Wisconsin Collaboratory for Enhanced Learning (WisCEL)

2011-2012 MIU Report of Impact and Accountability

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I. GENERAL PROGRAM UPDATE

Wisconsin Collaboratory for Enhanced Learning (WisCEL) is a complex project involving multiple units on campus, a collaborative funding model, new uses for technology, and pedagogical innovation.

The newly constructed WisCEL Centers, located in H.C. White College Library and Wendt Commons, combine deliberate choices of physical environment including collaboration-friendly, multi-use spaces and furnishings with innovative classroom technology and pedagogy to create an innovative learning commons. A critical design principle was to envision a space that students would embrace as "their own" place to engage informal learning, and marry it with an infrastructure that enables 21st-century, best practices for formal classroom instruction. WisCEL supports pedagogies which include spontaneous peer collaboration, instructor-as-coach models, self-pacing opportunities, frequent and immediate learning progress feedback, and increased instructor time with students.

The WisCEL team is pleased to present the following report of impact and accountability for the 2011-2012 academic year.

Following are just a few highlights noted in demonstration of the impact the Madison Initiative for Undergraduates (MIU) has helped make possible in its support of the WisCEL project:

- WisCEL course sections are showing preliminary evidence of significant learning gains.
  - Students in WisCEL sections consistently achieved grade outcomes of A, AB, and B and fewer grade outcomes of D, and F than in non-WisCEL sections of the same course.
  - Student evaluations indicate the following perceptions:
    - WisCEL course sections increase individual time with instructors.
    - Instructors care whether students learn course content.
    - There is an increased amount of time for problem-solving during class meetings.
    - There is an increased comfort level discussing course content with instructors.
    - WisCEL course sections encourage peer collaboration which has a high correlation with increased learning.
    - Students spend less time on course work outside of class while feeling very successful in learning the course content.
    - Students are more excited to come to a WisCEL class than they are to come to a non-WisCEL class.
  - WisCEL instructors report WisCEL Centers provide an excellent learning environment which inspires creativity in the way they teach their courses and that they are better able to discern student’s engagement in and understanding of course material in their WisCEL sections.
- Based on the positive results of Math pilot WisCEL sections, all sections of Math 95, 101, and 112 have been approved by the Math department to be taught at the College Library WisCEL Center beginning Fall 2012.
- Over the past year, nearly 1000 students in 21 sections of Math and Engineering courses have been impacted by the WisCEL project.
  - Of these students, 138 were targeted minority students.
- To date, proposals have been received and approved for a projected 65 WisCEL sections, impacting over 3000 students next year.
A cross-functional WisCEL Advisory Committee has been formed and meetings are scheduled through Spring 2013.

- A WisCEL space usage work group has been appointed by the Advisory Committee to consider a formal process for considering new course proposals, new ways to expand the use of the WisCEL Centers and to change current practices (or invent new ones) in order to increase course access.

- WisCEL instructors are currently working with evaluators to create tools which will measure the effectiveness of the new practices they plan to implement in WisCEL next year.

- WisCEL facilitates a faculty-led WisCEL learning community in which instructors share emergent insight into best practices for teaching in a WisCEL environment.

II. WISCEL IMPACT ON MIU GOALS

WisCEL project-specific goals include accumulating and reporting data on educational best practices, utilizing technology to enhance student learning, and the support of peer collaboration and other high-impact pedagogies. These goals directly support MIU goal #3 which states MIU projects will:

Expand best practices and innovation in teaching and learning, curricular design, and student services in order to enhance undergraduate student learning and their educational experience. (The Executive Summary specifically lists several types of innovations: (1) expansion of FIGS, URS and other research opportunities, RLCs, capstones, internships, and service-learning courses, and other “small, intensive seminar experiences taught by faculty and instructors;” (2) integration of technology and instructor capacity to use appropriate technology; (3) advances in “critical student services,” including academic and career advising, tutoring and peer-mentoring...
III.  WISCEL IMPACT ON PROJECT GOALS

A. For your specific project goals, what progress have you made? What impact is your project having on the quality of the undergraduate experience?

