IMPACT, Instruction Matters: Purdue Academic Course Transformation

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ABSTRACT

IMPACT, Instruction Matters: Purdue Academic Course Transformation, is a Provost-led initiative at Purdue University designed to fund research-based course redesign. Unlike other university transformation projects that focus on individual courses or departments, Purdue's initiative focuses on transforming courses across the campus. The goals of the Purdue IMPACT program are to: 1) Focus the campus culture on student-centered pedagogy and student success; 2) Enable faculty-led course redesign with campus-wide resources; 3) Network faculty through Faculty Learning Communities; 4) Base course redesign on best practices and sound research; 5) Grow and sustain IMPACT by adding new IMPACT faculty fellows annually and 6) Assess and disseminate results to benefit future courses and students. To accomplish these goals, cohorts of faculty participate in weekly workshops and work in a partnership with a development team to transform their courses. To date, two cohorts of faculty have completed teaching their redesigned course or are in the redesign process, and a third has been selected. Of the 49 courses currently undergoing transformation, 39 are from STEM fields. In this paper we will give an overview of the IMPACT process and discuss how this innovative program has helped transform many of Purdue's largest enrollment STEM courses.

Introduction

The face of higher education is changing. No longer is the focus solely on the professor and their lecture, but a greater focus is being placed on the student and how they learn. Research has long supported transforming higher education in this matter. (Chickering and Gamson, 1987) Pioneers across various academic disciplines showed improvements in students' abilities to solve problems and understand concepts, as well as more positive learning attitudes. A new initiative at Purdue, Instruction Matters: Purdue Academic Course Transformation (IMPACT) focuses on course transformation/ redesign of foundational courses, often delivered to freshmen through large lectures and typically challenging for today's students.

While most campus course redesign programs focus on funding individual professors to redesign their individual courses (Weimer and Lenze, 1991), Purdue's IMPACT program targets specific courses with specific characteristics. Key course attributes include foundational courses, number of students enrolled and historic Drop/ Failure /Withdrawal (DFW) rates for these courses. Other courses were selected by previous scholarship of teaching and learning (SoTL) efforts of the faculty. In this paper, we will focus on this first cadre of STEM first and second year courses. We will give an overview of Purdue University, the IMPACT program and provide details of several STEM course redesign projects.

Purdue University

Founded in 1869, Purdue University, located in West Lafayette, IN, is the land grant University of Indiana. As with most land grant universities, Purdue was founded on the principles of providing a foundation of a broad education for programs in engineering, technology and agriculture (Wikipedia, 2012). With a current undergraduate population of over 30,000 students, Purdue offers 283 different undergraduate majors. Purdue has long been

dedicated to being a leader in STEM fields with top ranked undergraduate programs in engineering, agriculture and technology. (Purdue University, 2010). Unfortunately, at 38%, Purdue has the second lowest four-year graduation rate in the entire the Big Ten (Stokes, 2011).

Instruction Matters: Purdue Academic Course Transformation (IMPACT)

The campus-wide IMPACT program was initiated by Purdue administration as a needed program for students, faculty, and campus to increase retention, help students learn better and to graduate in a span of four years versus five or six. The IMPACT initiative fosters a unique partnership among Purdue's Center for Instructional Excellence (CIE), Instructional Technology at Purdue (ITaP), the Libraries, Discovery Learning Research Center (DLRC), Extended Campus (Online course initiative) and faculty on campus.

The overarching goals of IMPACT are to 1) Focus the campus culture on student-centered pedagogy and student successes; 2) Enable faculty-led course redesign with campus-wide resources; 3) Network faculty through Faculty Learning Communities; 4) Base course redesign on best practices and sound research; 5) Grow and sustain IMPACT by adding new IMPACT faculty fellows annually, and 6) Assess and disseminate results to benefit future courses and students.

A series of foundational STEM courses, both on campus and online, were targeted for participation in each IMPACT cohort. The program initiates each cohort with a callout, a series of program awareness workshops, and meetings with Deans, Department heads and instructors of targeted courses. The department and its key faculty must submit an application for participation in a cohort.

Faculty and departments need to provide evidence of commitment to IMPACT by providing a short statement as to why they want to be part of IMPACT. In addition faculty must

agree to participate in Faculty Learning Communities (FLC) and development workshops; work with the IMPACT staff to achieve learning goals; present a brown bag seminar to their department, and agree to participate in evaluations of their course. Finally, the department must provide a letter of support ensuring that the department fully supports their faculty in the program and that the department has a full understanding of the commitment level by faculty as part of IMPACT. After a review process by the IMPACT steering committee, courses are selected for participation in each cohort. Faculty members of the redesign team receive a stipend for their participation in the redesign process.

