



Purdue Polytechnic **Educational Research and Development**  
**Highlights of 2014 & Ambitions for 2015**



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// I hope that you will  
have a wonderful year,  
that you'll dream dangerously  
and outrageously, that you'll make  
something that didn't exist before you made it,  
that you will be loved and that you will be liked, and  
that you will have people to love and to like in return.  
And, most importantly (because I think there should be  
more kindness and more wisdom in the world right now),  
that you will, when you need to be, be wise,  
and that you will always be kind.

*Neil Gaiman*



# Introduction from the Associate Dean

Welcome to this special Purdue Polytechnic report in which we celebrate our accomplishments in 2014, reflect on what we have learned, and prepare for another momentous year.

We wrapped up 2014 with a potluck dinner with the Purdue Polytechnic family. It was attended by students, staff, faculty, and their respective families. We especially enjoyed meeting many of our students' parents and hearing their feedback, questions, and suggestions. One of the highlights of the evening was when the students gave their parents a tour of the lab and showed them the projects they have designed.



We began 2015 with another communal event: a two-day working retreat where we processed program evaluation data collected in 2014 and planned the many activities for 2015. Here too students were present with us. They were invited to add their voices, and several enthusiastically decided to do so. It is very hard to capture the level of energy and the sense of boundless possibilities that reigned during the two-day retreat. When we started a year ago, we half-jokingly stated, “We are not creating a new curriculum; we are creating a new culture.” As we questioned, debated, and “dreamed dangerously and outrageously,” it definitely felt like a new culture – one built on mutual trust, respect, vulnerability, and commitment to a common vision.

The most fitting way to start 2015 is by saluting my colleagues who have been making this possible, taking risks, getting out of their comfort zones, and asking questions that deeply touch our very identities as educators. Kudos to all of you: Kirk Alter, Richard Dionne, Jeffrey Evans, Marisa Exter, Esteban Garcia, Michael Fosmire, Tom Hacker, Robert Herrick, Davin Huston, Gozdem Kilaz, Sorin Matei, Mark Shaurette, Michael Smith, and Amy Van Epps, founding faculty fellows. Welcome to new faculty: Rayvon Fouché, Marifran Mattson, Nancy Gabin, Ajith Rajapaksha, and Sharra Vostrel. And thank you to Stephanie Schmidt and John O’Malley, our dedicated staff.

Best wishes to all. Dream big ... and always be kind.

**Fatma Mili**

Associate Dean for Educational Research and Development  
College of Technology



# 1 The Charter

The Purdue Polytechnic Educational Research and Development's charter, adopted in December 2013, defines the following:

**Mission:** Serve as a live experimental laboratory for the education we deliver in all of its aspects.

**Values:**

- Students are partners in learning and teaching
- Faculty are partners in learning and teaching
- Questioning, experimenting, learning, and sharing are at the center of everything we do

**Mode of Operation:**

- Continuous research and experimentation
- Strong assessment, rapid learning, and rapid iteration
- Shared ownership and shared accountability

**Deliverables:**

- Research alternative approaches to the development, delivery, and governance of learning
- Development and implementation of learning experiences
- Dissemination and sharing of everything we learn
- Advocacy and fundraising through grant writing and applications to federal agencies and foundations

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**Our Values**

[tech.purdue.edu/incubator/about/our-values](http://tech.purdue.edu/incubator/about/our-values)



## 2 The Membership

Faculty in the Educational Research and Development team are, for now, full-time faculty from departments in the College of Technology (CoT) and other units at Purdue.

**The founding faculty fellows** are **Kirk Alter** (Building Construction Management, CoT), **Richard Dionne** (Theatre, College of Liberal Arts (CLA)), **Jeffrey Evans** (School of Engineering Technology, CoT), **Marisa Exter** (College of Education), **Michael Fosmire** (Libraries), **Esteban Garcia** (Computer Graphics Technology, CoT), **Tom Hacker** (Computer and Information Technology, CoT), **Bob Herrick** (School of Engineering Technology, CoT), **Davin Huston** (School of Engineering Technology, CoT), **Gozdem Kilaz** (Aviation Technology, CoT), **Sorin Matei** (Brian Lamb School of Communication, CLA), **Fatma Mili** (CoT), **Mark Shaurette** (BCM, CoT), **Michael Smith** (English, CLA), and **Amy Van Epps** (Libraries).

**Additional faculty fellows** joining in January 2015: **Nicholas Dib** (BCM, CoT), **Rayvon Fouché** (American Studies, CLA), **Nancy Gabin** (History, CLA), **Marifran**



**Mattson** (Brian Lamb School of Communication, CLA), **Ajith Rajapaksha** (Physics, College of Science), and **Sharra Vostrel** (History, CLA).

**Staff:** The dedicated staff consists of **Stephanie Schmidt** (Administrative Assistant) and **John O'Malley** (Communication Specialist). In addition, **Tom Frooninckx**, Managing Director for the Dean, is playing a key supporting role; **Mike Canning** was added recently as a consultant to support in identifying funding sources and in developing proposals.