WisCEL project-specific MIU goals are to:

1. Compare grades and evaluative assessments in WisCEL and non-WisCEL course sections. WisCEL class sections will result in equal or better student outcomes.
2. Make qualitative observations on what works and what does not work in the new WisCEL spaces.
3. Accumulate and report on data relevant to educational best practices.

WisCEL courses and sections for Fall 2011 and Spring 2012 included:

**Fall 2011: Pre-calculus math courses:** Math 95 Section 1, Math 101 Sections 1, 2, 3, 4, and Math 112 Sections 6, 12, 15, 19.

**Spring 2012: Pre-calculus math courses:** Math 101 Sections 3, 5, Math 112 Sections 4, 10, 14, 15, 16 and **Engineering courses:** ECE 230 (Circuit Analysis) Section 1, EMA 201 (Statics) Sections 1, 2, and INTEREGR 103 (Core Competencies for Engineering Leaders) Section 1.

Progress towards WisCEL project-specific MIU goals is reported below, beginning with Goal 1 (equal or better outcomes in WisCEL versions of courses or course sections), followed by Goal 2 (what does and does not work in WisCEL spaces), and Goal 3 (educational best practices). Results presented are based on data and analysis conducted by Academic Planning and Analysis, formative evaluation findings, survey results from DoIT Academic Technology, and feedback from WisCEL instructors and students.

**A.1 WisCEL MIU Goal 1 (Equal or better outcomes in WisCEL versions of courses)**

Figures 1-4 compare WisCEL and non-WisCEL sections for each 2011-2012 WisCEL course offered. Each chart represents a specific course in either math or engineering and compares student semester grade outcomes in traditionally taught course sections (non-WisCEL) to those in WisCEL sections. Percentages are used as there were differences in the number of traditional sections and WisCEL sections per term and number of students taking each section. Sample sizes in WisCEL sections were too small for statistical analysis; therefore charts show only aggregate data and emerging trends.
Figure 1: Comparison of Distribution of Grade Outcomes for Pre-calculus Mathematics Courses Math 95, Math 101, Math 112

Math 95: Non-WisCEL and WisCEL Sections (2005-2011) Comparison of Distribution of Grade Outcomes

Course Grades in Math 95

- Average percentage of students receiving specific grades

- Non-WisCEL 2005-2009 Sections
- WisCEL 2010-2011 Sections
- Linear (Non-WisCEL 2005-2009 Sections)
- Linear (WisCEL 2010-2011 Sections)
The comparison of WisCEL sections to Non-WisCEL sections in Figure 1 for Math 95, Math 101, Math 112 indicates that, in general, students in WisCEL sections perform equal to or better than those in non-WisCEL sections of the same math course. In particular, Math 95 and Math 101 show a linear trend line that indicates students in WisCEL sections are more likely to earn a grade B or higher, and less likely to earn a grade D or lower.

Figure 2: Comparison of Distribution of Grade Outcomes for InterEGR 103
Figure 2 compares InterEGR 103 grade outcomes in one WisCEL section and one non-WisCEL section; each section was taught by the same instructor. The trend lines for each section show students in the WisCEL section received equal or higher grades than their non-WisCEL peers.

**Figure 3: Comparison of Distribution of Grade Outcomes for EMA 201**

The comparison of several semesters of EMA 201 non-WisCEL sections, all taught by the same instructor, to a single WisCEL section taught in 2012 by the same instructor, shows WisCEL students earned higher grades than in the average of the non-WisCEL sections. Also, fewer students received BC or lower grades.

**Figure 4: Comparison of Distribution of Grade Outcomes for ECE 230**
Figure 4 compares ECE 230 grade outcomes in one WisCEL section and one non-WisCEL section. Each section was taught by the same instructor who purposely maintained similar course content, homework exams, and the level of rigor in each section. ECE 230 student grade scores in the Spring 2012 WisCEL version of the course were more than 6 percentage points higher on average than they were in the same course taught by the same instructor in Fall 2011 - the class average score increased from 77% to 83.5%. This was associated with a shift at both the lower and higher end of the distribution curve for WisCEL sections – more than 70% of WisCEL students scored 80% or higher and fewer than 4.3% students scored 60% or less.