Once accepted into an IMPACT cohort, the redesign faculty is paired with a support team of individuals from CIE, ITAP and the library. The support team is instrumental in providing guidance and feedback to the faculty members in their redesign process. Prior to meeting with the faculty, the support team meets and considers the following:

- Review faculty applications, syllabus, and identify needs for each course
- Identify resources for each course based on their redesign needs, and
- Identify redesign content to meet Purdue's core curriculum standards, different redesign strategies applicable to each course type, i.e. team based, problem based, and active learning exercises.

The support team meets with the faculty members on a regular basis. During these meetings they help focus the faculty to define their goals and objectives and provide knowledge and expertise on the redesign process as outlined in figure 1.

Figure 1. An overview of the redesign process.

To assist faculty in the redesign process, faculty are made aware of different redesign models. See Table 1.

In addition to the support team, the IMPACT faculty members become part of a FLC. The FLC's meet weekly to discuss topics of concern and to participate in a series of workshops that all address the three main topics in the design process: 1) what do you want to accomplish, 2) how do you want to approach it and 3) what methods and activities will you use to get there?

Finally members of the IMPACT cohort are invited to special talks by researchers outside of Purdue whose focus is related to the redesign process. During the fall 2011 and spring Semester 2012, speakers included John Squires from Chattanooga State Community College, Robert Beichner from North Carolina State University and Larry Michaelson from the University

of Central Missouri. After their visits to Purdue, videos of their talks are provided on the IMPACT cohort website.

Table 1. Sample of Different Redesign Models.

Course Redesign Models	*Description*
Flipped Model	Class for group work and activities. Students prepare for Flipped model classes by watching online lectures beforehand
Just-In-Time Teaching	Faculty use method to obtain feedback on student understanding prior to preparing in-class materials. This feedback allows faculty to modify and mold the curriculum to student needs
Hybrid/Blended Course	These courses combine online content with active group learning in the classroom. This classroom set up builds teamwork skills and ties student understanding to the success of the group.
Studio Approach	Traditionally separated sections, such as lab and recitation, to provide hands-on critical thinking experience. The goal is to encourage students to perform higher level thinking to better understand the material.

One of the key elements in this program is the space students learn in and how technology plays a key role in that. Our administration has committed funds to the program in creation of six SCALE-UP (Beichner, 2007) learning spaces in strategic locations across campus. Of the six planned spaces, one was developed in 2011(Figure 2), two will be completed during summer 2012 and three more to come as space on campus becomes available.

Faculty, who use these spaces, have seen significant amount of improvement in their students' grades, learning and involvement in course activities. As one faculty fellow put it, "I will officially start teaching my redesigned course in [Scale Up room] in Fall 2012, although I was able to get a head start and taught my course in that room last Fall and this Spring already. I love the IMPACT program. My course has been redesigned to utilize a studio style room, the learning is superior, the students are more engaged and I am happier. The critical aspect is the

team seating. I am sure many of you have thought a lot about space issues. As the IMPACT program prepares to bring on its third cohort I want to emphasize my desire to be able to continue to teach in a studio style room such as [SCALE UP room]. I can't imagine taking my class back to a lecture hall."

Figure 1: Picture of the first SCALE-UP learning space at Purdue University.

In addition to the innovative classroom spaces, Purdue has provided or developed a number of instructional technologies available to the IMPACT redesign teams and the rest of the Purdue campus. An overview of this technology is listed in Table 2 .By combining the use of modern technologies with innovative teaching spaces and the knowledge to use them effectively, IMPACT provides its cohort members with the tools they need to truly redesign their courses.

Table 2. Overview of Technology offered by Instructional Technology at Purdue University (Purdue University, 2012).

