Central Indiana STEM Talent Expansion Program (CI-STEP):
A systemic approach to increasing undergraduate success in STEM at IUPUI

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“STEP seeks to increase the number of students (U.S. citizens or permanent residents) receiving **associate or baccalaureate degrees** in established or emerging fields within STEM.”

“... 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.”

“The goal of the project must be to **increase the total graduation numbers** of such students at the institution.”

“The proposal must include specific numerical targets for these increases.”

“A project cannot focus efforts to increase the graduation numbers at the expense of degrees in other STEM fields.”
Indiana University Priorities

During President McRobbie’s State of the University address on September 28, 2010, he stated that one of the highest priorities of the university is to retain and graduate a higher percent of its students on all of the IU campuses.

“.... This fall, we surpassed those numbers with a new record total of 109,000 students, breaking records on nearly every campus. Enrollments of minority students have steadily increased over recent years as well, ...

But numbers are not enough—even of the best students—if they do not graduate. Our mission, after all, is graduation and not enrollment. The words of industrial production—often misapplied or simplistically applied to the academic enterprise—are apt here: we must focus on our outcomes and not only on our input. We must, in short, seek to enhance undergraduate student learning and success through university-wide efforts to address retention and graduation issues in a systematic, sustained fashion ...”

The goal of this CI-STEP grant is directly aligned with this priority.
State-wide Priorities

Study: Indiana Needs More College Graduates

*InsideIndianaBusiness.com Report*

Complete College America Senior Vice President Cheryl Orr Dixon says changes are needed, especially when it comes to remediation.

A national report shows Indiana still has plenty of work to do to improve college completion rates. The study by Complete College America, which is led by former Indiana Commissioner for Higher Education Stan Jones, shows only 33 out of every 100 Indiana public college students graduate when given eight years for a four year degree and four years for a two year degree.
IUPUI CI-STEP

- 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.”
- “Specific numerical targets must be included; efforts to increase graduation numbers must not come at the expense of degrees in other STEM fields.”
Our proposal aims to 'set the stage' for student success, removing barriers to learning and promoting a vision of a career in STEM. As a result, we are targeting for each year of the funding, a:

- 10% ↑ in the number of new and transfer students admitted to STEM majors,
- 10% ↑ in the number of minority students admitted to STEM majors
- 10% ↓ in the DFW rates for MATH, CS, PHYS, TECH and other courses
- 15 additional students participating in internship and research experiences
- 50 graduating seniors participating in honors seminars

These efforts will be distributed over 17 departments in the School of Science and School of Engineering & Technology at IUPUI.

**Overall**: 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.
# The Targeted STEM Departments

<table>
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<tr>
<th>STEM Program</th>
<th>F08 Direct Admits</th>
<th>F08 Transfers</th>
<th>F08 Total Majors</th>
<th>F08 Minorities</th>
<th>08-09 Graduates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sci - Biol, Chem, Geol, Phys</td>
<td>386</td>
<td>46</td>
<td>885</td>
<td>223, 25%*</td>
<td>123</td>
</tr>
<tr>
<td>Tech - EE, CM, CP, ME, CI, BM</td>
<td>55</td>
<td>108</td>
<td>967</td>
<td>230, 28%^</td>
<td>184</td>
</tr>
<tr>
<td>Engr - EE, ME, CPE, BME, MS</td>
<td>102</td>
<td>91</td>
<td>808</td>
<td>285, 38%^</td>
<td>110</td>
</tr>
<tr>
<td>Math - MA, CS</td>
<td>48</td>
<td>15</td>
<td>223</td>
<td>42, 19%*</td>
<td>40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>591</strong></td>
<td><strong>260</strong></td>
<td><strong>2,883</strong></td>
<td><strong>780, 29%</strong></td>
<td><strong>457</strong></td>
</tr>
</tbody>
</table>

* Includes AA, Hisp/Latino, and Native American students, excludes Asians and females.

^ Includes AA, Hisp/Latino, Native American and female students, excludes Asians.

**Goal:** 10% increase each year from 457 in baseline → 782 STEM graduates
## Profile of Students and Challenges Facing the STEM Talent Gap at IUPUI

<table>
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<tr>
<th></th>
<th>IUPUI SoS</th>
<th>IUPUI SoET</th>
<th>IUPUI Total</th>
<th>IUBL</th>
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</thead>
<tbody>
<tr>
<td>Hours employed</td>
<td>23.8 hr/wk</td>
<td>30.3 hr/wk</td>
<td>25.8 hr/wk</td>
<td>7.2 hr/wk</td>
</tr>
<tr>
<td>% of new students that are FT</td>
<td>83%</td>
<td>53%</td>
<td>69%</td>
<td>96%</td>
</tr>
<tr>
<td>% in top 10% of HS class</td>
<td>43.6%</td>
<td>28.8%</td>
<td>17.9%</td>
<td>31.2%</td>
</tr>
<tr>
<td>1-yr retention rate of FT/FT</td>
<td>79%</td>
<td>75%</td>
<td>68%</td>
<td>90%</td>
</tr>
<tr>
<td>6-yr graduation rate</td>
<td>45.9%</td>
<td>29%</td>
<td>32%</td>
<td>73%</td>
</tr>
<tr>
<td>Undergraduate degrees awarded to total number of undergrads in unit</td>
<td>163 / 1,108 (14.7%)</td>
<td>294 / 1,775 (16.6%)</td>
<td>3,356 / 21,423 (15.7%)</td>
<td>6,352 / 31,626 (20.0%)</td>
</tr>
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</table>