A.2 WisCEL MIU Goal 2 (What does/does not work in WisCEL space)
Instructor interviews and student surveys show that open and flexible space, movable furniture (e.g., white boards, laptop desks, and tables), new technology, and on-site instructor office space all foster increased interaction between students and instructors:

- Math instructors observed “Computers in pods allow for easy movement and discussion among students,” and is preferable to having computers in fixed rows like in most computer lab environments. The use of portable white boards to partition the classroom space from the rest of the main WisCEL room decreases distractions and increases on-task behavior. Math instructors also valued having a small side room with 4 networked computers for proctored student make up exams.
- WisCEL instructors all noted that up-to-date technology enables best practices, especially ones that require advanced learning software.
- WisCEL instructors like the capacity of the WisCEL space to serve large numbers of students without giving up dynamic learning practices. The InterEGR 103 instructor noted that the flexible space and furniture “maximize learner time on task even with frequent changes between large group, small group, mini-lecture, and videos. As the class grows—from 25 to 35, eventually perhaps to 100—the WisCEL space will be conducive to this sort of learning and teaching on a
broader scale. I don’t know of another room on the engineering campus that would allow this for 100 students.”

- The ECE 230 instructor reported, “The WisCEL space worked beautifully at encouraging student interaction and collaboration, creating a more informal environment to help put students at ease asking questions, and allowing the professor and two T.A.s to easily circulate among the students. The availability of a networked computer for each student permitted the use of online exercises to provide the tasks to stimulate student learning, which then combined with online grading capabilities allowing timely feedback to students and minimizing the grading workload.”

- Many WisCEL instructors have opted for two, 75-minute classes per week over three, 50-minute classes to allow for a better balance between lesson activities. Math instructors devote 15 minutes to introduce new concepts, give students 10-15 minutes to collaborate on sample problems, take 5-10 minutes to address student difficulties, then use the balance of time for students to work at their own pace on the daily assignment.

Also discovered during instructor interviews and operational trials of what works were the following:

- As mentioned above, 75-minute class sessions work better than 50-minute class sessions for these highly engaging, technology-enhanced courses. A 75-minute class allows for students to become more deeply engaged in understanding the material. For Fall 2012 the Math department has changed all Math 112 sections to 75-minute class sessions.

- According to WisCEL instructors, traditional lecturing is difficult in the new WisCEL learning environment. Though it is possible to hold the attention of all students for instructor-centered talk for short periods of time using the provided wireless microphones and monitors spread throughout the space, extended lecturing is cumbersome.

- Challenges arose this year coordinating simultaneous use of WisCEL Centers by multiple groups and individuals. It is common for study groups and individual students to work in the facility at the same time a course is meeting in a portion of the main room. Sometimes individual students desire to study in the WisCEL Center at the same time as a large WisCEL class that requires the entire room. We learned a greater number of larger and more prominent signs should be used in conjunction with a publicized, electronically accessible version of the WisCEL Center schedules to avoid confusion for students and instructors.

- Again, owing to the multi-functional capabilities of and increasing demands on the WisCEL Centers, a challenge arose related to mid-terms and final exam week. Evenings and exam week are peak times for individual and group study in WisCEL Centers. Increased use of electronic exams has resulted in course demand for WisCEL Centers for exam administration during some peak study times. WisCEL staff members and partners are assessing strategies for resolving this situation in the coming year.

A.3 WisCEL MIU Goal 3 (Educational best practices)
Instructors use the flexible spaces, furniture, and technology in WisCEL facilities to implement instructional strategies that are highly varied, student-centered, and carefully orchestrated. In addition to the lesson structure instituted by math instructors (see “Goal 2,” above) the Spring 2012 ECE 230 WisCEL course exemplified using a physical environment and technology in conjunction with student-centered pedagogy to heighten student engagement and performance. The WisCEL version of ECE 230 combined 2 lectures (Monday and Wednesday) with 2 WisCEL sessions (Tuesday and Thursday) weekly. WisCEL sessions consisted primarily of exercises related to the previous day’s lecture. Students frequently collaborated as they worked at computer pods. Because the professor had created a large bank of exercises, and the computer assigned individual students equivalent but numerically unique
problems, student collaboration did not allow students to copy answers instead of doing the work themselves. Computerized grading gave students instant feedback. The instructor and a second T.A. continuously assisted students working individually or in small groups on the day’s problems.

