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Annual IMPACT Report 2013: A report by the IMPACT Data Collection and Analysis Team

IMPACT Management Team

IMPACT Assessment Team

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Annual IMPACT Report 2013

A report by the IMPACT Data Collection and Analysis Team

Overview of Contributors

The current report represents the results of a collaborative initiative among several institutional units at Purdue University charged with the evaluation of the IMPACT Program. These units include the Center for Instructional Excellence, the Discovery Learning Research Center, Purdue University Libraries, and Information Technology at Purdue (ITaP). Individuals within these units who have played a key role in the report are acknowledged below. Other units and individuals who are responsible for the development and support of IMPACT more broadly are acknowledged within the report.

Center for Instructional Excellence

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Discovery Learning and Research Center

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Overview of the Program

Launching tomorrow's leaders is one of three major goals in Purdue's 2008 Strategic Plan.¹ Improving student success led to the creation of Instruction Matters: Purdue Academic Course Transformation (IMPACT) in December 2010. IMPACT aims to engage students more fully in their learning or create a more student-centered environment, with the expectation that this will improve student success as well as completion in large enrollment, foundational classes. In turn, greater student success in the classroom can improve retention and graduation rates. The IMPACT program is a large collaborative initiative on the Purdue West Lafayette campus (see Figure 1). It is an integrated campus-wide effort, involving multiple key partners across campus including the Office of the Provost, Center for Instructional Excellence (CIE), Information Technologies at Purdue (ITaP), Purdue Libraries, the Discovery Learning Research Center (DLRC), and Purdue Extended Campus (PEC).

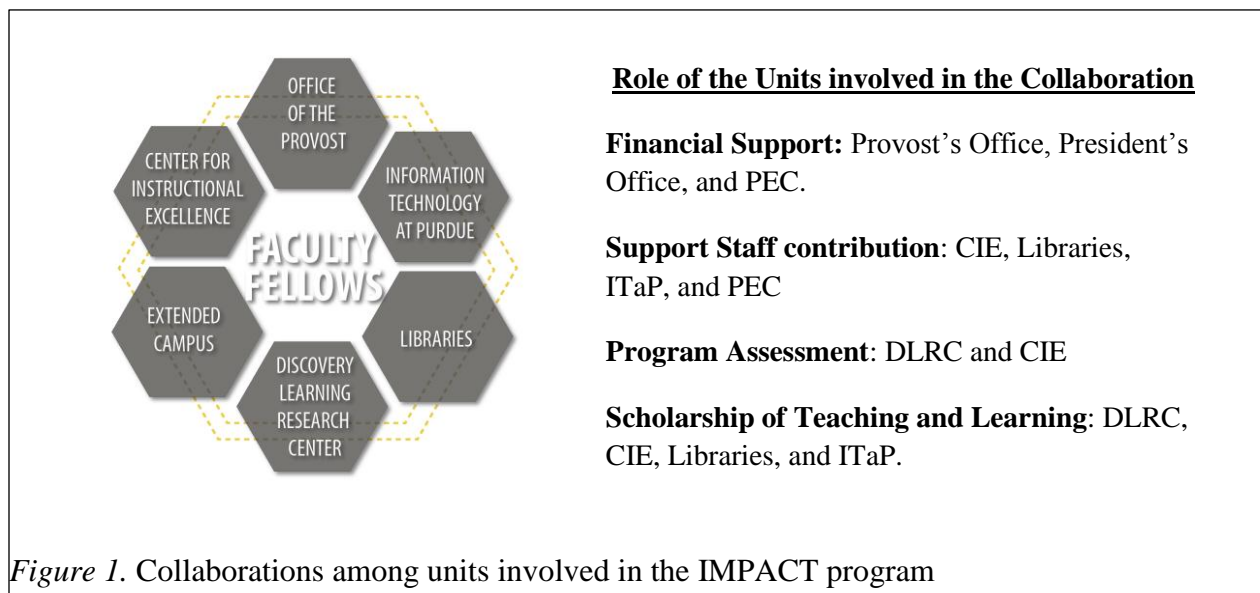


Figure 1. Collaborations among units involved in the IMPACT program

There is strong evidence that student-centered teaching leads to improvements in students' abilities to solve problems and understand concepts. Reviews of the literature and considerable research suggest that student-centered approaches, such as those utilizing collaborative learning, cooperative learning, problem-based learning, or active learning in general, enhance learning to a greater degree than purely face-to-face instruction (Prince, 2004; Weimer, 2013). As defined in Michael (2006), active learning is a "process of having students engage in some activity that forces them to reflect upon ideas and how they are using those ideas".

IMPACT is in part modeled after the work conducted by Carol Twigg, President and CEO of the National Center for Academic Transformation (NCAT). NCAT has been engaged in course redesign since 1999, and NCAT projects have been supported by several foundations, including the Fund for the Improvement of Postsecondary Education (FIPSE) and the Bill and Melinda Gates Foundation. Outcomes of the NCAT redesigns have been very encouraging. Results have shown statistically significant improvement in student retention and performance in subsequent

¹ http://www.purdue.edu/strategic_plan/

courses, improved student learning of core concepts, and enhanced performance on standardized exams, critical thinking skills and oral proficiency.

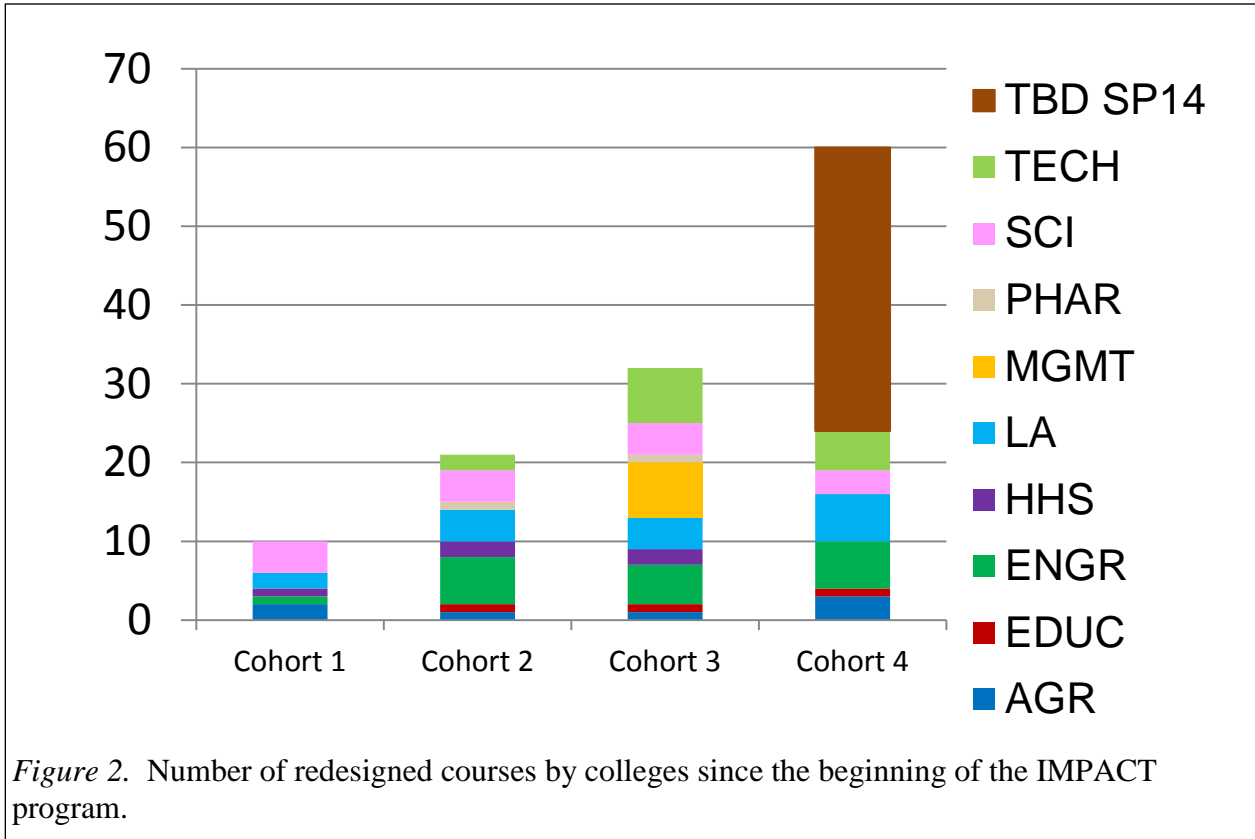
Although inspired by NCAT, Purdue’s approach to course redesign is more flexible, allowing faculty to make many choices regarding the tools and strategies they want to use to achieve their redesigns. While many universities are prioritizing active learning, few are doing so at a broad campus-wide scale like Purdue. While approximately 110 courses at a variety of institutions have been redesigned through NCAT from 1999 through 2012, by the end of only four years of the IMPACT program (Spring 2014), Purdue will have redesigned over 120 foundational courses (see Figure 2).

Number of Courses Transformed and Students Impacted

The inaugural IMPACT cohort was launched in the summer of 2011. The number of courses which have been redesigned in each cohort is listed in Table 1 and depicted in Figure 2. The number of students exposed to the program is presented in Figure 3. Course redesign programs at institutions of higher education do not typically transcend disciplines within each institution; instead, they tend to be confined to one department, especially in STEM fields with large enrollment courses. Purdue is a leader in interdisciplinary course redesign at a research intensive university. Starting in the Fall 2013 (cohort 4 in Figure 2), foundational courses that are part of the new core curriculum at Purdue will be redesigned over the next 3 years at a rate of 60 courses per year.

Table 1.