In 2008, the IUPUI undergraduate student population was:
- 46% FT/FT, 23% transfer, 12% returning adults, 9% non-degree,
- 7% inter-campus transfer, 2% FT/FT international, and 1% all other.
- STEM Faculty Course
- Transformation Grants
- Expansion of PLTL, JiTT, Peer Mentoring
- Honors Seminars
- Bridges to the Baccalaureate
- STEM Summer Bridge
- New School of Science Career Development Services
- New CI-STEP Internship Program
- Student-Centered Pedagogies of Engagement
- Career Services
- Articulation with Ivy Tech
- Calculus for Technology I, II Multidimensional Mathematics
- Multidimensional Mathematics
CI-STEP Initiatives

- Peer Mentoring Programs (SI and SLA)
- Peer-Led Team Learning (PLTL)
- Just-in-Time Teaching (JiTT)
- Summer STEM Bridge Academy
- Inter campus programs (IUPUI-Ivy Tech)

For each initiative:

- Major research and education activities.
- Major findings resulting from these activities.
- Opportunities for training, development and mentoring.
- Opportunities for outreach activities.
Peer mentoring has resulted in a measurable course success rate at IUPUI in General Biology K101/K103, Chemistry C101, Physics P201, Anatomy N261 and Physiology N217 through IUPUI’s Gateway Initiative and the Bepko Learning Center.

New CI-STEP activities include:

**Calculus Recitations (Fall 2010)** developed and implemented into the large lecture sections of MATH 16500 and 16600. Recitations became a required component of the course and students were trained how to facilitate discussions using peer mentoring techniques used in the Mathematics Assistance Center.

**Genetics Recitation (Fall 2011)** implemented into Genetics and Molecular Biology K322. Currently in pilot semester as a Supplemental Instruction (SI).
Peer-Led Team Learning (PLTL)
Developed in Chemistry by Pratibha Varma-Nelson et. al. Students work in workshops of 6-8 students, developing problem solving skills facilitated by Peer Leaders supervised by faculty. Funded at IUPUI by NSF and Educause (Next Generation Learning Challenges) for new cPLTL initiatives. (Note: Session E3 3:10 pm Tuesday 10/11)

New CI-STEP activities include:

PLTL at Ivy Tech: Fall 2011 CI-STEP course transformation grant to introduce PLTL to Chemistry courses at Ivy Tech.


Fall 2010-2011 Goal: Expand Just-in-Time Teaching (JiTT) in STEM courses

JiTT was developed in Physics by Andy Gavrin, Gregor Novak et. al. 1995. Expanded to Biology (Marrs) and Math (Watt) at IUPUI and nationwide.

- Uses web-based work to leverage time between classes.
- Feedback between web homework and class adjusted in real time to create active learner classroom shown to:
  1. Identify misconceptions students bring to STEM courses.
  2. Create interactivity and active learning in large lecture class
  3. Improve student study habits and class attendance
  4. Increase motivation for and relevance of studying STEM
  5. Enhance content knowledge in STEM disciplines
  6. Lower DWF rate and increase course success in Physics, Biology and Math

New CI-STEP activities include: Planned for Spring 2012 - on. CI-STEP provides funding for JiTT course transformation.

*Marrs and Novak (2004) Just-in-Time Teaching in Biology: Creating an Active Learner Classroom Using the Internet*
Summer STEM Bridge Academy

- Serves incoming Freshman 1-2 weeks in late summer
- Academic preparation in math, critical reading and writing
- Orientation to campus, university culture
- Academic habits: note taking, time management, test-taking
- Community building
- 20 sections this summer, 440 students

New CI-STEP activities include:

- New STEM Residential Summer Bridge for students in Women in Science House, Purdue House
Inter-Campus Programs

- NIH Bridges to the Baccalaureate  (NIH-funded, ongoing)  
  Opportunity for minority students to complete Associates Degree with transition to IUPUI; plus scholarships and research project.

- IUPUI and Ivy Tech articulation agreements

New CI-STEP activities include:
- Realigning mathematics coursework between Ivy Tech and IUPUI to improve the seamless transition of STEM students from community college to IUPUI.

Fall 2010-2011:  IUPUI - Ivy Tech Articulation Agreements:
- Calculus for Technology I (MATH 22100),
- Calculus for Technology II (MATH 22200),
- Math for Elementary Education I (MATH 13000),
- Math for Elementary Education II (MATH 13100),
- Math for Elementary Education III (MATH 13200).
- Multidimensional Mathematics
Program Research Questions

Mariah Judd, Postdoctoral Fellow in STEM Education

STEM Attrition

Why do students stay, why do they go
Where is the bottleneck
Effect of undergraduate course transformation in reducing the achievement gap in STEM disciplines
## CI STEP Project: Two-Phase Assessment Framework

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<td>Career or Job Placements in STEM fields</td>
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Progress to Date:

**Goal:** an additional 782 STEM graduates by 2015, for a total of 3,067 STEM graduates by 2015
15 of the Top 50 “Hot Jobs” in Indiana are in STEM fields.
QUESTIONS?

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TRANSFORMING EDUCATION:
FROM INNOVATION TO IMPLEMENTATION

OCTOBER 10-12, 2011
DISCOVERY LEARNING RESEARCH CENTER
PURDUE UNIVERSITY, WEST LAFAYETTE, INDIANA