Technology	***Description***
Adobe Connect	Supports the use of PowerPoint, video, audio and screen sharing with multiple people simultaneously through web browser. Sessions can be recorded
Blackboard	Gradable discussion boards, chat, internal email to one address or to all members of course. Homework may be delivered and graded electronically
BoilerCast	Media recording/delivery platform (powered by the Echo360 system) that allows instructors to capture audio and/or Videos of their scheduled courses for student viewing.
Confluence	Online Wiki space that allows multiple users to edit and create web pages. Each page developed includes a threaded discussion list.
Course email list	Creates an easy to use course email distribution list.
Doubletake	Designed to be used by students in production of video assignments, allows for easy sharing.
Apple Facetime	Similar to Skype, allows for sharing of webcam and audio.
Hotseat	Allows instructors and students to participate in discussion inside and outside the classroom.
iClickers	Allows an instructor to ask questions of students and receive instantaneous answers via radio frequency clickers.
JetPack	Enables instructors to create collections of interactive media that can be downloaded or stored on a student's device to run natively.
Mixable	Allows students and instructors in a course to connect via a Facebook-like stream.
Qualtrics	A web-based secure survey tool available to all faculty
Respondus	A tool for creating and managing both web-based and paper-based exams.
Safe Assign	A plagiarism identification tool
Signals	A web-based tool, allowing instructors to intervene, alert and direct the student to help.
Skype	Share one-on-one video conferencing
Study Mate	Allows for students to create flash-card like study aids for specific courses

Once the redesign is complete, re-design faculty members are invited to participate in the Scholarship of Teaching and Learning (SoTL) and disseminate their results to their department and through other SoTL venues.

Currently we have 59 faculty fellows and 49 courses in the program. All of the first and second cohorts have completed the FLC workshops and are in the process of development/ redesign (2nd Cohort) or implementation and evaluation (1st Cohort). Figure 3 shows the distribution of faculty and courses with the number of students to be affected by the IMPACT redesign process.

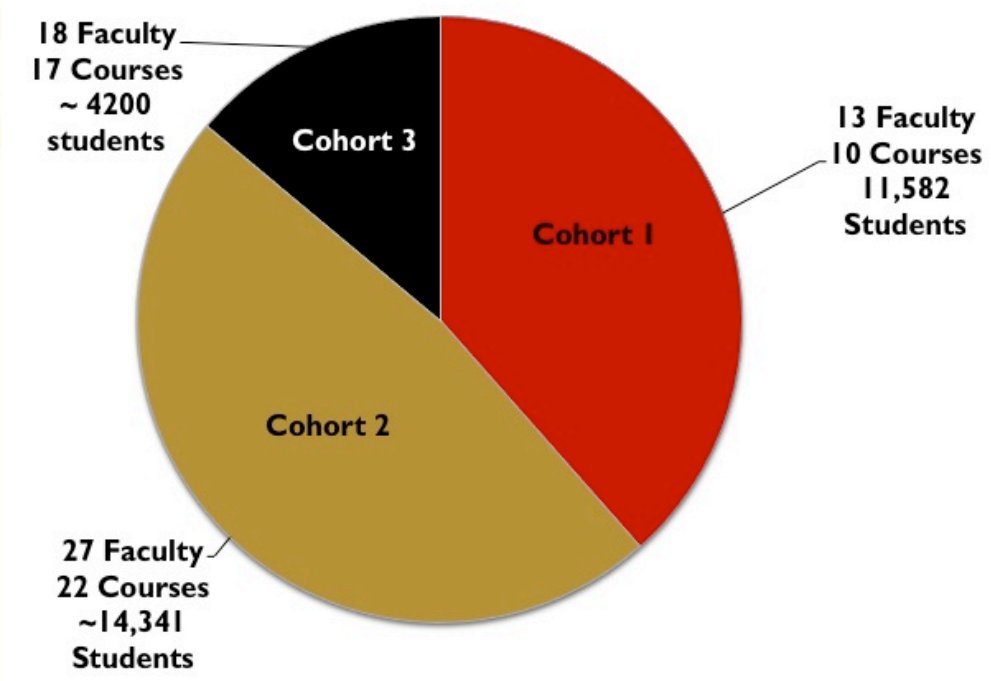

Figure 3: Pie chart of number of courses, faculty and students affected by IMPACT program to date. Projected students affected predicted from past enrollments.

Evaluation of the progress and goals of the IMPACT redesign process is done through six categories: faculty development, student experience/class format, learning objectives, comparison to previous course, culture change, and student achievement, see table 3.

Table 3: Evaluation Plan for IMPACT.

