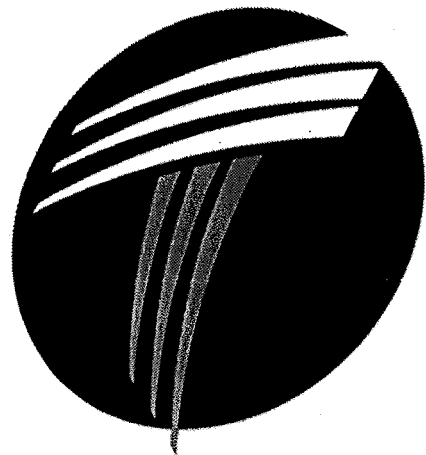


PURDUE  
*PolyTechnic*  
INSTITUTE

**A Transformational Plan for  
the College of Technology**

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College of Technology  
Purdue University  
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**PURDUE**  
UNIVERSITY

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## Our Vision

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The Purdue Polytechnic Institute will be the nation's premiere technological college, an innovative institution that seeks to redefine technology curricula and use-inspired research.

## Our Mission

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The Purdue Polytechnic Institute seeks to educate technologists in a ***Learn by Doing*** environment through the application of theory to practice. The Purdue Polytechnic Institute balances the arts, science, and technology through the tight integration of these disciplines to prepare leaders, researchers, technological innovators and whole-system thinkers to serve the needs of industry and solve global challenges.

## Purpose

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There is agreement that something dramatic needs to be done to change higher education in general, the science, technology, engineering, and mathematics (STEM) disciplines in particular, and to better serve the needs of business and industry. Reports from various federal and professional bodies<sup>1</sup> have been consistent in their conclusions about the nature of the shortcomings in higher education, the substance of recommendations about what needs to happen to redress them, and the sense of urgency for a *comprehensive, transformative, and immediate* response. The key shortcomings are an outdated higher education system that is no longer engaging students, an absence of demonstrable significant learning of the skills needed for the 21<sup>st</sup> century, and an educational mission that has been diverted and subsumed to the more glorified research mission. The key recommendations call for an overhaul of the curricula with a refocus on the skills needed in the 21<sup>st</sup> Century (creativity, innovation, collaboration, communication, knowledge fluency, and application), the generalized adoption of empirically validated teaching practices, and the stronger integration of teaching, economic development, and research. The urgency to take bold comprehensive actions stems from the fact that the incremental approach has been tried for more than a decade and failed to deliver<sup>2</sup>.

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<sup>1</sup> Boyer Report 1999, Gathering of the Storm 2005, 1-Million Engineers 2012, LEAP Report 2013, iFoundry Whitepaper, among others. Full references are found in the appendix.

<sup>2</sup> The NAE report *Rising Above the Gathering Storm* made firm recommendations that were adopted by many in an incremental fashion. A meeting of the same body in 2010 concluded that little progress was made as a result of these timid incremental steps.

In response to the aforementioned opportunities and needs, this proposal suggests the immediate establishment of an educational incubator, the Purdue Polytechnic Institute (PPI), that provides a safe environment for faculty and staff in the College of Technology as well as key collaborators across the Purdue campus to effect targeted changes on a small scale, test them, refine them, and diffuse them to the rest of the College

In other words, we are not interested in an incremental piecemeal approach; such an approach has been tried and shown to have very limited and ephemeral effects. Rather, we are interested in *deep transformational change* that takes a *comprehensive system approach*. We are interested in changing the *culture* that produces the byproducts (curricula, contents, courses, etc.). Our approach starts with the faculty and addresses their changing role from expert to coach. The traditional development of faculty is a trio of domain expertise, research training, and (some) pedagogical training. This is what Dr. Goldberg calls the “above the surface” professional development. Deep professional development training focuses on the new role of coach that faculty are called to play. The faculty will be trained in the sciences of human potential, motivation, learning, and in the techniques of evidence-based educational approaches.

***Technology Education Innovation and Transformation*** by fundamentally changing the learning culture to prepare graduates who have acquired a deep liberal arts education with finely honed technical skills who are better prepared as innovators and “makers”, possessing both technical and professional expertise, an attitude of curiosity to learn and connect with others, and the courage to initiate and collaborate for the benefit of society.

