IMPLEMENTING AND ASSESSING STEM INTERVENTIONS: A WORK-IN-PROGRESS

COUNCIL ON RETENTION AND GRADUATION, IUPUI
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IUPUI CI-STEP

(Central Indiana STEM Talent Expansion Program)

• National Science Foundation, awarded September 2010, $1.99 M

• “STEP seeks to increase the number of students receiving associate or baccalaureate degrees in established or emerging fields within STEM.”

• CI-STEP at IUPUI is creating a central Indiana pipeline to increase the number of students obtaining STEM degrees of all demographic groups who:
  (1) pursue STEM academic and career pathways;
  (2) participate in STEM research, internships, and honors activities;
  (3) graduate with an undergraduate degree in STEM fields; and
  (4) transition into industry, graduate and professional programs.

• “… STEP Type 1 activities should be aimed at adapting and implementing best practices that will lead to an increase in the number of students (U.S. citizens or permanent residents) obtaining STEM degrees.”

Overall Goal: The program has set a target of increasing the number of STEM graduates at IUPUI by 10% per year -- an additional 782 STEM graduates by 2015, for a total of 3,067 STEM graduates by 2015.
**Initiatives**

**Genetics K322** is the next required course after the first year introductory courses for all Biology majors. Peer mentoring is utilized in the intro courses but not thereafter, therefore CI-STEP funded a peer mentoring formatted recitation for this course (pictured to the right). Participation among students is high and support from the professors is encouraging.

**School of Engineering and Technology event for transfer students**

**The School of Science Career Development Services Center (CDS)** was created in 2010 with funding from CI-STEP. The number of students utilizing career services increased over 3 fold since its inception to 2012 and continues to grow. One-on-one advising has increased substantially. In Spring 2012, a survey was administered to students who attended the CDS and revealed the following:

- 17% accepted a position
- 24% attending graduate school
- 19% attending professional school
- 43% of graduates completed an internship

**Undergraduate students discussing internships**

**Student-centered Pedagogy**

**STEM Summer Bridge 2011.** IUPUI student mentors with their mentees.

Recent data indicates that STEM Bridge participants have higher GPAs compared to non-participants and students participating in Summer Residential STEM Bridge have lower DFW rates compared to non-participants.

**Physics Learning Space (PhyLS)** opened in Fall 2012 and is designed to advance student success in introductory physics by providing mentoring to all students taking these courses.

**Student Success**

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**Undergraduate students discussing internships**

**Career Services**

**Articulation w/ 2yr College**

**Accomplishments:**
- Increased dialogue among faculty;
- New course and program articulation agreements;
- New transfer student recruitment/support services;
- Increased number of transfer students;
- Increased retention of transfer students in STEM majors

**Mathematics professor at IUPUI, Jeffrey Watt, giving one on one attention**

**Initiative**

- Faculty Development workshops
- E-Mentoring in Computer Graphics Technology
- Genetics K322 Peer Recitation*
- CHEM C341 Organic Chemistry Workshop series*
- Calculus Recitation for MATH Courses
- Peer Mentoring in Technology and in Engineering*
- Using Inductive Learning Methodology in MET Course*
- Building Support and Increasing Recruitment of Transfer Students into E&T*
- Development of Career Centers for School of Science
- Summer Industrial Projects Program*
- Residential and Non-Residential STEM Bridge Program
- 2+3 Dual Degree Program with Butler University
- Physics Learning Space*
- Post Enrollment Requirement Checking (PERC)
- Promotion of Math Minor
- Increase retention of Multicultural Students in E&T*
- MATH Course Transfer Agreement
- E&T Program and Course Transfer Agreements
PLTL & Peer Mentoring

PLTL and Peer mentoring have been shown to increase student performance, decrease DFW rates, and improve retention. New CI-STEP supported initiatives include:

- Genetics K322 Peer Recitation
  - Reduction in DFW rate by 10% after first 2 semesters
  - Promotes content retention and understanding as well as student satisfaction and confidence

- Calculus Course with Recitation
  - Sections of calculus with recitations had 20% lower DFW rates
  - Students with recitation performed 10% points better on departmental final exam

- CHEM 341 Organic Chemistry Workshop Series
  - Sections of Organic Chem with recitations had 22% lower DFW rates
  - Students with recitation showed statistically significant difference on the ACS Organic Chemistry final exam

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CAREER SERVICES

Educational programs include:
- Resume Development
- Class Presentations
- Workshop Series
- Social Media Networking
- Etiquette Lunches

The number of students utilizing career services increased from 95 students in the first year to 327 in 2012.
Articulation with 2 yr College

E&T Program and Course Transfer Agreements

Re-aligned program content and learning outcomes for pre-technology/engineering AS degrees

- Increase in enrollment, student retention and credit hours/student/year
- Academic quality of transfer students continues to improve
- IVYTech transfer students make up 24% of IUPUI's ethnic diversity
Physics Learning Space (PhyLS)

Designed to advance student success in introductory physics by providing mentoring to all students taking these courses.