Best practices for instruction used broadly by WisCEL instructors include:

- Computerized learning software to allow students to work at their own pace, get immediate individualized feedback, hold students accountable to a specific level of learning mastery on homework assignments, reduce instructor grading, and provide instructors with current information on student performance.

- Instructors have taken advantage of the WisCEL space to increase student collaboration and individual and small group instruction. Instructors use increased student contact not only to convey academic content, but also to bolster student motivation and active engagement, foster good work habits and teamwork, and focus on optimizing student conceptual development to prepare students to apply their knowledge beyond the classroom. Many WisCEL instructors observe that this instructional approach places a premium on instructors’ questioning strategies and that the right question can uncover student misconceptions which, if left unaddressed, would cause further difficulty.

- Many WisCEL instructors have expanded and rebranded their “office hours” and now conduct them in the WisCEL facility as “lab hours” outside of the regular class period, resulting in much greater student use of office hours.

- WisCEL instructors are increasingly using online video (via LearntoUW, Moodle, Pearson, etc.) to reduce in-class lecturing and devote more time to students working on exercises with instructor help. Instructors report that short video clips that explain a fundamental concept or illustrate a problem solution verbally and visually work better than long videos of traditional lectures.

- WisCEL instructors often report that the amount of planning needed to launch a WisCEL version of a course they have already taught in a traditional setting is comparable to launching an entirely new course. However, many also report that much of the planning will not need to be repeated every semester (e.g., creating online “lecture” video, online problem sets, or learning new instructional software). Regular meetings in which WisCEL instructors discuss their innovative practices have helped expedite course design and planning.
V. NEW HIRES AND DIVERSITY

B. If you made new hires, how have you increased the diversity of your unit/department’s faculty and staff? Describe your efforts to increase the diversity of your recruiting pool.

The WisCEL Centers at H.C. White and Wendt Commons were completed in November 2011. This year, WisCEL hired operational staff for both Centers to provide faculty and students using the Centers with smoothly functioning technology and support for their WisCEL courses and study time.

WisCEL places great value on staffing diversity. To gather a diverse pool of applicants, full-time positions were marketed through the Madison Times, LinkedIn, and other social networking sources. Technical positions were also listed where applicable with the following lists: Technology partners at UW Madison and Lab Managers (UW Madison, Wisconsin, and National). Student positions were advertised online (on the library.wisc.edu site), physically in the library spaces, and through the student job center. In addition, diverse Search and Screen Committees were formed for each position. For the College Library WisCEL Center, an Equity Action Monitor was also assigned to WisCEL position Search and Screen Committees.

Employees hired or newly funded, at least in part, using MIU funding for 2011-2012 include:

- **A WisCEL Technology Manager for each WisCEL Center:** *(Steven Fife and David Moe)* As part of the partnership agreement between WisCEL and the Libraries, the Libraries agreed to support the new WisCEL technology using existing support infrastructure and processes where possible. This allows for WisCEL support hours and skills beyond what would otherwise be possible. In return, the WisCEL project has agreed to fund 1 FTE per site for technical management and support to include support of the 250 additional computers and myriad additional technical hardware, software, and services required to operate the WisCEL Centers.

- **A WisCEL Lab Manager for each WisCEL Center:** *(Steve Frye and Anne Glorioso)* Included in the partnership with the libraries is an agreement that the libraries will support the operational aspects of the WisCEL facilities to include but not limited to: facility scheduling, maintenance, supervision of service desk student support, supply purchase and management, etc. In return, the WisCEL project has agreed to fund .25 FTE per site for operational management and support of the two new WisCEL Centers.

- **Student support for the WisCEL Center Service desks:** Though student support for the WisCEL Center Service Desk is hired and managed by the WisCEL Lab Manager at each Center, the students are funded through the WisCEL project. Included in the 24 students who worked at the WisCEL service desks last year were 7 female and 8 reported minority students.