The Purdue Polytechnic Institute is being created to serve as a disruptive transformer of the College of Technology and is motivated by the widening gulf between the excitement and passion in generations of students who are adventurous, curious, and socially and environmentally aware.

The Purdue Polytechnic Institute will create an educational environment that nurtures and unleashes student enthusiasm and passion rather than discourage and filter them out. Our approach to effecting change within the college is built on several elements:

- (i) Using the Purdue Polytechnic Institute as an incubator that permits learning innovation outside of the usual norms and constraints,
- (ii) Changing not just the byproducts of the educational system (courses and pedagogies) but addressing the very culture underlying it,
- (iii) Engaging in strategic partnerships at Purdue and bringing in outside expertise from educational and industrial environments,
- (iv) Adopting proven methods that address emotional and cultural change in a systematic and sustainable way.

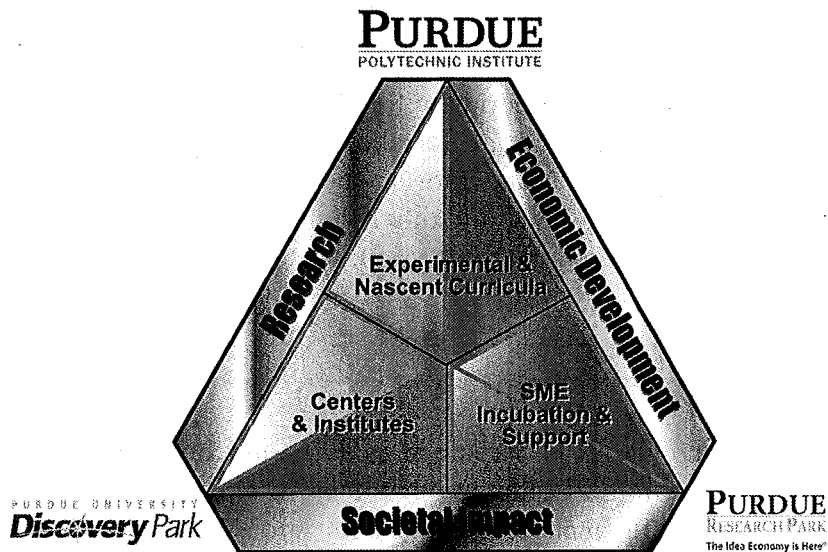
The Purdue Polytechnic Institute will transform the College of Technology by changing the learning culture to prepare innovators and leaders who possess deep

technical skills, an attitude of curiosity to learn and connect with others, and the courage to initiate and collaborate for the benefit of society. The initiative will collaborate with related existing efforts, such as IMPACT, Discovery Learning Research Center, Discovery Park, Purdue Research Park, and other units, to avoid duplication and leverage Purdue's investments in programs and resources that are available to all.

The academic home for the transformation will be accomplished through the establishment of a Division of Technology, Culture & Society. This new Division will establish its own governance, leadership team, and faculty. Initial curriculum transformation and new degree programs that adhere to the principles of the Polytechnic will be developed in the division.

The Purdue Polytechnic Institute (PPI) will become the College of Technology's experimental home to link the three missions of the university in discovery, learning, and engagement. The PPI will be the College of Technology's versions of the third leg for the 21<sup>st</sup> century land grant university bridging the gap between Purdue's Discovery Park and the Purdue Research Park. The institute presents a unique and innovative model, as defined by the College of Technology in an effort to focus the college's current and emerging core competencies on:

- 1) ***Technology Education Innovation and Transformation*** by fundamentally changing the learning culture to prepare graduates who have acquired a deep liberal arts education with finely honed technical skills who are better prepared as innovators and "makers", possessing both technical and professional expertise, an attitude of curiosity to learn and connect with others, and the courage to initiate and collaborate for the benefit of society;
- 2) ***Innovation Acceleration for Industry*** through a curricula where students experience the cycle of innovation multiple times and workforce development efforts leveraging an expanded Statewide Technology network of educational programs to serve the needs of industry;
- 3) ***Application-Oriented Research*** and technology transfer centers to support business and industry through the creation of Consumer-Oriented Research Centers and Innovation Labs (iLabs) that focus the efforts of the College of Technology's faculty, students, and staff.