Classes Transformed as Part of Each IMPACT Cohort		
Cohort Number	Semester	Classes Transformed
Cohort 1	Summer 2011	10 Courses
Cohort 2	Fall 2011	21 Total Courses
	Spring 2012	
Cohort 3	Summer 2012	6 Courses
	Fall 2012	10 Courses
	Spring 2013	15 Courses
Cohort 4	Fall 2013	22 Courses
	Spring 2014	To Be Determined



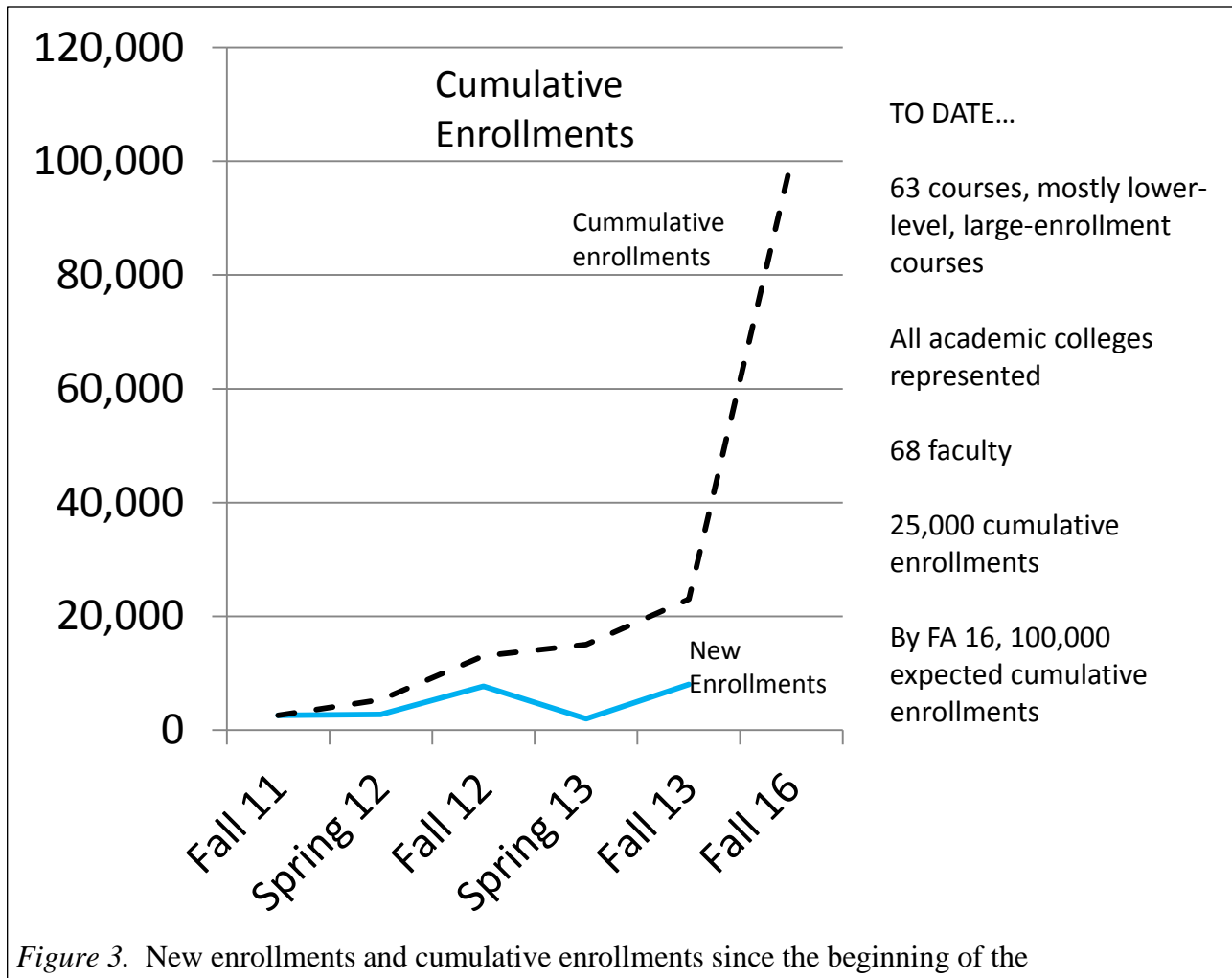


Figure 3. New enrollments and cumulative enrollments since the beginning of the

Goals of the IMPACT Program

The overarching goal of IMPACT is to achieve a greater student-centered learning environment by incorporating active and collaborative learning as well as other student-centered teaching and learning practices and technologies into large enrollment foundational courses. The creation of a student-centered learning environment will foster student engagement and student confidence in their own learning, as well as increased attainment of course-specific learning outcomes and higher-order thinking skills. Specifically, the goals of the IMPACT program can be summarized as follows:

- To refocus the campus culture on student-centered pedagogy and student success.
- To increase student engagement, competence, confidence, and learning gains.
- To develop a network of faculty, knowledgeable in teaching and learning best practices and passionate about teaching through Faculty Learning Communities (FLCs).
- To base course redesign on research-based pedagogies.
- To enhance and sustain IMPACT by adding new IMPACT faculty fellows annually.
- To support faculty-led course redesign with campus-wide resources.
- To reflect, assess, and share results to benefit future courses and students.

Faculty Fellows

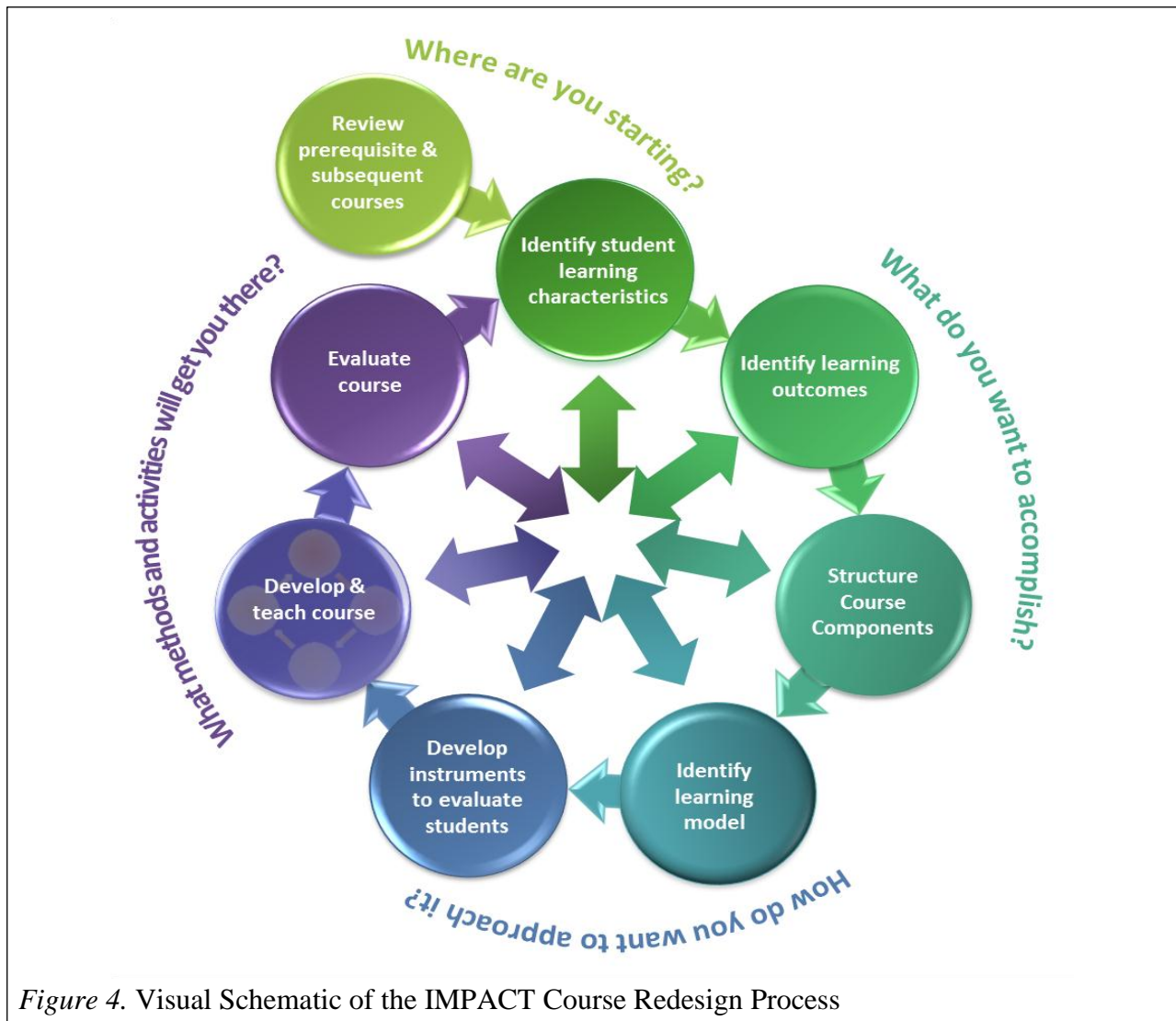
IMPACT faculty fellows come from a variety of disciplines university wide. Each semester, interested faculty submit their application to become part of the next IMPACT cohort. Each application is reviewed by the IMPACT management committee and recommendations are submitted to the IMPACT steering committee. For more information about past and current IMPACT faculty fellows, visit the IMPACT website (<http://www.purdue.edu/impact/>)

Faculty Learning Community Professional Development Curriculum (FLCs)

In addition to modeling our approach in part on NCAT course redesign, the FLC professional development component of IMPACT has been influenced by several research-based best practices in teaching and learning, as well as innovations in teaching and learning technologies, including some created at Purdue (e.g., Purdue Studio applications HotSeat and Mixable). Each course redesign plan recognizes that the needs of each course, faculty, and students in the course may differ. Each redesign is tailored to the needs of the faculty member, students, and the course. To accomplish the goals of the redesign, each faculty fellow accepted in the program works closely with a support team comprised of staff members with expertise in pedagogy, technology, and information literacy from CIE, ITaP, Libraries, and PEC (Figure 1). There is no “one-size fits all” model or formula. Therefore, the work of each support team is extremely important.

The curriculum used as part of the IMPACT program and delivered through the Faculty Learning Community (FLC) can be divided into four components (Figure 4), organized by leading questions for faculty fellows to consider in the redesign of their course.

- Where are you starting from? Who are your students?
- What do you want to accomplish? What do you want your students to be able to do, know, and appreciate at the end of the course?
- How do you want to approach the redesign and the attainment of your course goals and student learning outcomes?
- What methods and activities will you use to accomplish the redesign and assess the effectiveness of the redesign?