- **WisCEL Project Assistant:** In partnership with the Engineering department, the WisCEL project partially funds a Project Assistant to assist with website updates and other assorted operational tasks.

These positions leverage existing processes and personnel such that WisCEL could not replace the utility of these positions using the same funds or FTE allotment. Through these partnerships, then, the Libraries, the College of Engineering, and WisCEL are able to offer more services for more hours of the day using less funding.
VI. ACHIEVEMENT GAP

C. How have you considered the achievement gap among students based on demographic characteristics (race, gender, socio-economic status) as relevant to your project? What impact are you making?

WisCEL will begin its first semester of non-pilot sections in Fall 2012. Included in the fall WisCEL schedule are sections from Integrated Liberal Studies, Physics, Engineering, and Pre-Calculus Math. We hope Spring 2013 may show even more increased diversity in represented departments using WisCEL Centers for formal instruction.

Now that pilot courses have been offered at both Centers, we’ve requested and received information on the achievement gap (rates of D, F, or drop) in WisCEL taught courses. WisCEL staff members are meeting with individual departments to discuss the findings.

VII. UNANTICIPATED BENEFITS

D. Have you observed unintended or unanticipated benefits to undergraduate students, graduate or professional students, faculty or staff as a consequence of your MIU project? If so, please describe them.

- According to analysis by the Academic Planning and Analysis office, students from WisCEL sections of Math 95, 101, and 112 progressed to the next course at higher rates than their non-WisCEL counterparts.
- Students reported spending less time on the course outside of class while at the same time reporting a high level of success in learning the course content.
- Instructors reported feeling more engaged with students in the WisCEL sections and that the individualized time they spent with WisCEL students helped them to better tailor course content delivery to gaps in understanding.
- Utilization of the WisCEL Centers for tutoring is increasing. This offers the opportunity for students to take advantage of more course-related services in a location where they already spend a great deal of time.
- At least one student organization used the WisCEL Center facility and technology for a Friday night “gaming night” increasing the feeling of ownership of the Centers by the students.

VIII. TEACHING AND LEARNING

H. How are you demonstrating increased student learning and teaching excellence?

In addition to the student grade outcomes shown above, instructor and student comments and survey responses indicate the WisCEL environment enhanced teaching and learning. All WisCEL instructors have observed increased student attendance, engagement, and learning. WisCEL students have noticed instructional differences between WisCEL and traditional classrooms, and prefer WisCEL instruction.

WisCEL students in Math 95, 101, and 112 were more likely than their non-WisCEL counterparts to agree that peer collaboration helps math learning (83% WisCEL versus 69% non-WisCEL), and were also more
likely to agree that their class fostered collaboration (71% WisCEL versus 55% non-WisCEL). Also, students in WisCEL sections of Math 112 were nearly twice as likely as students in non-WisCEL sections to “strongly agree” that they learned a lot from their class.

Figure 5: Student Perceptions of ECE 230

<table>
<thead>
<tr>
<th>For each item select the response that best represents the extent to which you feel ECE 230 or your Comparison Course rates “Greater/Higher,” or “About the Same” in ECE 230 and the Comparison Course (i.e., to indicate that you spend more time on something in ECE 230 than your Comparison Course, select “Greater/Higher in ECE 230”).</th>
<th>Greater/Higher in ECE 230</th>
<th>About the Same in ECE 230 and Comparison Course</th>
<th>Greater/Higher in Comparison Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>The amount of time you discuss course content directly with instructors.</td>
<td>64*</td>
<td>32</td>
<td>04</td>
</tr>
<tr>
<td>Your level of comfort discussing course content with the instructor.</td>
<td>63</td>
<td>33</td>
<td>04</td>
</tr>
<tr>
<td>How much the instructors care whether you learn the course content.</td>
<td>69</td>
<td>29</td>
<td>02</td>
</tr>
<tr>
<td>Your level of comfort discussing course content with other students.</td>
<td>72</td>
<td>26</td>
<td>02</td>
</tr>
<tr>
<td>The degree to which working with other students increases your learning.</td>
<td>74</td>
<td>20</td>
<td>05</td>
</tr>
<tr>
<td>The amount of time devoted to solving problems during class meetings.</td>
<td>72</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>The amount of time devoted to solving problems in the course as a whole.</td>
<td>72</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>The amount of time you spend on the course outside of scheduled class periods (i.e., for homework and studying.)</td>
<td>20</td>
<td>38</td>
<td>43</td>
</tr>
<tr>
<td>The amount of time you work on the course by yourself.</td>
<td>18</td>
<td>34</td>
<td>48</td>
</tr>
<tr>
<td>How excited you feel to come to class.</td>
<td>59</td>
<td>29</td>
<td>13</td>
</tr>
<tr>
<td>Your level of interest in the course.</td>
<td>61</td>
<td>30</td>
<td>09</td>
</tr>
<tr>
<td>Your level of success in learning the course content.</td>
<td>64</td>
<td>32</td>
<td>04</td>
</tr>
</tbody>
</table>