## 3 Highlights of Activities Undertaken in 2014

In 2014, this group came together as a team and accomplished the following:

- Created a charter expressing commitment to an educational vision.
- Developed an educational and pedagogical architecture (January retreat).
- Adopted a governance system based on distributed responsibilities and accountability.
- Developed a Hubzero-based web site for out-facing and inner-facing information related to our activities.
- Designed a first-year curriculum reflecting the vision and the architecture. Three design review sessions were held in April (CoT), May, and June; the last two included external reviewers from Olin College. The design continued over the summer based on the feedback received.
- Created and continue to nurture and grow a faculty development culture based on transparency, sense of community, and continuous intellectual and professional growth.
- Created and continue to grow a community within the College, Purdue, and beyond. Established many working relationships with departments at Purdue and educational innovators around the country.
- Competed for and won the \$500,000 Presidential CBE Competition (August 2014). Started working on implementing competency-based education (CBE) with ITaP Open Passport team in May 2014.

**GO ONLINE FOR MORE ...**

**President Daniels awards \$500K prize for Purdue Polytech's competency-based degree proposal**

[tech.purdue.edu/cbe-award](http://tech.purdue.edu/cbe-award)

- Developed a competency-based transdisciplinary degree, completed in the summer, which was approved by the CoT senate on December 10, 2014. The proposal will now move to the Provost, President, Board of Trustees (targeting February meeting), then ICHE and HCL. The goal is to have this degree in place for Fall 2015.
- With leadership from the president's office, started work with an infrastructure task force to implement CBE. The task force includes Enrollment Management, Financial Aid, Registrar, ITaP, Open Passport.
- Recruited a cohort of 35 CoT and Exploratory Students to enroll in the pilot offering 2014-15.
- Developed a robust formative program evaluation team and protocol with a very rapid feedback loop.
- Developed and supported parallel efforts in statewide locations South Bend and New Albany.
- Started diffusing the movement by mentoring a First-Year Experience Team and a Competency Workforce.
- Started to organize our efforts to broaden our research exposure and seek funding.

## 4 The Fall 2014 Offering

### 4.1 The Curriculum

The curriculum offered in the fall was the first materialization of the guiding principles that the Purdue Polytechnic faculty fellows have adopted: Learning in context, learning relevant to students' interests, maximizing students' autonomy, addressing the whole person by balancing between technology and the humanities, and focusing deliberately on higher order cross-cutting capacities and habits of mind. These principles, which were supported with research literature and experiential research, led to a first-semester design that began planting the seeds of implementation.



#### 4.1.1 Learning Environments

A large portion of the students' time is divided between two distinct but inter-related learning settings: a Design Lab and a Seminar. The Design Lab offered the space for the students to work on a problem relevant to them (in this case, food deserts) and in the process learn and practice a comprehensive design process, project management, teamwork and collaboration, and learn and apply introductory material in a variety of disciplines: mechanical, electronics, materials, and computing.

During the fall semester, students designed a garden in a box. They had full decision-making power over the design

of their solutions. Projects ranged from a low tech garden in a water jug with a simple irrigation system and lighting to much more elaborate designs integrating a variety of sensors and controls.

The Design Lab is run in a studio format with design reviews and continuous feedback loop from peers and faculty. The design studio space was dedicated to the students full time and became their home for the whole semester, although the cohort overall occupied the whole ground floor of DLR.

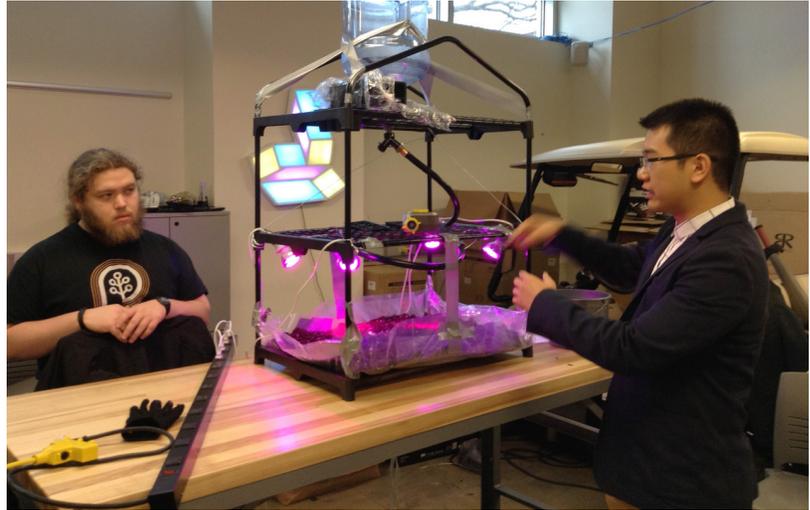
The second learning experience followed a seminar format. It bears the title: "Culture, Communication, and

Digital Narratives.” The learning experience focuses on storytelling as a way of thinking: How can artistic storytelling help you learn, create, and communicate? What is your story? The seminar put communication at the core of several key skills and activities: discovery and knowledge of self and others; idea fluency and creativity; communication as a way of learning and deepening areas of interest; and using technology (animations, video, audioscapes) to communicate effectively and professionally and communicate across disciplines.