Category	*Evaluation Method*
Faculty Development	Faculty working within Impact evaluated through surveys given after workshop presentations along with longer interviews to examine perceptions of the program.
Student Experience with Class Format	Observations of student experience in the classroom through student and faculty surveys. Given weekly to ~10% of students and monthly to faculty. Follow up surveys with direct observation to observe correlation between survey data and actual experience
Learning Objectives	In conjunction with the faculty goals surveys, evaluations of the learning objectives include more thorough faculty interviews and document analysis of the faculty learning objectives and assessments from students.
Compare to Previous Courses	Compare the performance of the current class via DFW rates, grades in dependent courses, retention rates in major and rates for graduation to the historical data for the course
Cultural Change	To see how this affects the teaching culture in their respective departments and administrators in the department or college level by observing if administrators and faculty seek to adapt the IMPACT principles to improve the classes across all levels in their department.
Student Achievement	To mitigate issues with differing disciplines and objectives, faculty will assess their students based off their individual class learning objectives and assess critical thinking.

IMPACT and STEM

Of the 49 courses currently undergoing transformation, 39 are in STEM fields, see figure 4 for the number of courses by cohort and figure 5 for the course distribution by college. Courses range from the fundamental STEM courses taken by majors to fundamental course required for non-STEM majors. The redesigns implemented/ planned run the gambit of different redesign types, different uses of space and utilization of technology. Table 4 shows the different courses and their implemented/ planned redesign.

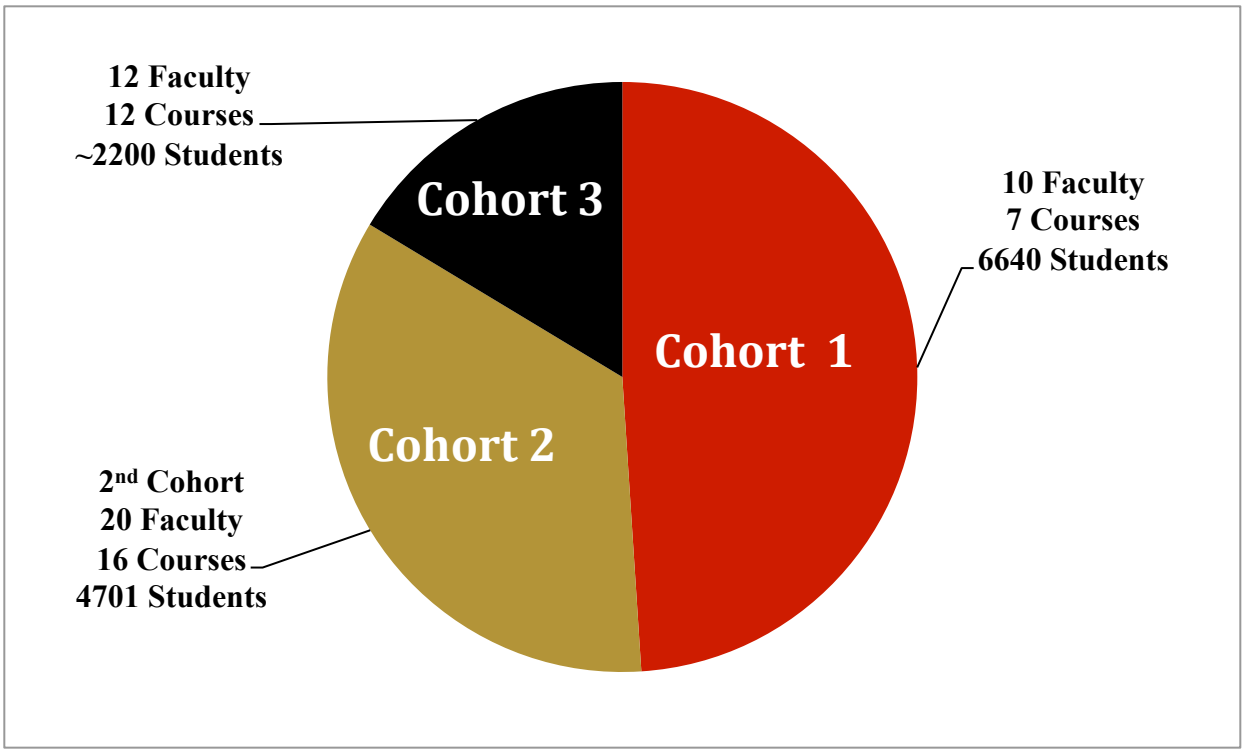

Figure 4: Number of STEM courses per cohort,, the number of faculty and number of student potentially affected.