Located at the intersection of Purdue’s missions in learning, discovery and engagement, the Institute will serve as an incubator—a “hot house” or “skunk works”—in the College of Technology, where transformation can thrive.

The Purdue Polytechnic Institute is being created to serve as a disruptive transformer of the College of Technology and is motivated by the widening gulf between the excitement and passion in generations of students who are adventurous, curious, and socially and environmentally aware.

The Purdue Polytechnic Institute will transcend the college’s archaic model of education based on static knowledge delivery, solitary abstract work, and testing.

## Approach

The Purdue Polytechnic Institute will create an educational environment that nurtures and unleashes student enthusiasm and passion rather than discourages and filters them out. Our approach to effecting change within the college is built on several elements:

- (v) Using the Purdue Polytechnic Institute as an incubator that permits learning innovation outside of the usual norms and constraints;
- (vi) Changing not just the byproducts of the educational system (courses and pedagogies), but addressing the very culture underlying it;
- (vii) Engaging in strategic partnerships at Purdue and bringing in outside expertise from educational and industrial environments;
- (viii) Adopting proven methods that address emotional and cultural change in a systematic and sustainable way.

The Purdue Polytechnic Institute will transform the College of Technology by changing the learning culture to prepare innovators and leaders who possess deep technical skills, an attitude of curiosity to learn and connect with others, and the courage to initiate and collaborate for the benefit of society. The initiative will collaborate with related existing efforts, such as IMPACT, Discovery Learning Research Center, Discovery Park, and other units, to avoid duplication and leverage Purdue's investments in programs and resources that are available to all.

## **Purdue Strategic Partners**

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An important element of our approach is to break the boundaries between the disciplines and educate the students in context, in a multi-disciplinary fashion. As such, the Polytechnic is anchored in the College of Technology with partnerships under development with other colleges and units on campus. These include:

- The School of Liberal Arts. Technological artifacts are enabled by technology (sciences, engineering, and manufacturing), but exist because they are desirable and satisfy a human need or want. The integration of technology and liberal arts in the curriculum provides a context and motivation for the students. Multi-disciplinary courses and projects will be a signature of the Polytechnic. In particular, we have begun discussions with the Department of Philosophy and the School of Foreign Language and Culture to create integrated courses that bridge the understanding of humanities in context with technology.
- Modern pedagogies built on scientific understanding of human motivations and learning will be at the core of the curriculum developed. We will be using approaches that are based on the latest findings in human motivation and learning. The School of Education will be a key partner in this endeavor.
- The use of the above mentioned approaches require a completely new mindset and paradigm shift from the faculty. Their role will no longer be the stewards and deliverers of knowledge but coaches who help the students create their paths towards mastery of subjects. The Center for Instructional Excellence and the Discovery Learning Research Center will help develop and deliver professional development for all faculty involved.

It is anticipated that other opportunities for collaborations will develop over the life of the initiative, especially within the STEAM disciplines.



## **Student Learning Outcomes**

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The Purdue Polytechnic curriculum will prepare graduates for highly skilled technical careers, lifelong learning and citizenship in a globally connected and competitive world. Student learning outcomes will include the following:

- Ability to use critical thinking and problem solving;
- Ability to collaborate across networks and lead by influence;
- Proven agility and adaptability in their professions;
- Demonstrated initiative and entrepreneurship;
- Ability to access and analyze information in novel situations;
- Ability to integrate and fabricate technology to innovate and solve problems;
- Effective use of oral and written communications;
- Displayed attributes of curiosity and imagination when solving problems;
- Ability to problem solve using technical knowledge applied at a system or enterprise level;
- Proven application of the lifecycle of innovation in business and industry settings;
- Demonstrated life-long-learning behaviors through self-direction.