During the FLCs, IMPACT faculty fellows spend a significant amount of time carefully considering the pre-requisites and post-requisites for their course, and the delivery and content of their course, reflecting upon the structure of their course, and learning about new pedagogies that encourage and foster active learning. Specifically, faculty fellows explore:

- Their students' characteristics and students' prior knowledge.
- The development of learning outcomes and course objectives.
- The alignment of course learning outcomes with appropriate and authentic assessments.
- Student-centered models of teaching and learning.
- Transformation models for course redesign.
- Research-based links between improved student learning and pedagogical approaches.
- Active learning techniques and Team-Based Learning, Case-Based Learning, and Problem-Based Learning.
- Innovative tools and technologies that foster student-centered learning environments through student engagement and active learning.

- Information Literacy: Understand and proficiently search Information pathways to determine authenticity. Synthesize information to critically analyze results to create new knowledge.

Course Redesign Models

IMPACT faculty, in collaboration with their redesign teams, identify the most appropriate course redesign model to meet faculty determined student learning outcomes. IMPACT faculty can select from various redesign models including the following:

Supplemental Model – The supplemental model retains the basic structure of the traditional course but supplements lectures and textbooks with technology-based, out-of-class activities.

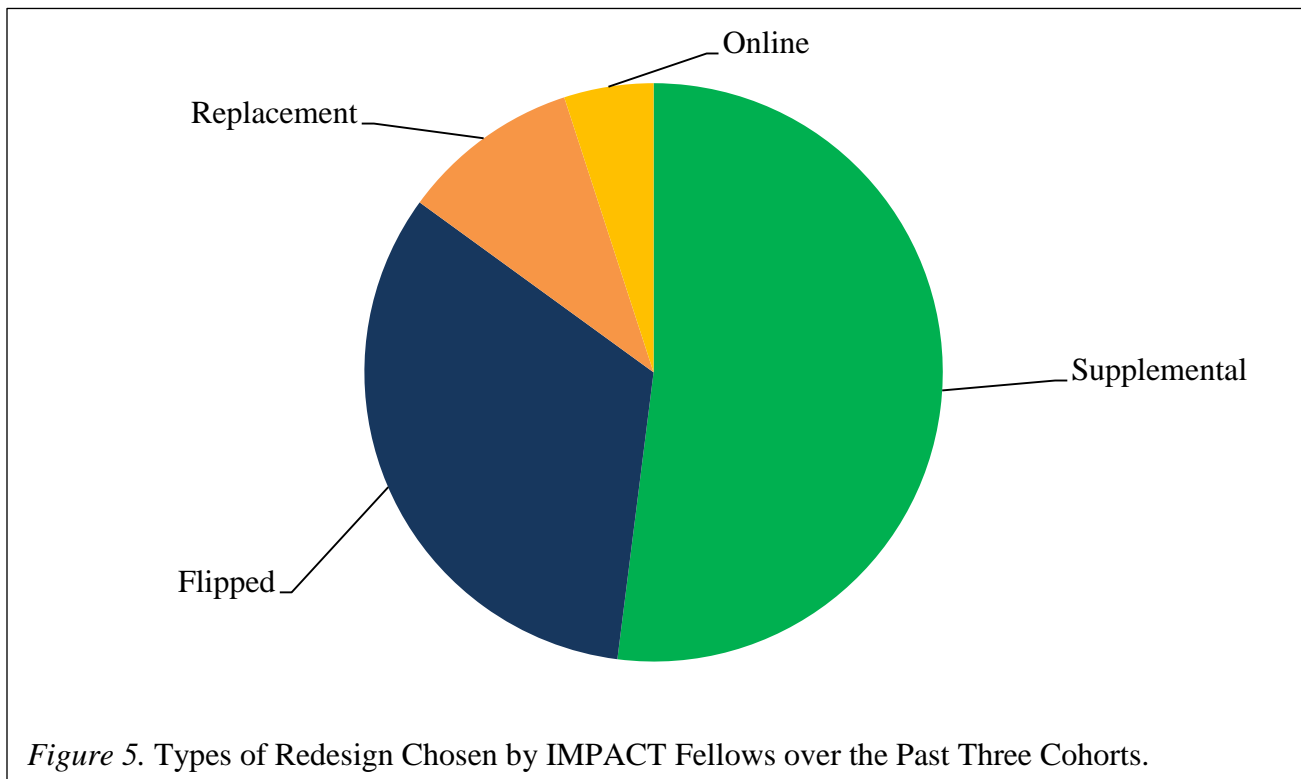
Flipped Model – Instructor-created video lectures or other videos and interactive lessons are reviewed by students before class. Class time is used for working through problems and collaborative learning.

Replacement Model – The replacement model reduces the number of in-class meetings and replaces some in-class time with out-of-class, online, and interactive learning activities.

SCALE-UP Model – Student-Centered Active Learning Environment with Upside-down Pedagogies (SCALE-UP). Specially designed active learning classrooms are used to facilitate small-group work. Lectures are typically 10-15 minutes and “just-in-time” active learning classes give students the opportunity to practice or work on concepts from the lecture. The focus is on active learning.

Fully Online Model – The fully online model eliminates all in-class meetings and moves all learning experiences online, using Web-based, multi-media resources, commercial software, or automatically evaluated assessments with guided feedback and alternative staffing models.

Figure 5 below depicts percentage of each types of redesign chosen by IMPACT fellows since the beginning of the program. The Supplemental Model was adopted by 52% of the IMPACT faculty, making it the most commonly used redesign model. The Flipped model ranks second in frequency of use and has been adopted by 33% of the IMPACT faculty. It is important to note that the implementation of these course redesign models affects the utilization of space in significant ways. In particular, the Flipped model foster an efficient utilization of classroom space by allowing space to be utilized continuously by a large number of classes or course sections. This is possible because the Flipped model replaces some face-to-face class time with online lectures, activities or assignments that students perform outside of class and in preparation for class.



Use of Technology in IMPACT

Information Technology at Purdue (ITaP) has developed a portfolio of technology tools to enhance learning as well as engagement in and out of the classroom. ITaP recently won the *Campus Technology* magazine annual award for top innovations in 2012 for its mobile applications. Furthermore, ITaP is recognized internationally as a leader for campus technology innovation and has won 6 *Campus Technology* annual innovation awards since 2006. You can learn more about the Studio suite of technologies at the following link <http://www.itap.purdue.edu/studio/hq/>

As shown in Figure 6 below, there are a variety of ways to use technology in order to create an engaging and collaborative learning environment. IMPACT faculty fellows integrate many of these technologies into their course redesign in order to foster student engagement, motivation, and active learning. Visit the ITaP website to learn more about the IMPACT faculty fellows who have made use of these technologies to support student learning and create student centered learning environments.

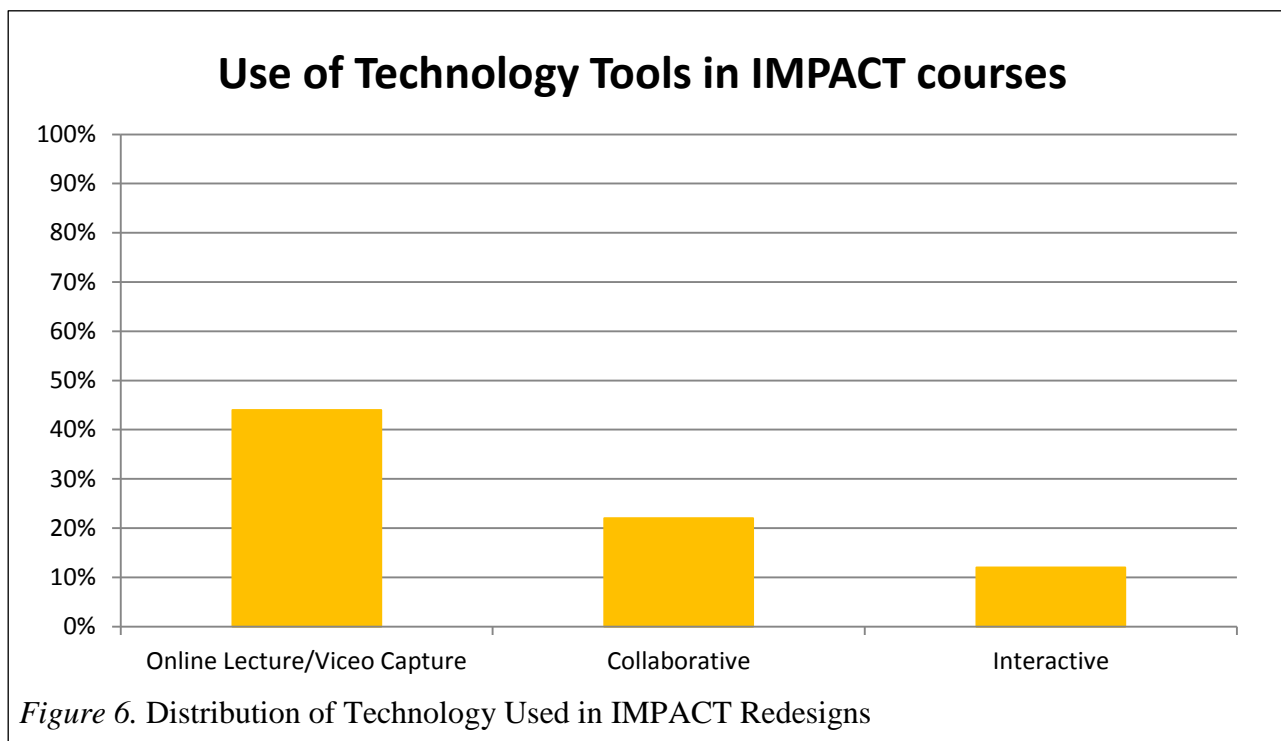
Specifically, approximately 44% of the IMPACT courses currently make use of one or more online lecture or video capture technology tools available to them. These include BoilerCast, Doubletake, and Blackboard lectures. Additionally, 34% of the IMPACT courses currently make use of a collaborative or interactive technology solution. These include Purdue-made products such as Mixable and JetPack.