*Percentage of students choosing a given response. The anonymous survey was completed by 56 of 91 ECE 230 Spring students.

Students who took the WisCEL pilot version of ECE 230 in Spring 2012 completed a survey in which they compared ECE 230 to other STEM courses they had taken of similar size and difficulty. As shown in Figure 5 (above), students noticed how the instructional design and pedagogy of ECE 230 differed from that of their comparison classes. Students perceived the WisCEL version of the course as placing much more emphasis on instructional practices such as discussing course content with instructors and time devoted to solving problems or exercises during class meetings. Students perceived the WisCEL version placed “less” emphasis on practices such as doing exercises or problems outside of class, and working on the class by oneself. Students further perceived that the WisCEL environment made it easier to discuss course content with instructors and peers, that their WisCEL instructors care more about student.
learning, and that their own level interest in the course and success in learning course content was higher.

In addition to taking notice of the innovative pedagogy and instructional design of the WisCEL ECE 230 class, survey respondents preferred the class as conducted in WisCEL. Fifty students responded to an open-ended survey item that asked them to briefly explain what they liked or thought was working well in the ECE 230 classes held in the Wendt WisCEL facility. Of the 50 respondents, 31 (62%) said they liked how the class fostered peer collaboration, 26 (52%) liked the emphasis on working problems in class, and 14 (27%) appreciated having instructors ready to help with difficult problems. Nine students explicitly noted that they liked peer collaboration in conjunction with readily available instructor help, 8 others mentioned liking a combined emphasis on in-class problem solving and peer collaboration, and 5 additional students expressed appreciation for simultaneous emphasis on all three of these aspects of the class.

Of the 50 students who noted liking one or more things about the WisCEL classes, 21 explicitly stated that the thing or things they liked resulted in more effective learning, 14 strongly implied the liked practices led to enhanced learning, and 15 simply stated their preference without elaboration. A significant number of students volunteered details about why or in what way WisCEL classes were especially supportive of learning. This includes 9 students who acknowledged that working on problems in class with peers and instructors made them “keep up” with the class instead of putting off serious studying until just before exams, 6 students who noted that the ECE 230 WisCEL classes were especially conducive to developing conceptual understanding, and 4 who noted that the class format was particularly good at preparing them to apply their knowledge beyond the classroom. Two students captured themes sounded frequently in the broader sample when they said,

Working together on the homework is very helpful, but each person still submits their own quiz and therefore does their own work. Personally, I learn best when applying the concepts, so the computerized classroom is really a great way to learn and to retain information on how to approach and solve similar problems.

And,

[I like] the fact that we can work with other students to do the various questions in the on line quizzes. The quizzes are not difficult, but being able to collaborate with students makes it easier to understand concepts which are fundamental. I also like being able to ask the professor and T.A.s questions directly and having them be willing to help and give clear answers.

THANK YOU

The WisCEL team wishes to thank the MIU committee and also the many WisCEL partners and supporters throughout the University. We are excited to begin fall semester 2012 and to put into practice all we have learned over the past year. Please let us know if you would like to discuss any part of this report further.