## **Transforming the Student Learning Experience**

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The PPI will be a zero-gravity space that is free of constraints, restrictions, and traditions. The newly created education will be formed by well-established research and evidence based best-practices and will be developed in an environment that encourages innovation and risk taking. Once it is fully implemented, the curricula will include the following required experiences:

- *Real-world Immersive Capstone Experience (RICE)*—Year-long industry or agency sponsored team-based senior design projects supervised by professors and industry and agency representatives
- Semester-long *Study Away* experience
- Foreign language
- Disciplinary integration with Liberal Arts

- *Polytechnic Field Experience*—Semester/summer internship between their sophomore and junior years
- Required experiences in undergraduate research projects or student-based projects, such as Eco-Car, Solar Decathlon, EPICS, etc.
- *iMakers Certificate Program*—Innovation or entrepreneurship emphasis throughout the curricula that can lead to a certificates in Entrepreneurship and Innovation and Applied Innovation and Commercialization
- *iMakers Lab and iLearning Lab*—hands-on learning and problem-based team projects every semester in facilities designed for collaboration and creativity
- *The Sustainability Initiative*—Social responsibility through the sustainability unifier integrated throughout the curriculum
- *History and Impact of Things & Stuff*
- Principles of critical thinking and logic
- Common first-year core curriculum
- Creativity and problem solving
- Leadership and supervision principles
- Business and enterprise practices

## **Purdue Polytechnic Institute Talking Points**

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The **Purdue Polytechnic Institute (PPI)** provides a transformative learning environment and experience for students that are uniquely aligned with the needs of industry and society. The curriculum is almost entirely based on Learn by Doing through project-based learning experiences along with self-paced and competency-based instruction.

Students will be prepared as innovators and makers, project managers and leaders who possess deep technical skills and business management principles. The deep technical skills and knowledge are tightly integrated with the humanities to build an understanding of the complex nature of applying science and technology to social issues, problems, and solutions.

## The Purdue Polytechnic Institute Difference is...

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### Practical

It is not enough to know things. PPI graduates need to be able to use their knowledge to solve difficult and important problems. ***Learn by Doing*** is the most powerful form of learning. This tradition of balancing theory with practice is embodied in our project-based undergraduate curriculum.

### Purposeful

Undertaking big problems is a way of life at the Purdue Polytechnic Institute by doing things that address the issues and needs that matter most in the world. PPI students immerse themselves in solving large-scale social and technical problems from day one through the college's first-year ***Technology Makers Grand Challenge Experience***.

### Flexible

PPI students are free to build a curriculum that matches their curiosity and aspirations. Academic advisors guide students in making flexible course selections to meet their overall goals. The ***Polytechnic Grading System*** encourages students to explore their interests without impacting their overall GPA.

### Challenging

The ***Real-World Immersive Capstone Experience (RICE)*** is one of the most innovative elements of the Purdue Polytechnic Institute's undergraduate curriculum. It requires students to work in teams to find relevant solutions to societal problems using science and technology. Often, those problems lie well outside of their major areas. It's difficult, rewarding--and life changing.

### Global

Today's problems and opportunities are global. Students need to think globally, too. That's why PPI's ***Global Perspective Program*** is much more than a study abroad program. The Global Perspective Program is a ***Study Away*** program where students become immersed in another culture, domestic or international, through a semester or summer-long experience to solve a real, meaningful problem and produce results.

### **Vibrant**

The humanities and arts are an integral component to the PPI curriculum and experience. Academically, the humanities enrich, broaden and engage as they prepare students for rewarding lives. The humanities also build understanding of the complex nature of applying science and technology to social issues, problems, and solutions.

### **Real-World**

Every PPI student has the chance to experience the kind of real-world problem solving that will soon characterize their professional careers. It's called the ***Polytechnic Field Experience***, an engrossing, high-level design or research experience in the major field.

## **Imagine a college where...**

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- “Fully assembled” applied science and technology graduates have finely honed the soft skills to build, collaborate, and lead new and old business in the State of Indiana and around the world.
- Indiana and Global corporations mesh seamlessly with Purdue faculty and students to help transform the College and transform the economy of the State at the same time
- Parents no longer worry about the job prospects for their sons and daughters because every Purdue student has a string of practical internship and work experiences embedded in their education, leading to high paying and fulfilling work opportunities following graduation.
- Students know from the first day of class that they are being educated and trained for the demanding workforce of the 21<sup>st</sup> century in a College leading the charge for a new kind of 21<sup>st</sup> century education.
- Students are trusted, they believe they are trusted, and they are unleashed to initiate, fail, and try again until they succeed.
- Students are valued, not for their grades and their test scores, but for their whole selves, their minds, hearts, and hands.
- Students are engaged in studies aligned with their aspirations in ways that motivate them to work longer, harder, smarter, and with greater joy and fulfillment.