BoilerCast: Lecture capture system that enhances and extends instructional activities whether in face-to-face, blended or fully online courses. It is available in select classrooms and powered by software and hardware from Echo360.

Doubletake: Mobile video sharing system designed for students to use with their video-based class assignments. The system allows the easy capture, upload, and share video within minutes using mobile devices.

Mixable: Creates a course stream. Connects students in a course to share thoughts, images, videos, and other files in a Facebook-like environment accessible from mobile devices as well as computers.

JetPack: Create mobile app/e-book hybrids that replace classroom textbooks or course packs.



Use of Classroom Space

The unprecedented collaboration among major units on campus, and the redesign of a large number of courses to achieve a student-centered learning environment are currently driving the need for new types of learning spaces. This is mentioned in the recent report produced by DEGW for the Office of the Provost entitled *A Study of Trends in Pedagogy at Purdue University: Analysis on the Impact of Changes in Pedagogy and Study Needs on Facilities*. The report can be downloaded at the following link http://docs.lib.purdue.edu/provost_pubs/2

Purdue Libraries has been an active and enthusiastic partner in IMPACT and has provided space to accommodate IMPACT's ambitious timetable. To address the changing needs of the twenty-first century student learner, many of today's academic libraries in higher education are

transitioning their formal and informal learning spaces. The reconceptualization of library space into a collaborative student learning “place” changes the essence of the traditional library, moving from a book-centered to a learning-centered space. Therefore, creating three new IMPACT classrooms in the Hicks Undergraduate Library (HICKS) provided a natural and excellent solution as a home for innovative and active learning classroom spaces. In the active and student-centered learning environment, students are no longer simply recipients of knowledge, but rather collaborators and producers of knowledge—they become active participants in their own learning and discovery process.

The pictures below highlight the four collaborative classrooms we currently have on campus as part of the IMPACT program. These collaborative classroom spaces are in high demand by faculty teaching IMPACT classes. For example, HICKS B848 (Figure 7) is occupied at 76% utilization during the daytime hours, Monday through Friday. In addition, it is occupied at 100% utilization from Monday through Thursday evenings for the Supplemental Instruction program. The Learn Lab (KРАН 250, Figure 8) is occupied at 80% utilization during the daytime hours, Monday through Friday. The two newer IMPACT classrooms, HICKS G980D (Figure 9) and HICKS B853 (Figure 10), which opened in Fall 2012, are currently operating at a similar level of utilization.



Figure 7. Hicks Undergraduate Library – B848



Figure 8. Roland G. Parrish Library of Management and Economics – KРАН 250



Figure 9. Hicks Undergraduate Library – G980D



Figure 10. Hicks Undergraduate Library – B853

The video at the following link was shot from the G980D IMPACT classroom, Provost Tim Sands, who at the time the video was shot was serving as Acting President, is discussing the IMPACT program, the use of technology in the active classrooms as well as some of the preliminary results of the program effectiveness <http://www.purdue.edu/impact/videos.html>

Results of the IMPACT Program

The purpose of this section is to provide a summary report on data collected and preliminary analyses conducted since the beginning of the IMPACT program in Fall 2011. Data included in this report are drawn from the following sources: Classroom Perceptions Survey (Pre/Post), Enrollment Management Grade Data, Dashboard Course Data, and CoursEval end of the semester student ratings. At the onset, one key limitation should be recognized. Data from CoursEval and Classroom Perceptions Survey are affected by a low response rate. For example, CoursEval data is only available for 1,101 students (7.6% of the total IMPACT pool). This has implications for the interpretations drawn from all data analyses, but is especially worth noting because the low response rate prohibits drawing conclusions from specific courses. As a result, all analyses are conducted at the level of IMPACT as opposed to at the course level. Data is collected every semester and efforts are being made to increase response rates. Nonetheless,

these results can be informative when all the components of the data and results are taken together.

Generally, assessment of the IMPACT program aims to align with the following goals (see Figure 11). 1) Assessing faculty change, 2 student perceptions, and 3) student learning and retention.

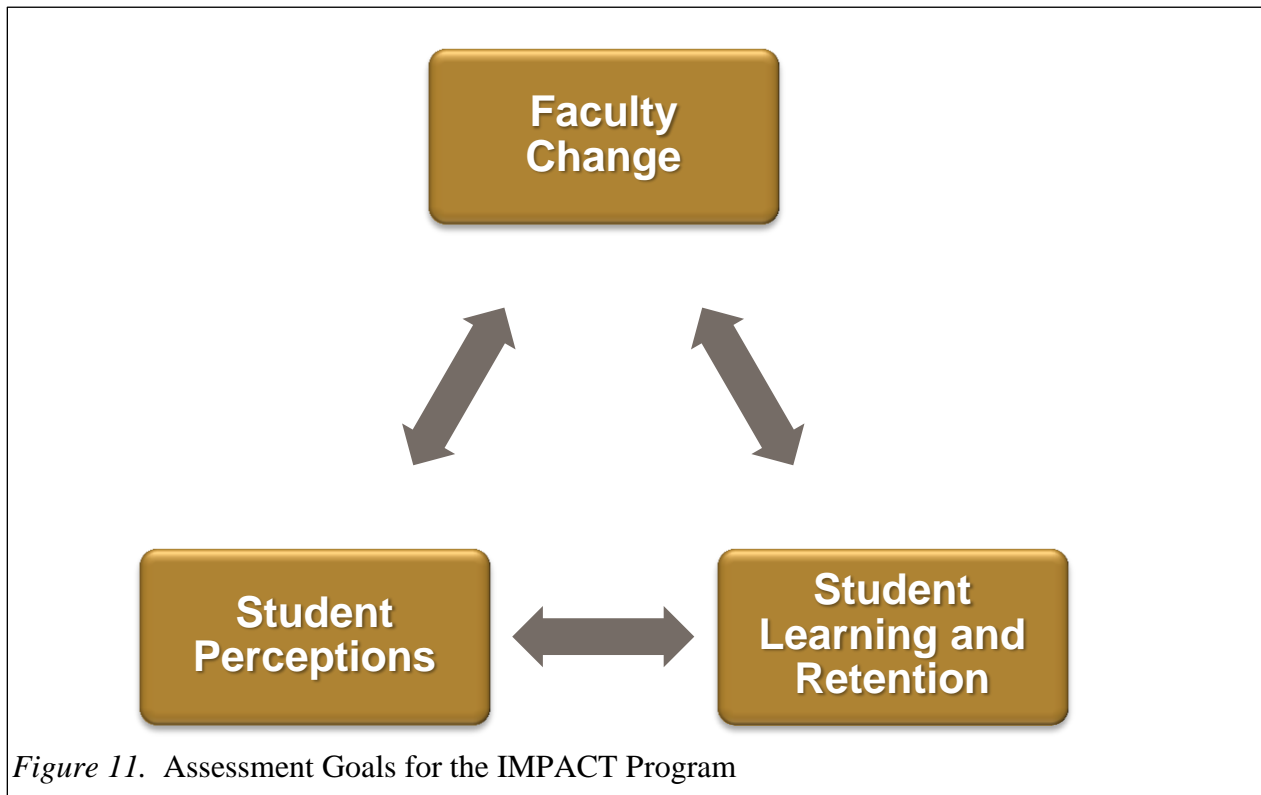


Figure 11. Assessment Goals for the IMPACT Program

Faculty Change (Cohort 1 only)

This following section reports on the results of a follow-up survey with IMPACT faculty fellows from cohort 1, one year after the implementation of their redesigned course. It is important to understand that much has changed since the implementation of the IMPACT program with the first cohort. The IMPACT program has significantly improved and we expect longitudinal results from subsequent cohorts to be stronger. In addition, the sample size for cohort 1 is very small.

Faculty fellows were surveyed regarding their perceptions of sustainability and transferability (to other courses) of the redesigns implemented as IMPACT faculty fellows. The survey was administered through Qualtrics to the nine faculty fellows who implemented their redesign during or before the spring 2012 academic semester. The survey contained 19 items in total: five categorical Likert-style rating items, nine multiple choice questions, and five open-ended questions. Analysis was descriptive and involved tallying the frequency and percentage of responses to both Likert-style rating items and multiple choice questions, as well as conducting thematic analysis of the written responses to open-ended questions. Thematic analysis of written responses sought to identify respondents' perceptions of the barriers and supports as well as the

sustainability and transferability of their IMPACT redesigns. Thematic analysis also identified changes to faculty instructional approaches when teaching *non-IMPACT* courses. The written responses were coded to represent types of perceived barriers and types of supports necessary to sustain and transfer the course redesign to other courses. Seven of the nine cohort 1 faculty fellows responded to the survey. Results of the survey indicate that:

- Roughly half of faculty continued to teach their redesigned course.
- The development of a network of like-minded faculty and collaborative staff members was the primary current support mechanism mentioned.
- Almost 43% of the faculty report complete departmental support of the redesign.
 - Over 70% of the faculty report a mostly supportive environment for the redesign of their courses.
 - However, about a quarter of the instructors perceived some institutional resistance for their redesign.
- All faculty viewed their redesign as mostly sustainable.
 - When asked about barriers to sustainability, most faculty report the lack of teaching assistants as the most important barrier.
 - Some faculty also reported a lack of access to appropriate teaching facilities as a barrier as well as lack of time allocated to teaching, grading, and course administration.
- Approximately 70% of the reporting faculty viewed their redesign as mostly transferable to other courses.
 - All of the faculty indicated that, despite the challenges experienced, their experience with IMPACT influenced how they teach non-IMPACT courses.
 - However, about 28% of the faculty are uncertain about the transferability of redesign elements to other courses.
- Faculty comments are generally positive about the redesign process. However, some of these responses raise concern about institutional resistance to change at the department and college level.

Student Learning and Retention (Cohort 1 and Cohort 2)

One Year Fall to Spring Retention Rates for Cohort 1 and Cohort 2

Note. Census is taken at the end of the first week of classes. In Fall 2013, when census data is made readily available, we will be able to analyze 2 years of longitudinal census data.