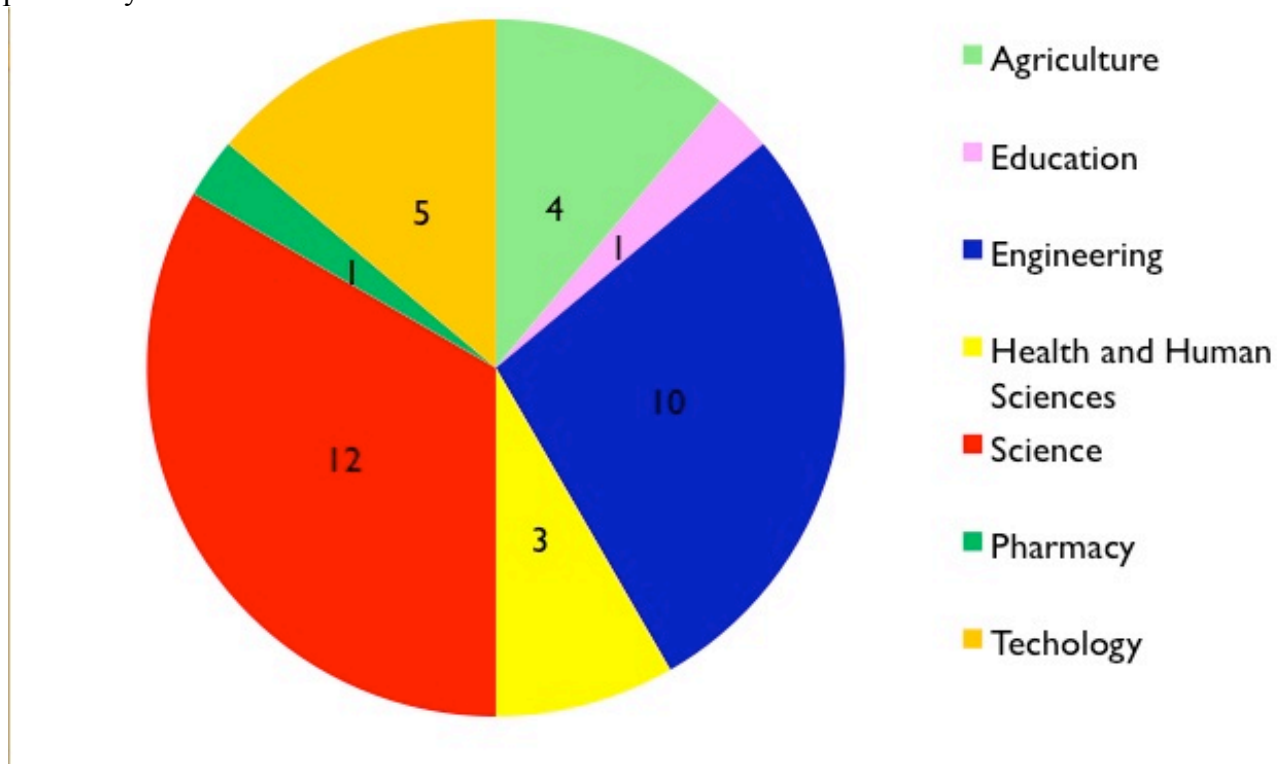

Figure 5. Distribution of STEM courses by College, Number of courses affected shown.

Table 4. Overview of STEM courses and redesign

Course	*Description*	*Redesign*
BIOL 230	Biology Of Living Cell	Cohort 3 – New Course
BIOL 230	Biology Of Living Cell	Cohort 3 – New Course
BIOL 131	Biology II: Development, Structure, And Function Of Organisms	In Progress
BME 390	Professional Development and Design in Biomedical Engineering	Active and team based learning; short topic lectures, 24 hour turn around on assignments. Next will redesign to Asynchronous; flipped pre-recorded topical lectures; PBL; Peer review (more extensive)
BTNY 301	Introductory Plant Pathology	In Progress
CE 355	Engineering Environmental Sustainability	Hybrid Model using games, problem based learning, cooperative learning, flipped
CGT 163	Introduction To Graphics For Manufacturing	In Progress
CHEM 115	General Chemistry I	MWF lecture with interactive think-pair-share activities and TA facilitation of student questions
CHEM 116	General Chemistry II	In Progress
CHEM 126	Honors General Chemistry II	Once weekly meeting, supplemented by online lecture, SCALE-UP classroom.
CLPH 872	Pathophysiology And Therapeutics II	Cohort 3 – New Course
CS 159	Programming Applications For Engineers	Flipped classroom; lectures/demo videos to classroom; problems, activities in face to face; Considering using Piazza or Hotseat; higher order learning.
CS 235	Introduction To Organizational Computing	In Progress
CS 240	Programming In C	Cohort 3 – New Course
ECE 201	Linear Circuit Analysis I	In Progress
ECE 264	Advanced C Programming	Cohort 3 – New Course
ECE 270	Introduction To Digital System Design	In Progress
ECE 362	Microprocessor Systems and Interfacing	Mixed – combination of traditional lecture and in-lab collaborative problem solving (hybrid); Technologies used-iClicker, Parallel presentation; online lecture videos and lab tutorials.