- The example of bold and smooth change at the Purdue Polytechnic Institute sets a model imitated around the State, the Nation, and the World for technology education.

## **Basic Tenets of the Purdue Polytechnic Institute**

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The Purdue Polytechnic Institute uses the idea of an entrepreneurial business incubator, not to create new business, but rather to pilot new education programs by:

- Creating a new culture that celebrates success, learning, and community in place of failure, sorting, and judgment;
- Moving at a pace of innovation and change that is unprecedented in the usual academic circles;
- Trusting students before they trust themselves, holding that trust until they believe it, and then watching their courage unleash powerful initiative and confidence to learn, act, and grow in the world;
- Augmenting faculty disciplinary expertise (“I know”) with a broad, caring faculty coaching capacity (“I trust”) through special training and coaching experiences;
- Infusing the PPI with the secrets of entrepreneurial thinking through *effectuation*, little wins, small failures, leading to scalable education that works;
- Bringing modern leadership development and executive coaching practices to PPI leaders, faculty, and students;
- Involving students in all change processes, and by engaging student passion and energy as the prime mover of educational change;
- Turning away from the usual process of “death by committee” and by turning toward modern *change management* combining head, heart, and institutional rewire;
- Bringing faculty and students from different disciplines and colleges together in the classroom and applied laboratories in unprecedented numbers with unparalleled interaction and creative collaboration;
- Bringing alumni and industry partners into the educational design paradigm and instruction process to create authentic work and learning experiences for career-ready graduates;

- Celebrating faculty, student, and stakeholder creativity and accomplishment, and by expressing gratitude and appreciation for the opportunity to participate in this bold venture.

## **Distinctive Attributes of the Purdue Polytechnic Institute Initiative**

The Purdue Polytechnic Institute is a long-term plan to transform the College of Technology and has some distinctive features that will lead to metamorphic change. Here are a few examples currently under development:

- *Creation of an Interdisciplinary Technology Studies (ITS) Division*
  - The Interdisciplinary Technology Studies (ITS) Division in the Purdue Polytechnic Institute will serve as a center for undergraduate education innovation that extends beyond traditional departmental boundaries. The major and minor programs will attract undergraduates who wish to explore the most intellectually engaging and promising interdisciplinary technology fields under the direction of scholars who are pioneers in charting these new areas and methods of inquiry. The Interdisciplinary Technology Studies Division will be an incubator for new ideas—including experimental programs and courses—as well as curriculum designed to promote the ideals of technology education. Shown below are a few possible new courses, divisions, and degree options.
- *New Courses*
  - *Humanities & Technology*—a first year course that integrates important humanities, such as critical thinking, logic, philosophy of technology, and great literature, with an introduction to the grand challenge problems facing humanity.
  - *History and Impact of Things & Stuff Course*—a first-year course in the Purdue Polytechnic Institute that is team-taught by Liberal Arts and Polytechnic faculty. The course will cover important technological artifacts and societal events to guide the students to understand the significance and impact of technology throughout human history.
- *BS in Product and Production Innovation*
  - *Product Design and Production degree option*
  - *Mechatronics degree option*
  - *Robotics Institute and degree option*
  - *Enterprise Systems Management degree option*

- BS in Information Technology & Informatics
  - Human Computer Interaction degree option
  - Big Data Analytics & Visualization degree option
  - Interactive Media Arts & Technology degree option
- BS in Art & Technology
  - Interdisciplinary Degree Option
- MS and PhD in Innovation Science
  - Interdisciplinary Degree Option in partnership with Science, Engineering, and Management

Other programs and initiatives under development:

Faculty Fellows Program

Technology Makers Grand Challenge Experience

iMakers Labs

iLearning Labs

iMakers Certificate Program

Polytechnic Field Experience

Global Perspectives Program

Real-world Immersive Capstone Experience (RICE)

Curricula Assessment and Continuous Improvement (CACI)

Define the summer learning experience- study away, team based

What about grades? Measure creativity and problem solving

Serving the underserved- nationally and internationally (free web-based instruction)

In-semester interns—University of Waterloo

Branch campuses in cities around technology applications for interns