When examining courses that have been redesigned through the IMPACT program in Cohort 1 (9 courses) and Cohort 2 (17 courses) since Summer 2010, we find that:

- 65% of the redesigned courses show increases in retention rates within a time frame of one year (e.g. Fall to Spring). These differences were statistically significant for 34.6% of redesigned courses.
- 46% of the redesigned courses have shown their highest retention + graduation rates over the last 4 years.

DFW rates for Cohort 1 and Cohort 2

When examining courses that have been redesigned through the IMPACT program in cohort 1 (9 courses) and cohort 2 (17 courses) since Summer 2010, we find that:

- 65 % of the redesigned courses had lower DFW rates (grades of D/F or withdrawals) than their 4-year historical averages.
- In 38% of the cases, these DFW rates were the lowest they have been over the past 4 years.
- These declines were statistically significant in 53% of the cases.

Course GPA for Cohort 1 and Cohort 2

When examining courses that have been redesigned through the IMPACT program in cohort 1 (9 courses) and cohort 2 (17 courses) since Summer 2010, we find that:

- 65 % of the redesigned courses had higher GPA than their 4-year historical averages.
- In 75% of those cases, the GPA for the redesigned course was the highest it has been in 4 years.

IMPACT Case Studies

STAT 113: Statistics and Society: Ellen Gundlach's Redesign

Ellen's redesign involved the transformations of three sections of the STAT 113 course: face-to-face, online, and the creation of a flip class. Prior to Fall 2012, Ellen had been teaching the class in a traditional format: large lecture sections of approximately 250 students with small recitation sections of 20 students once a week. In 2008, the class, then also taught by Ellen Gundlach experienced a very high level of DFW equal to 33.87%. In general, prior to 2012, the DFW rates in STAT 113 were consistently high in the lower 30% and upper 20%. The Learning Outcomes of the course are as follows 1) Distinguish between and qualify methods of data collection 2) Interpret graphs and statistical analyses 3) Express and calculate the likelihood of events 4) Create a narrative from statistical analysis. Beginning in Fall 2012, the flip or hybrid section was introduced. In the flip class, the lectures were recorded and students had to watch the lectures and complete online activities before coming to class. The face-to-face portions of the class were interactive and focused on problem solving, group work, and completion of activities and exercises. The online and out of class components of the class were reused in the online and traditional (supplemental) models. Approximately 350 students were registered in the Supplemental section of STAT 113. In the Supplemental section, Ellen made appropriate use of Mixable to increase student engagement. Figure 12 summarizes the different components of the redesign in all three modalities.

As seen in Table 2, exam scores significantly increased after the redesign for all three modalities. This occurred without jeopardizing the rigor of the course. The course and exam material were reorganized but the difficulty and rigor of the course remained the constant. Elements of the course were not dropped. The presentation sequence of material was adjusted to foster learning. As seen in Table 3, significant decrease in the DFW (Letter grade of "D", "F", and Withdrawals) rates were also observed following STAT 113 redesign.

	Traditional Supplemental	Fully Online	Hybrid
Structure	Monday recitations with T.A. T/Th lectures using clickers in large hall with Ellen Gundlach.	Everything except exams is done online.	Lectures are watched online. Th classes with Ellen Gundlach for group work and discussion.
HW	Perdisco, online. StatsPortal Learning Curve for extra credit.		
Mixable	Discussion assignment due after Exam 2.		
Exams	Pencil/paper. 2 evening exams + a final exam in big room on campus.*		
Quizzes	Given in Monday recitations.	No quizzes.	Given in Thursday meetings.
Class Part.**	iClicker questions in lecture.	Surveys in Blackboard.	Participation in group activities on Th.

Figure 12. Components of the Redesign Models in STAT 113. *Off-campus online students have the option to register a proctor for exams. **CP: All sections also do Syllabus quiz in Blackboard, Qualtrics surveys, official course evaluation proof.

Table 2.

Exam Scores Before and After the Redesign for the Three Redesign Models.

	Section	Exam 1	Exam 2	Final Exam
Before Redesign Spring 2012	Traditional	74.0	74.7	69.4
	Online	69.3	66.8	62.1
After Redesign Fall 2012	Traditional	84.4	87.8	82.2
	Online	79.1	82.8	80.1
	Hybrid	81.6	83.0	78.8

Table 3.

DFW Rates Before and After the Redesign					
	Before Redesign				After Redesign
Fall Semester	2008	2009	2010	2011	2012
DWF Rate	33.87%	30.20%	29.15%	25.25%	14.59%

CHEM 126: Gabriela Weaver's Redesign

CHM 126 (General Chemistry for Chemistry Majors) was redesigned using the flip model. Student performance was assessed using the American Chemical Society (ACS) nationally standardized exams. The test was administered to students at the end of their first semester, which was taught in the traditional format and at the end of their second semester, which was taught in flipped format. Students in the flipped format improved their performance by about 1 standard deviation from the standard score, which was statistically significant. The exams used were the “semester” exams, specialized for each semester of the course, not the end-of-year exam.

Student Perceptions of the Learning Environment (Cohorts 1 – 3)

Presented below is demographic information on the student sample. NOTE: students were asked to report this information in the Classroom Perceptions Survey, so these data are only available for students who completed that survey either at Time 1 or Time 2.

- Relative to Gender ($N=1,901$), 1,037 of the respondents were male (54.6%) and 864 were female (45.4%).
- Of the 1,941 students reporting ethnic affiliation, 1,284 identified as Caucasian (66.2%), 40 were African American (2.1%), 3 were Native American Indian (.2%), 98 were Asian American (5.0%), 52 were Hispanic (2.7%), 42 were Mixed (2.2%), and 422 identified as other (21.7%).
- Most students who reported age ($N=1,945$) were between the ages of 18 and 22 ($N=1,838$) with the average age falling between 18 and 19 years old.
- Of the 1,945 students who reported class rank, 747 were freshmen (38.4%), 652 were sophomores (33.5%), 343 were juniors (17.6%), 201 were seniors (10.3%), and 2 were graduate students (.1%).
- Of the respondents reporting international students status ($N=1,945$), 1,490 were domestic students (76.6%) and 455 were international students (23.4%).

The Classroom Perceptions Survey was designed to measure student perceptions of the learning environment during week two of the semester (Time 1) and week 17 of the semester (Time 2). This survey consisted of five measures that captured different dimensions of students' classroom experiences. The Learning Climate measure (LC) measured the extent to which the instructor is able to foster a student-centered learning environment. The Classroom Experience Questionnaire (CEQ) also measured the degree to which the instructor fostered a student-centered learning environment. Confidence measured students' perceived ability for course content. Competence,

which assessed students' feelings of competence related to course content, and Doubt, which measured the extent to which students doubted their abilities related to course content.

Descriptive statistics were calculated for specific study outcome variables and are summarized in Table 4. Note that GPA and DFW data are available for all students, whereas data for rate instructor and rate course are only available for students who completed the CourseEval survey.

Table 4

Variable	N	M	SD	Minimum	Maximum	Skewness
GPA	14,500	2.78	1.21	.00	4.00	-.93
DFW Rate	14,500	.15	.07	.00	.30	-.03
Rate Course	1,101	3.88	.98	1.00	5.00	-.90
Rate Instructor	1,101	4.07	.98	1.00	5.00	-1.15

Note: GPA=Course Grade Point Average; DFW Rate=Section Drop, Withdrawal, and Failure Rate

Descriptive statistics were also calculated for the five measures included in the Classroom Perceptions Survey at both pre- and post-assessment and are reported in Table 5.

Table 5.

Variable	Pre-Survey			Post-Survey		
	N	M	SD	N	M	SD
Learning Environment	417	5.23	1.21	417	5.15	1.33
CEQ	417	5.55	1.12	417	5.45	1.18
Doubt	409	3.40	1.32	409	3.47	1.52
Competence	409	4.84	1.12	409	4.79	1.28
Confidence	409	5.43	1.13	409	5.36	1.27

Note: CEQ=Classroom Experience Questionnaire

Overall Changes in Variables from Time 1 to Time 2 (Classroom Perceptions Survey)

When examining the overall change in student perceptions over the course of the semester, clear patterns could not be detected (see Table 5). The student success variables examined did not seem to change over the course of the semester.

Correlations among Study Variables

Relationships between the student success variables did relate to one another as predicted (Perceptions of the Learning Climate, CEQ, Doubt, Competence, Confidence, Course Grade, and section DFW Rate). These measures were also compared to student responses on course evaluations.

The larger the correlation, the stronger the relationship that exists between the two variables in question. As seen in Table 6, the more student-centered the learning environment (LC), the more students feel competent and confident, and the less doubt they report with regard to their abilities in the course. In addition, students tend to perform better in a course that is student-centered as indicated by the significant relationship between LC and course grade. Not surprisingly, a higher level of doubt is associated with lower levels of competence and confidence, higher failure rates and lower student academic success in the course.

Table 6.

Correlations among Key Study Variables

	LC(1)	CEQ(2)	Doubt(3)	Comp(4)	Conf(5)	CG(6)	DFW(7)	OCR(8)	OIR(9)
1	1								
2	.892**	1							
3	-.386**	-.399**	1						
4	.691**	.638**	-.375**	1					
5	.561**	.595**	-.568**	.647**	1				
6	.163**	.220**	-.285**	.223**	.385**	1			
7	-.135**	-.196**	.169**	-.034	-.193**	-.330**	1		
8	.589**	.524**	-.330**	.580**	.460**	.178**	-.068*	1	
9	.628**	.571**	-.318**	.485**	.345**	.086**	-.023	.735**	1

Note: LC=Student-Centered Learning Climate; CEQ=Classroom Experience Questionnaire; Comp=Competence; Con=Confidence; CG=Course Grade; DFW=Percent of Student Receiving Grades of D/F and Withdrawals; OCR=Overall Course Rating; OIR=Overall Instructor Rating; *Correlation is significant at the $\alpha=.05$ level (2-tailed); **Correlation is significant at the $\alpha=.01$ level (2-tailed).

Advantages of a Student-Centered Learning Environment and Redesign Model

As mentioned above, the overarching goal of IMPACT is to create a student-centered learning environment. As part of IMPACT assessment, student-centered learning environment is measured by the Learning Climate Scale (Deci & Ryan, 1985, 2000).

