are fairly simple requiring little time to learn and implement and other approaches are complex in implementation. The instructional techniques should be selected based on the learning goals and in consideration of the students and course context. Passive receipt of information via lecture is not commonly considered active learning, though lecture (used thoughtfully) can be a component of a successful active learning course. Some common techniques can be found on the Center for Innovative Teaching & Learning (CITL) Website (citl.mines.edu).

Why should we utilize active learning in Mines' courses?

As Mines strives to have distinctive courses and programs of study or degrees, we need to consider questions such as:
- What is the added value of our courses? In other words, why are our courses worth the extra money? How are they superior to lower cost alternatives (i.e., online courses, Khan Academy Courses, CC courses)?
- How do we strengthen the learning experience for our students to ensure they graduate as strong creative thinkers, able to not only join the workforce as prepared professionals, but able to become leaders in their STEM fields?
- How do I organize my class to be most efficient, making the best use of limited contact time?

Active learning addresses these questions. Numerous studies have shown the positive impact of active learning on faculty productivity, student performance and student learning. Well-designed and implemented courses that are predominately organized around active learning are distinctive and often perceived to be of value.

Technology-enhanced learning is the use of instructional technology in, or as part of, a course in such a manner as to enhance or improve the learning. The instructional technology may be used by the instructor (e.g., showing a video, demonstrating a simulation) or by the student directly (e.g., watching a video, engaging with a simulation, using a clicker). Technology-enhanced learning can be implemented in support of active learning.

The Committee has agreed to focus our efforts around the use of instructional technology as part of a face-to-face course, and to reserve discussion of fully on-line courses for another time or committee.

Why should we utilize technology-enhanced learning in Mines' courses?
Please note that we do not endorse adding technology to the classroom for its own sake. Technology-enhanced learning involves the deliberate use of technology to advance course goals. These goals may include (but are not limited to):
- Engaging more of the students present
- Providing course content outside of contact time
- Helping with difficult-to-visualize concepts
- Giving students direct experience with relevant technological platforms in the presence of instructors and TAs who have expertise with these platforms and can apprentice students in the best use of the technology

Teaching and research are in support of the University's mission – they also support each other

The university's teaching mission is not, and should not be thought of, as in conflict with the university's research mission. For example, mentoring significant numbers of undergraduates in research or senior capstone projects requires active learning. Active learning builds students' abilities to critically analyze, design, question, and articulate ideas – active learning develops future researchers. Additionally, strong researchers have insights into the fields that should be shared with and valued by undergraduates. Several Universities establish positions of high prestige that support senior researchers to teach undergraduate courses. These positions are viewed as honored positions that only faculty who excel in both teaching and research can achieve.

Section 5: Recommendations
The committee has developed initial recommendations for faculty and for administration. They are presented organized by the two categories. We welcome feedback and additional suggestions from faculty. We will continue to explore and refine these recommendations across the next few months.

Recommendations for Faculty:
1. Start simple – learn about the simple active learning approaches and implement a few. Contact CITL for support.

2. Become a reflective practitioner - intentionally focus on ways to enhance learning through active learning in your courses.

3. Encourage other faculty to use Active Learning.

4. Take advantage of opportunities to learn about new pedagogies
   a. Contact CITL to learn about being more efficient in your classroom by using Active Learning
   b. Attend pedagogy seminars
   c. Join PLCs or a Teaching Triangle
   d. Request conference funds to attend conferences that focus on pedagogy
   e. Learn about resources available at Mines – e.g., InkSurvey (ticc.mines.edu)

5. Work with administration to help refine and align policies with intended teaching practices. In other words, become part of the solution. Help identify areas that need to be strengthened and help share success stories.

6. Do not view teaching and research as conflicting interests. Learn to be efficient in both and how to use one to build the other.

Recommendations for Administration:
1. Provide support and encouragement for faculty so they can learn how to use Active Learning in efficient ways. This support might include:
   a. Departments and Colleges should schedule pedagogy events in conjunction with CITL to highlight approaches and tools in a focused approach (e.g., using clickers and giving faculty each a clicker, facilitating discussion in lecture, quick assessing techniques).
   b. Invest in technology infrastructure and staff to provide the resources and support needed for new instructional approaches. For instance, CSM needs to invest in video hosting, on-demand streaming, for instructional videos so they are compatible within the LMS (BlackBoard) and accessible for all faculty. Increase CITL staff to provide additional supports to faculty such as instructional design specialists, video support, and additional pedagogical support.
   c. Faculty should be offered service credit (or release from other service responsibilities) for specific tasks related to advancing the quality of instruction in their department. These may include actively participating in a Professional Learning Community or Teaching Triangle, significant revisions or new course development in collaboration with CITL, targeted research and reporting on existing pedagogical innovations, and so on.

2. Each department should develop a small number of 'starter courses' that can be taught comfortably by new faculty. These starter courses could have clear and detailed notes and schedules, well-written homework sets and solutions, and banks of appropriate supplementary materials like projects, in-class activities, or clicker questions. The intent would be for new faculty to be able to be shepherded into good teaching practices without severe demands on their time.

3. Having a single data point is problematic in assessment and evaluation. Numerical teaching evaluations have been shown to depend significantly on unintentional factors such as instructor popularity and expected student grade. Also, it has been widely documented that new modes of instruction frequently cause dips in numerical scores, incentivizing faculty to maintain the status quo. Thus, we recommend that the university de-emphasize (but not remove) these numerical scores during evaluation of teaching for promotion, tenure, and awards. We further recommend that faculty be encouraged and/or required to provide qualitative data on their teaching. For example, one might have the FDR template include the line "Describe the manner in which your courses have added to the distinctiveness of the Mines degree. In what fashion and to what extent do your courses provide benefits that could not be easily matched online or at lower-cost institutions?" The intent here is to still hold faculty accountable for advancing the school's educational mission, while giving them more flexibility in how they advance that mission.

4. CITL should expand the resources available to faculty such as a set of online

examples, both of good teaching practices on campus and of the processes that people have followed to learn what practices to use. For instance, how productive discourse is promoted to engage students and advance their thinking in physics studio; adaptations general chemistry faculty have made to the course design to facilitate active learning; how faculty members have formed Teaching Triangles to learn from each other and study their own teaching practices; and the other various ways CSM faculty have begun to enhance learning.

5. Both teaching and research should be honored at CSM and a plan should be established to encourage faculty to connect and build on both.

Section 6: Next steps

This report reflects the early work of this committee. The committee will gather faculty input during Faculty Conference. The input will guide refinement of the recommendations and next steps. Further efforts will be made to specifically develop plans to facilitate curricular improvements where there are opportunities and in conjunction with the Center for Innovative Teaching & Learning. These plans will be shared with focus groups consisting of instructors and administrators.

As the plans are being developed and through conversations with the focus groups, the committee will develop more specific recommendations as to the degree Mines can broadly adopt advanced pedagogy techniques. The recommendations will consider how to appropriately value and assess changes in pedagogy from both student and faculty perspectives.

Section 7: Resources/references consulted

Center for Research on Learning and Teaching. University of Michigan.. Found at: http://www.crlt.umich.edu/tstrategies/tsal

Cornell University Center for Teaching & Learning. Found at: http://www.cte.cornell.edu/teaching-ideas/engaging-students/active-learning.html

Fink, L.D. (2013). Creating Significant Learning experiences: An integrated approach to designing college courses. San Francisco, CA: Jossey-Bass.

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