FN303	Essentials of Nutrition	Cohort 3 – New Course
FS 362	Food Microbiology	Cohort 3 – New Course
IT 230	Industrial Supply Chain Management	Cohort 3 – New Course
IT 342	Introduction To Statistics Quality	Cohort 3 – New Course
MA 154	Algebra And Trigonometry II	Scale-up, once weekly problem solving meeting of 56 students, online lectures.
ME 270	Basic Mechanics I	In Progress
ME 274	Basic Mechanics II	MWF lecture, online problems and homework, blog integration, student discussion and group problem solving
MET 213	Dynamics	Linked workshop models to labs and online content; Helping students learn with hands on experiences; Revise grading
NUR 108	Introduction to Nursing	In Progress
NUR 22301	Foundation of Research and Evidence Base Practice	Problem Based Learning, Flipped classroom (scale-up); 2 hour online; 2hr classroom; with linked workshop model.
PHRM 820	Professional Program Laboratories	Info literacy is critical. Incorporate iPad technology into lab instruction for assessment, map learning outcomes to Bloom's taxonomy and others.
PHYS 172	Modern Mechanics	Just in time teaching; animated pre-lecture tutorials; iClicker; doing a studio approach to recitation and lab. Hopefully in a scale up
PHYS 218	General Physics	Cohort 3 – New Course
STAT 113	Statistics and Society	Flipped/hybrid. Maybe some case based learning. Eventually buffet. 30-60 students in HIKS. Homework SW; Technology – BB, Mixable, iClicker, Excel.
TECH 120	Technology And The Individual	Cohort 3 – New Course

Discussion and Conclusions

Preliminary results from the first year implementation of cohort 1 are promising, but not conclusive. Data shows that the redesigned courses improved grade distribution, discipline specific knowledge emphasized in classroom activities, attendance, engagement, and student satisfaction. Cohort 2 courses will be taught during the Fall 2012 and Spring 2013 semesters. Evaluation of IMPACT courses is ongoing. We believe final measurable outcomes will take at least three years in the program to observe.

Table 5: Departments with more than one course in IMPACT.

Department	*Number of Courses*
Aerospace/ Aeronautical Engineering	2
Agronomy	2
Biology	2
Chemistry	3
Computer Science	3
Electrical Computer Engineering	4
Technology	5
Mechanical Engineering	2
Nutrition	2
Pharmacy	2
Physics	2

Several issues presented themselves during the first and second cohorts' implementation. First, the current SCALE-UP rooms are extremely popular and are insufficient to meet the needs of the entire IMPACT faculty. This is especially relevant to the STEM courses that need dedicated space due to large enrollment and the use of computer and other equipment.

The other issue that arose was the lack of full commitment to the program. Several courses that agreed to the redesign chose not to participate after receiving funds. In addition the courses may be redesigned by the final evaluation of the course could not be completed due to refusal by the faculty and department.

Future Goals

- Redesign 60 courses within the first three years of the program. An additional cohort of 15 courses will be added during fall 2012.
- Bring all campus-level resources to bear so that faculty members benefit from the best of the best (technology, assessment, research and pedagogies) while bringing their own innovation and subject matter expertise to the table, as well.

- Utilize new pedagogies that are informed by research while utilizing teaching innovations that are conducted as research (SOTL).
- Continue FLC's as instruments for faculty exploration, collaboration, learning, development and contributions to the Scholarship of Teaching and Learning.
- Integrate technology and active learning pedagogies that support the instructional approach of IMPACT and the faculty.
- Explicitly integrate the course transformation project into other ongoing campus initiatives such as distance education, supplemental instruction and hybrid course development.
- Promote long-term sustainability through faculty and college buy-in and through advisory/research faculty oversight.

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