Using self-determination theory (SDT; Deci & Ryan, 1985, 2000), it can be hypothesized that a student centered learning environment will result in positive effects on students perceived competence, and self-efficacy, while reducing doubt, and ultimately contribute to learning gains. Extending this hypothesis, we would only expect to see positive effects on student learning when redesigns lead to a student-centered environment

In order to test this hypothesis and examine group mean differences, the students were divided into two groups based on their perception of the learning environment (LE). Students who reported a post-survey learning environment score of 4.99 or lower on the 7 point scale were placed into the low student-centered learning environment group, while those reporting a 5.00 or above were classified as being part of the high student-centered learning environment group. This resulted in 350 cases identified as low(er) learning environment (38% of the sample) and

572 being classified as high(er) learning environment (62% of the sample). Importantly, most of the redesigns led to a student-centered learning environment.

Further, students were classified according to the type of redesign they were exposed to: Replacement (Reduction in class hours) or Supplemental (No reduction in class hours and face-to-face time supplemented with online activities, but not solely online). The following analyses examine the effect of course redesign and the presence of a high(er) or low(er) student-centered learning environment on changes in the following outcome variables: competence, confidence, and doubt.

Competence. As depicted in Figure 13, results indicate that competence in both the replacement and supplemental models increases when learning environment is high (right side of the figure), and decreases when learning environment is low (left side of the figure). However, these is not a significant difference between the two different redesign models.

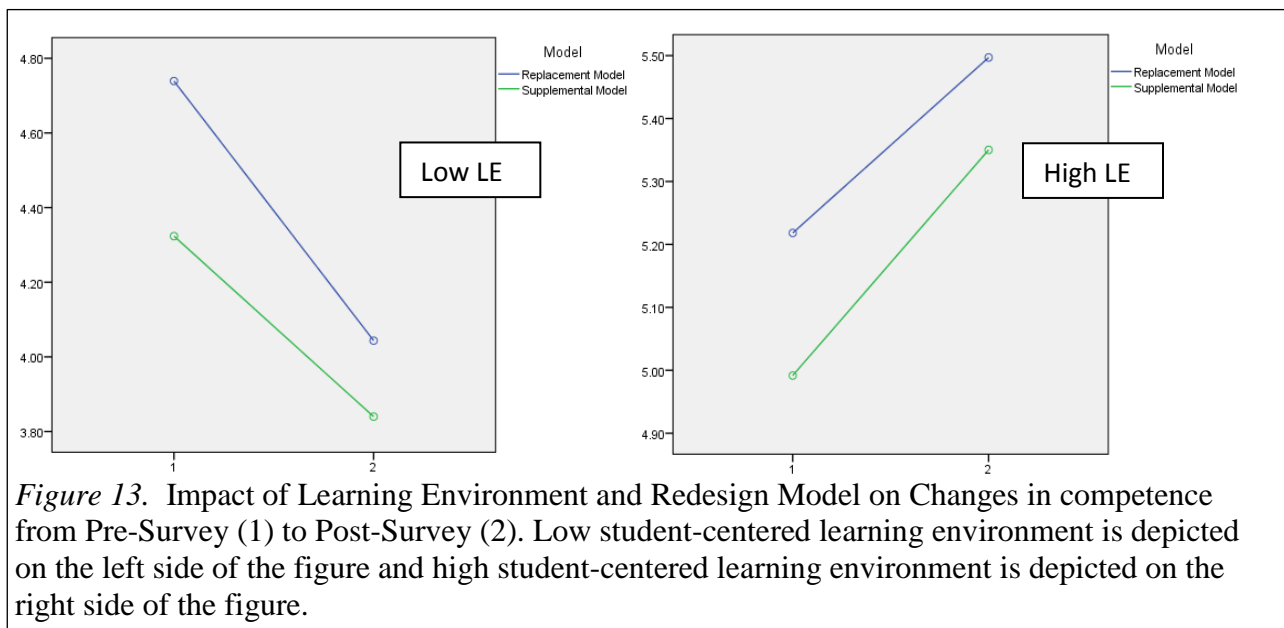


Figure 13. Impact of Learning Environment and Redesign Model on Changes in competence from Pre-Survey (1) to Post-Survey (2). Low student-centered learning environment is depicted on the left side of the figure and high student-centered learning environment is depicted on the right side of the figure.

Doubt. Figure 14 below shows that doubt in both the replacement and supplemental models decreases when learning environment is high (right side of the figure), and increases when learning environment is low (left side of the figure). A notable difference in the pattern of results is that in this case, when the learning environment is low doubt increases more in the replacement model than the supplemental model from pre- to post-survey. In contrast, when the learning environment is high, doubt decreases more in the replacement model than in the supplemental model from pre- to post-survey.

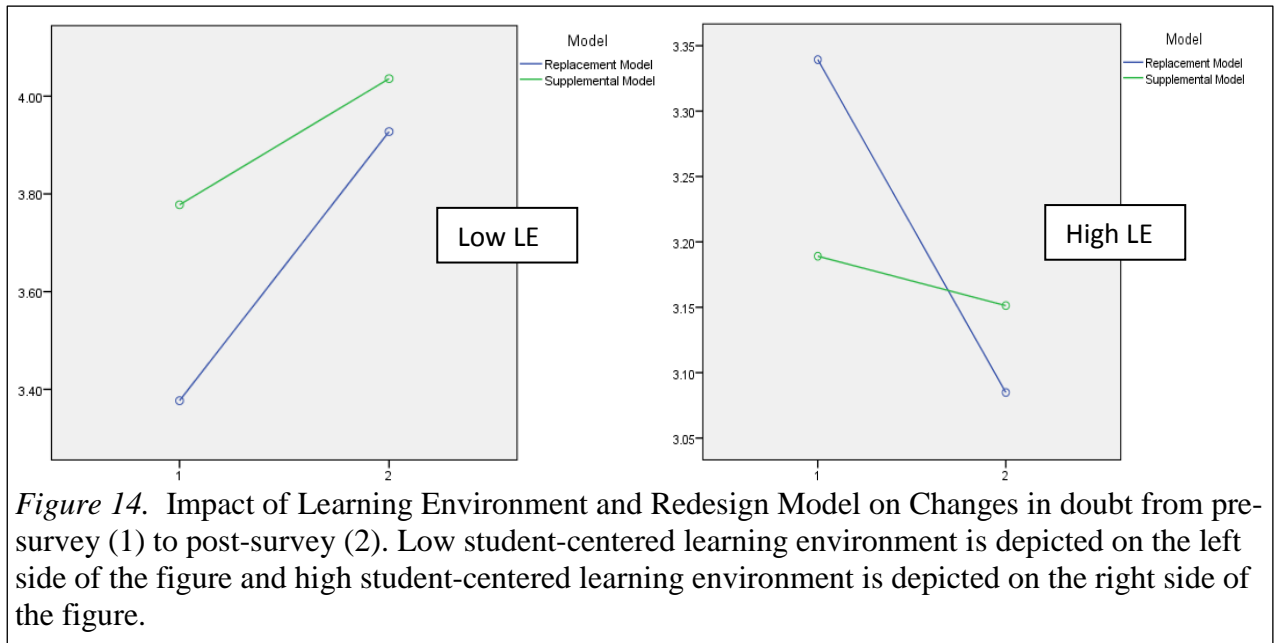


Figure 14. Impact of Learning Environment and Redesign Model on Changes in doubt from pre-survey (1) to post-survey (2). Low student-centered learning environment is depicted on the left side of the figure and high student-centered learning environment is depicted on the right side of the figure.

Confidence. Figure 15 below demonstrates how confidence in both the replacement and supplemental models increases when learning environment is high (right side of the figure), and decreases when learning environment is low (left side of the figure). Interestingly, under a low student-centered learning environment, the rate of decrease in confidence from pre- to post-survey in the replacement model is greater than for the supplemental model (crossing lines on the left side of the figure). When the learning environment is high, the rate of increase in confidence from pre- to post-survey is the same (parallel lines in on the right side of the figure).

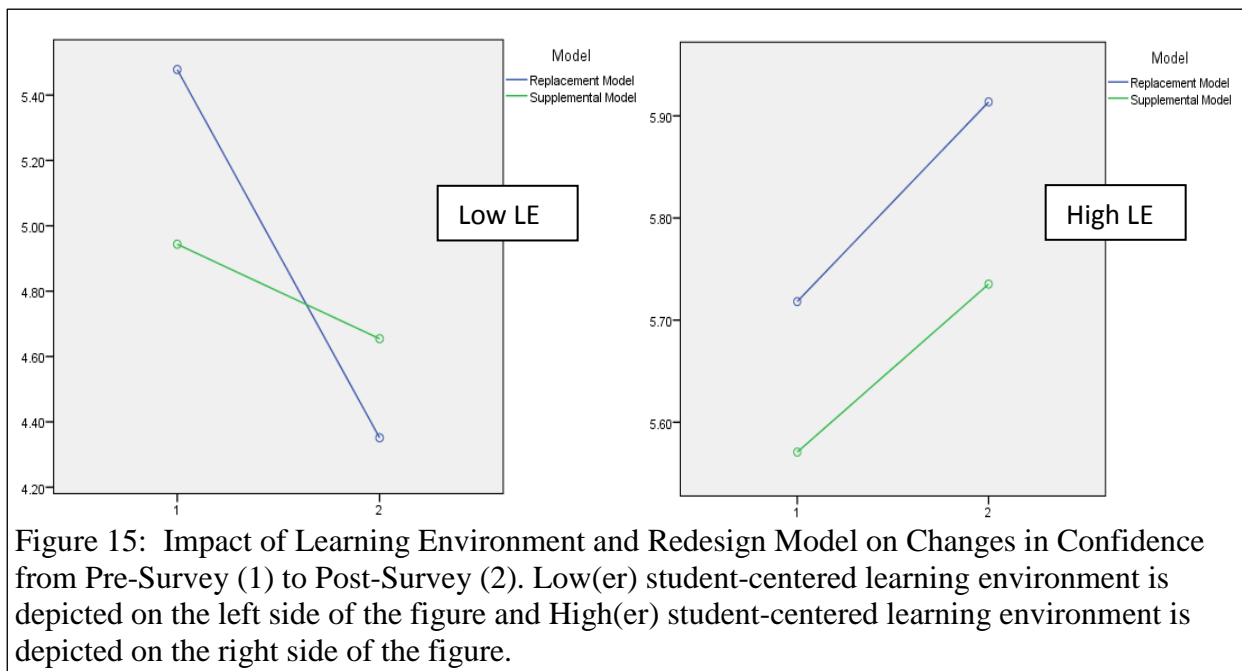


Figure 15: Impact of Learning Environment and Redesign Model on Changes in Confidence from Pre-Survey (1) to Post-Survey (2). Low(er) student-centered learning environment is depicted on the left side of the figure and High(er) student-centered learning environment is depicted on the right side of the figure.