- Physics 218/219 (required by technology majors)
- Physics P201/P202 (biology, chemistry, and pre-professionals)
- Physics 152/251 (engineering, mathematics, CS, and physics majors)
- Physics 100 (survey of physics for general education)
- Physics 200 (elementary education majors)

Total enrollment ~ 1600 students annually
Open 42 hours/week
OVERALL PROJECT ASSESSMENT (SUMMATIVE EVALUATION)

• Process and Outcomes (Impact) Assessment:
  - Assure that project objectives have been / are being achieved
  - Document detailed impact on student learning and degree completion
  - Provide evidence of program achievements in increasing degree completions in STEM disciplines (at IUPUI)

• Utilized a **Mixed Methods** Evaluation Approach …
  - Multiple data sources and multiple evaluation measures
  - Employ **Process Metrics** and **Outcomes Metrics** (for documenting or assessing progress and success of strategic initiatives)
  - Attain balance between **Direct Measures** and **Indirect Measures**

• Project Impact Analysis:
  - Continue data collection and analysis to assess efficacy and impact of each strategy and overall impact of CI-STEP project (on retention & graduation)
  - Acknowledge challenges / limitations in data collection and analysis
Overall Project Assessment

Types of Evaluation Measures

Direct Measures:
- Course-embedded assessments
  - Exams/Tests, Papers, Assignments, Oral Presentations, Group Work, etc.
- Standardized Achievement Tests
- Exit Exams/Common Final Exam
- Project Documents (e.g., mini-grant project proposals, progress/annual reports, etc.)
- Student ePortfolio Assessments

Indirect Measures:
- Pre-Post Knowledge Surveys (Questionnaires)
- Participant Satisfaction Surveys
- Interviews/Focus Groups with study participants
- Mentor Evaluation Survey
- Event Tracking/Usage Data Records
- Course/Event/Session Evaluations
- Extant Data (e.g., enrollment, participation, completion, retention, demographic data, grades, GPAs, %DFW rates, and related data)
- Participant Testimonials/Reflections
ARTICULATION WITH 2 YR COLLEGE

Assessment

Progress Metrics and Indicators of Success:

- # of new Course Transfer Agreements signed
- # of Transfers per Year (transfer enrollment trends)
- # of Credit Hours transferred per Year
- # of Transfers (& Minorities) Enrolled in STEM fields
- # of Transfers who complete the first year
- Articulation of transfer credits to degree requirements
- Student Retention (one-year retention rates)
- Track Success of Transfers (from one year to next)
- Track # of Associates Degrees Granted per Year

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**Assessment**

Progress Metrics and Indicators of Success:

- **# of Faculty Development Workshops**
  - increased attendance and demand
- **Course Enrollment Data**
  - consistent enrollment or steady increase
- **Retention and Completion Data**
- **Student Satisfaction**
- **Performance on Course Final Exams**
- **Success or Failure (%DFW) Rates**
- **Student Evaluations or Focus Group Comments**

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# Career Services

## Assessment

Progress Metrics and Indicators of Success:

- Number of Students Utilizing Career Services
- Graduating Student Survey (of Science Majors)
- Number of Students Completing Internships
- Number of Job Postings
- Career Placements or Employment Data
- Number of career-related Student Presentations

### Initiative

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Student Success

Assessment

• Progress Metrics and Indicators of Success:
  • Track Usage of PhyLS
    – > 900 visits per semester
    – Average visit length: 1 hour 10 minutes
    – 80% of visitors return multiple times
  • PhyLS Tutor Survey Evaluation Form (5-point response scale)
    – “The mentor provided me with appropriate, relevant information: 4.5/5
    – “My overall experience with the Tutor-on-Duty was positive: 4.3/5
CI-STEP: Progress on Primary Goal

Number of STEM Graduates by Year at IUPUI

- **Science**
  - 2008-2009: 112
  - 2009-2010: 134
  - 2010-2011: 148
  - 2011-2012: 165
  - 2012-2013: 144

- **Technology**
  - 2008-2009: 181
  - 2009-2010: 185
  - 2010-2011: 189
  - 2011-2012: 180
  - 2012-2013: 233

- **Engineering**
  - 2008-2009: 87
  - 2009-2010: 96
  - 2010-2011: 99
  - 2011-2012: 137
  - 2012-2013: 161

- **Mathematics**
  - 2008-2009: 37
  - 2009-2010: 28
  - 2010-2011: 37
  - 2011-2012: 42
  - 2012-2013: 49

- **Total**
  - 2008-2009: 417
  - 2009-2010: 440
  - 2010-2011: 473
  - 2011-2012: 524
  - 2012-2013: 587

Legend:
- **2008-2009**: Blue
- **2009-2010**: Red
- **2010-2011**: Green
- **2011-2012**: Purple
- **2012-2013**: Cyan
PROJECT IMPACT ASSESSMENT

CI STEP PROJECT:
DATA ON PRIMARY GOAL
NUMBER OF STEM GRADUATES BY YEAR AT IUPUI

- Science
- Technology
- Engineering
- Mathematics
- Total STEM
- Goal

NUMBER OF GRADUATES

DEGREE YEAR (JULY 1 - JUNE 30)

2008 2009 2010 2011 2012

37 28 37 42 49
112 131 148 160 161
102 185 189 189 233
517 440 474 524 587
427 417 459 505 555
Number of IUPUI STEM Majors Graduating
(Includes International Students)

Year (May, Aug, Dec of Same Year)

Number of Students

Science
Technology
Engineering
Mathematics
Total STEM

Goal: 5 year average before 2009; 10%/yr starting in 2008
IUPUI MATH Minors Awarded

Note: Number of majors graduating lags number of minors by a year.
QUESTIONS

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