Summary of Analyses

The three preceding analyses indicate that student perceptions of competence, doubt, and confidence increase from pre- to post-survey in the presence of a high student-centered learning environment, but decrease when the perceived learning environment is low. This illustrates the importance of developing a student-centered (i.e., high) learning environment in facilitating the development of competence and confidence, while decreasing doubt. Doubt appears to increase more rapidly when using the Replacement Model if the learning environment is low and to decrease more rapidly in the Replacement Model if the learning environment is high. In a similar fashion, students participating in a Replacement Model course noted larger decreases in confidence when the learning environment is low. There may be greater risks associated with using a Replacement Model over the Supplemental Model if the redesign creates a low student-centered learning environment. Conversely, as is evidenced by the larger decreases in doubt, there may be benefits associated with using the Replacement Model over the Supplemental Model when the learning environment is perceived to be high.

Student Learning, Retention, and Course Ratings

Additional tests were performed to examine the impact of redesign model and the perception of a high or low student-centered learning environment on course grade, section DFW Rate, Overall Instructor Rating, and Overall Course Rating.

Course Grade. Consistent with previous findings, results indicated that average course grade was higher in the presence of a high student-centered learning environment than when the learning environment is perceived to be low. The difference between course grade in the Supplemental and Replacement Models was not significant when the learning environment was high. However, in the presence of a Low Student-Centered Learning Environment, the Replacement Model was associated with a significantly lower Course Grade than the Supplemental Model.

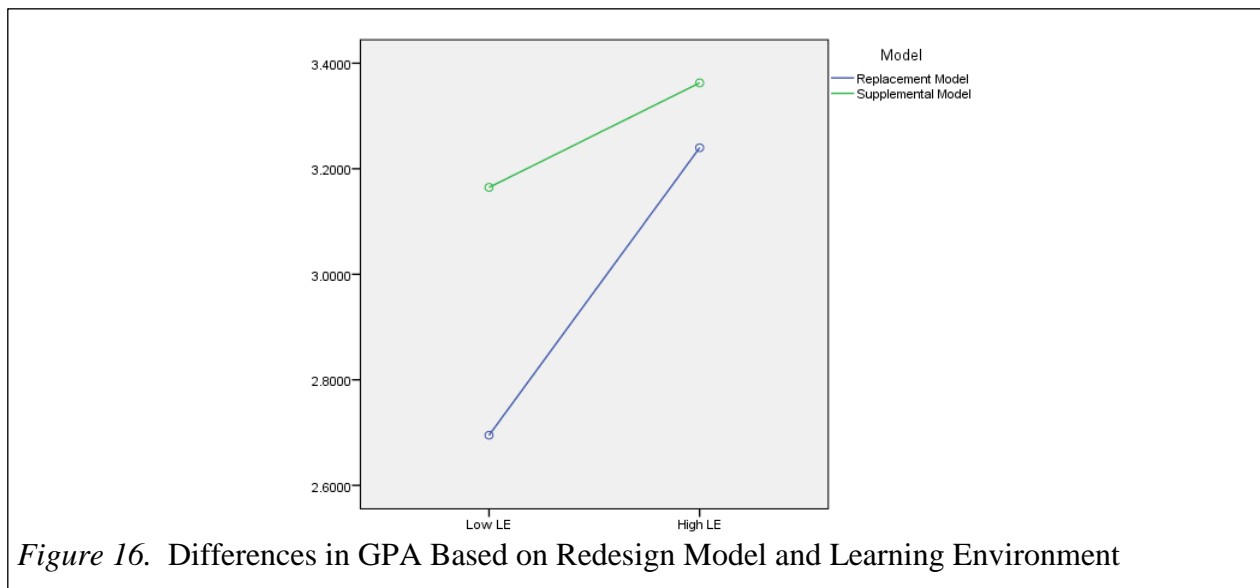
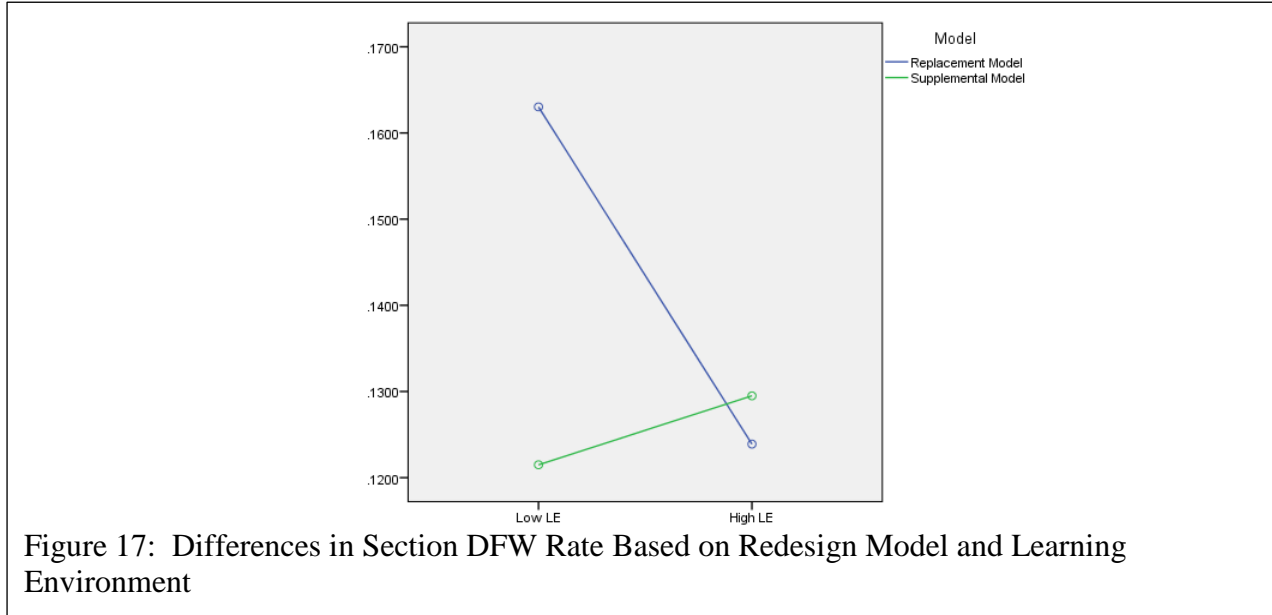
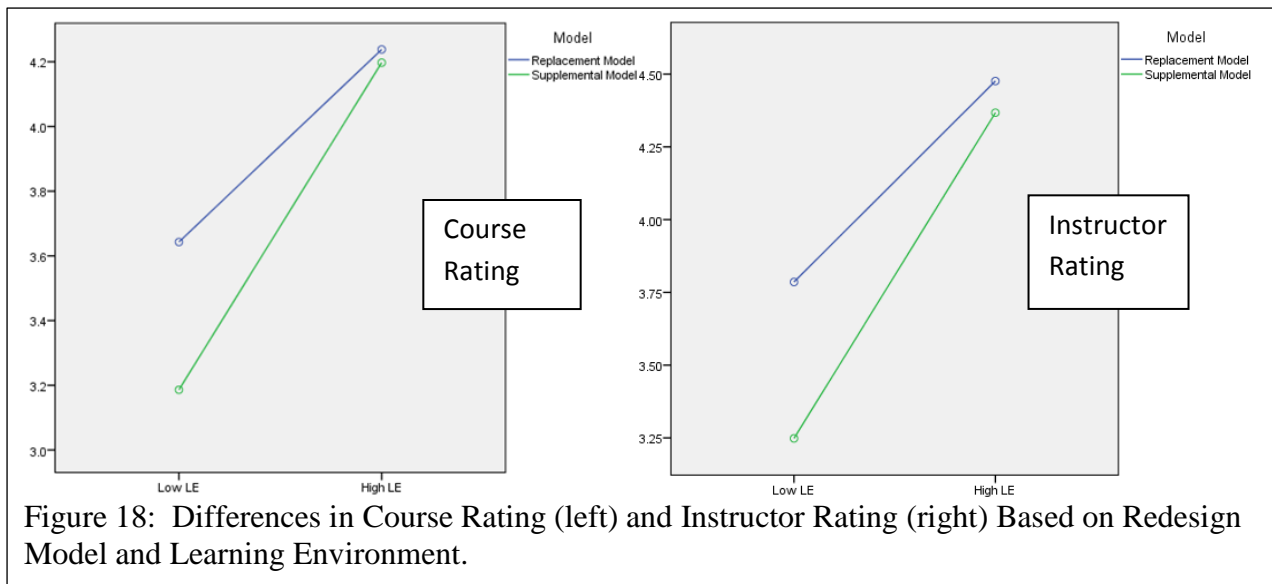


Figure 16. Differences in GPA Based on Redesign Model and Learning Environment

Section DFW Rate. In a high student-centered learning environment, the difference in DFW rate between the Replacement and Supplemental Models is minimal and non-significant (Figure 17). However, when the learning environment is highly student-centered, the DFW rate is significantly higher in the Replacement Model when compared to the Supplemental Model.



Overall Course and Instructor Rating. Figure 18 presents the results for Overall Course Rating (left side of figure) and Overall Instructor Rating (right side of figure). Both the Replacement and Supplemental Models are associated with higher course and instructor ratings under the high student-centered learning environment condition than the low student-centered learning environment condition. The Supplemental Model is associated with significantly lower course and instructor ratings than the Replacement Model when the learning environment is low. In a high student-centered learning environment condition, there is no difference between the two models.



Summary of Analyses

When students perceive that a course has a highly student-centered learning environment, students generally have higher course grades, rate their instructors and courses higher, and receive fewer D & F grades or withdraw from courses. The Replacement Model is associated with lower course grades and higher DFW rates than the Supplemental Model when the learning environment is not student-centered. This would seem to support the hypothesis that the Replacement Model can have more marked negative outcomes in a low student-centered learning environment. Interestingly, the relationship is reversed when looking at Course and Instructor Ratings as the Replacement model results in a higher ratings than the Supplemental Model when the Learning Environment is Low.

Summary of Differences Associated with Learning Environment and Replacement Model

Based on the analyses conducted in the student perceptions and student learning sections of the report, it is clear that the creation of a student-centered learning environment is the critical element necessary to achieve greater student success and learning. In some of the results, we gathered evidence suggesting that the Replacement Model appears to outperform the supplemental model in some instances, but in other instances, it also seems to lead to greater risks when not associated with a student-centered learning environment. Importantly, when a student-centered learning environment is achieved, both types of redesign (replacement and supplemental) seem to perform equally well. In other words, when a student-centered learning environment is produced, the differences between the two models are less pronounced.

Results suggest that a specific redesign model will not create improved student learning in comparison to another. High student-centered learning environments were achieved under the Replacement and Supplemental Models. Rather the use and implementation of the redesign has greater impact. If a student-centered learning environment is not achieved, the effects on student competence and learning are not observed. We can summarize by noting that when the redesign is successful (i.e., results in a student-centered learning environment) both the Supplemental and Replacement models are effective in improving student learning. This conclusion supports the flexibility and choice afforded to the faculty fellows during the IMPACT redesign process.

Factors Contributing to a Student-Centered Learning Environment

The preceding analyses document the positive impact of a student-centered learning environment and redesign model on key outcome variables. The analyses below identify characteristics and elements of a redesign that may lead to increases in the perception of a student-centered learning environment. Several tests were performed to evaluate various redesign elements (See Table 7).

IMPACT Room. Courses taught in an IMPACT room result in higher learning environment scores than those not taught in an IMPACT room.

Interchangeable Sections. Courses that allow for interchangeable sections produce a more student-centered learning environment than those that do not allow for interchangeable sections.

Reduction of In Class Hours. Reduction of 25-50% of in class hours resulted in a significantly higher learning environment than no reduction or a 75% or more reduction of in class hours. Therefore, it appears that some reduction is a good thing, but a significant reduction (i.e., more than 75% is not necessarily associated with further increases in the perception of a high student-centered learning environment.

Percentage of Time Dedicated to Lecture. Dedicating no class time or up to 25% of class time to lecture resulted in a significantly higher learning environment than dedicating 50-75% of class time to lecture. This indicates that classes that reduce the amount of lecture are more likely to increase the student-centeredness of the learning environment.

Percentage of Time Dedicated to Team Work. Dedicating at least 25% of class time to teamwork resulted in a significantly higher learning environment than dedicating no class time to teamwork. This indicates that including some teamwork increases student-centeredness of the learning environment.

Evaluation of Teamwork. In the courses that used group work, those that evaluated performance as a team led to an increased perception of a Student-Centered Learning Environment.

Online Lectures. Using online lectures has a positive effective on the development of a student-centered learning environment. In addition, results indicate that making the online lectures mandatory or optional had no effect on learning.

Boilercast. Using Boilercast has a positive effective on the development of a student-centered learning environment.

Discussion Board. Using a discussion board has a positive effective on the development of a student-centered learning environment.

Problem-Based Learning. Using problem-based learning has a positive effective on the development of a student-centered learning environment.

Team-Based Learning. Using team-based learning has a positive effective on the development of a student-centered learning environment.

Clickers. Results indicate that the use of clickers is associated with a decreased perception of a student-centered learning environment.

Hotseat. Results indicate that using Hotseat is associated with a decrease in the perception of a student-centered learning environment.

Summary of Factors Contributing to the Student-Centeredness of the Learning Environment

Table 7.

Influence of Various Classroom Elements on the Development of a Higher Learning Environment

Class Element	Positive Influence	Conditional Influence	Negligible Influence	Negative Influence
IMPACT Classroom	XXXX			
Interchangeable Sections	XXXX			
Online Lectures	XXXX			
Boilercast	XXXX			
Discussion Board	XXXX			
Team Eval. of Group Work	XXXX			
Problem-Based Learning	XXXX			
Team-Based Learning	XXXX			
Increase in Team Work		XXXX		
Reduction of Class Time		XXXX		
Increase in Team Work		XXXX		
Online Activities			XXXX	
CATME			XXXX	
Social Media			XXXX	
Mixable			XXXX	
Case-Based Learning			XXXX	
Clickers				XXXX
Hot Seat				XXXX

Results of the preceding tests illustrate classroom-level factors that can contribute to student perceptions of a student-centered learning environment. To summarize, teaching in an IMPACT classroom, allowing for interchangeable sections, incorporating online lectures, using Boilercast, having a discussion board, evaluating team work as a group, and integrating problem-based learning and team-based learning all have a positive impact on the development of a student-centered learning environment. Conversely, clickers and Hotseat appear to have a negative

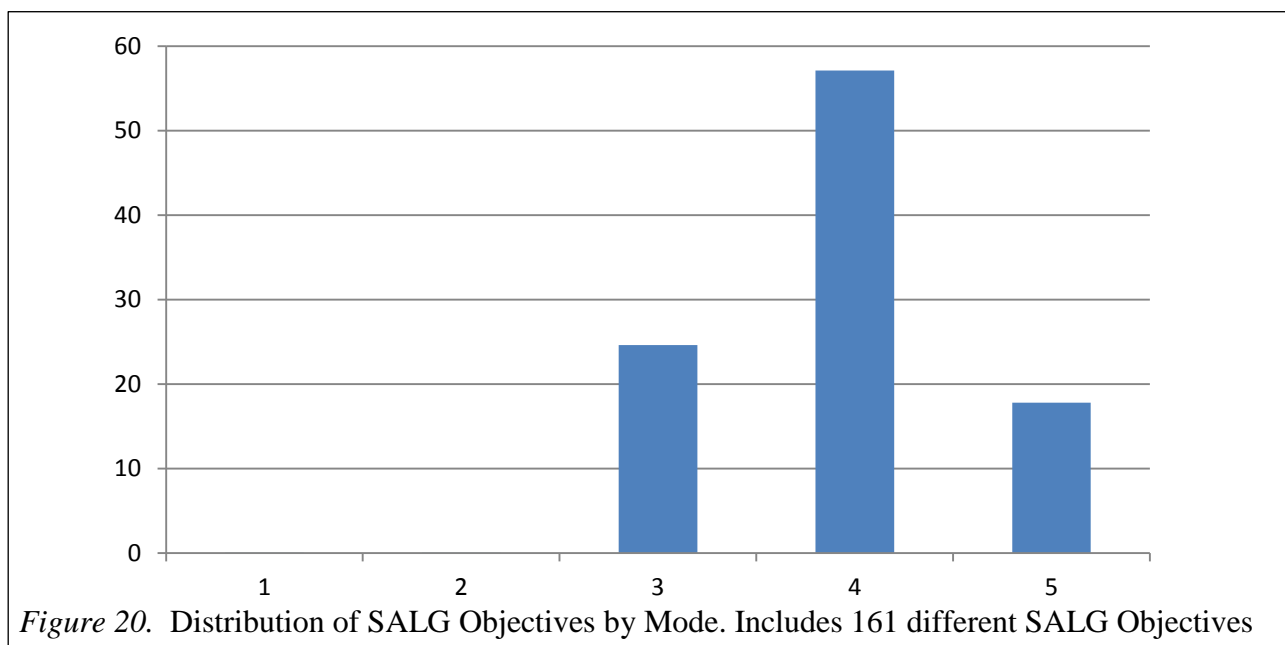
impact on the development of a student-centered learning environment. However, it is speculated that this negative influence has more to do with the way in which the technology was implemented than the technology itself. Similar results have been observed in instances in which the technology was inadequately used or did not follow research-based pedagogical practices.

As illustrated in previous sections, developing a student-centered learning environment is critical for understanding and predicting increases in student perceptions such as doubt, competence, and self-efficacy, and in turn, student learning. This section has documented factors that are associated with student-centeredness. Such information can be used to inform faculty decisions about the specific elements of their redesign.

Student Assessment of Learning Gains (SALG)

The Learning Outcomes (LOs) identified by faculty for each of the redesigned courses are included on the end of the semester course evaluations. All SALG variables are determined by the instructor and these data are collected every semester. Students then evaluate and reflect on each of these learning outcomes, indicating the extent to which they perceive having attained each one of the learning outcomes. These evaluations are done on a 5 point scale ranging from (1) did not gain at all, through (5) gained a great deal. In other words, students are asked to evaluate their learning in the course as measured according to course-specific learning outcomes identified by faculty. This process and the resultant data is what we refer to as SALG data.

As is depicted in Figure 20, the majority of the SALG variables had a mode of 4 (57.14%). The next most prominent mode was 3 (24.64%), followed by 5 (17.79%). A score of 3 indicates that students perceived having gained somewhat on those LOs. Very few SALG questions had modes of 2 (.01%) or 1 (.004%). These results indicate that when we consider all the courses redesigned through IMPACT, and all the LOs listed by faculty fellows, the vast majority of student perceived that they made progress working toward the material referenced in the SALGs. In fact, 74.93% of the SALGs received ratings of 4 or 5 as evaluated by the students.



References

- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum Press.
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*, 319-388.
- Michael, J. (2006). Where’s the evidence that active learning works? *Advances in Physiology Education, 30*, 159-167.
- Prince, M. J. (2004). Does active learning work? A review of the research. *Journal of Engineering Education, 80*, 645-662.
- Weimer, M. E. (2013). *Learner-centered teaching: Five key changes to practice*. Jossey-Bass. San Francisco, CA.