#### 4.1.2 Administration and Delivery of the Fall Curriculum

Because we do not have an independent curriculum yet, existing courses were used as a medium to deliver the Design Lab and Seminar. Students were signed up in existing courses. Based on their majors and, notably, on where they placed in Math and English, students needed different courses. We used TECH 120, ENG 106, and COMM 114 as common denominators and complemented them with at least one discipline-specific course. These 12 credits were delivered through the Design Lab and Seminar supplemented with Independent Learning Modules. The delineation between the two learning environments was not strict but a good approximation in that the Design Lab delivered TECH 120 plus a discipline-specific course (often complemented with independent learning modules), and the Seminar delivered COMM 114 and English 106. In practice, the boundary is intentionally porous. Communication took place about work performed in the design studio, and questions raised in the design studio are debated and written about in the seminar. Overall, the students got exposed to much more than the sum of the courses for which they enrolled.

The design and delivery of the curriculum continues



to be a team effort driven by the desire to collaborate, learn from each other, and continue to challenge each other and innovate. In the fall, each of the two learning environments received on average two to three visits per week by individuals and groups of faculty, administrators,



and external visitors. The program evaluation team, comprised of two faculty and two graduate students, assured a constant presence in the classroom in addition to independent surveys and interviews. Our weekly reflection meeting was also a setting to review and debate everything related to the experience. This opening of the classroom space, faculty-student interactions, fully transparency, and subject to reflection and debate were among the most important cultural shifts. We believed very strongly in the benefits of this approach for all involved despite being out of our comfort zones. It has to be said that the very high level of trust between the faculty fellows as developed during the past year was a key ingredient in making this transparency and vulnerability possible and effective.

### 4.1.3 Lessons Learned about the Designed Content and Delivery

The program evaluation team is compiling a comprehensive report analyzing data collected from faculty interviews, student interviews, group reflection sessions, and class observations and taping. The remarks included here are consistent with that report but do not get into the details of the assessment.

The faculty who designed and delivered these experiences have all taught the same or similar content in the traditional mode. Overall, they found the integrated approach to be more stimulating, much more flexible in accommodating a variety of additional content, and much more engaging for the students. It also resulted in much

higher level of performance for the majority of the students. Throughout the semester, rapid feedback received from the program evaluation team has been incorporated in the experiences and resulted in many adaptations and changes.

In both experiences, the students felt that the work they were doing was relevant and important and not just busywork. The quantity and variety of artifacts produced by the students exceed by far what is generally expected in a first semester. Each group designed and built a garden in a box using technologies of their choice; each student participated in creating a short movie or animation conveying a message important to them (stereotypes, alcohol abuse in college, loneliness, etc.); each student also produced a sound narrative. These artifacts were in addition to the typical collection of writing and speeches that first year students produce.

In both experiences, faculty, with support from the program evaluation team, kept their fingers on the pulse of the experience to determine how well the students were adjusting to this new environment in terms of higher expectations and higher autonomy. The faculty scaled back the sizes of the projects from what they had designed over the summer. This calibration happened very early on in the semester and was consistent with the Olin faculty's experience and their recommendations to us. The adaptation and calibration around autonomy was the more intensive, and as expected more challenging. Some students were ready to take the reins and really flourished. Others were overwhelmed by the level of freedom and did not yet have the time management habits developed. They needed to develop these first. Faculty spent most of their energy with the latter group. Going forward, we will be working on developing processes and tools to help the students learn time management and self-knowledge as they practice them in learning course content.

## 4.2 Teaching vs. Learning – Student Assessment

### 4.2.1 The Rationale for Competency-Based Education

During the design process, the faculty fellows converged towards using competency-based education as a way to address several criteria adopted:

#### Accountability on the Outcome

The book *Academically Adrift*, published in 2011, rang a very loud alarm when it reported on its findings of the level of learning in our colleges. The documented lack of significant improvement in critical thinking, complex reasoning, and writing in one-third of graduates was unsettling. If nothing else, it pointed to a deep flaw in our system of accountability. What if we shifted graduation requirements from credits and grades to *actual learning and demonstrated competence*? What if degrees were defined in terms of the outcome rather than the process? Competency-based education is meant to do just that.

#### Accountability on Higher Order Skills

Along with the focus on the outcome, CBE raises the question of the nature of these competencies. With the deepening of our academic disciplines, we have experienced increased specialization and sharpened focus on the growing amount of disciplinary knowledge in the design and delivery of curricula. Even so, interviews and surveys of employers are consistently valuing higher order skills over the specific disciplinary domains in which the graduates learned to practice. In the recent AACU report “It Takes More than a Major” (Association of American Colleges and Universities and Hart Research Associates, 2013), nearly all those surveyed (93 percent) say that “a demonstrated capacity to think critically, communicate clearly, and solve complex problems is more important than [a candidate’s] undergraduate major.” Although not a panacea to all problems, CBE can help us bridge the disconnect by explicitly identifying both types of competencies and designing around them.

#### Empowering the Students with Their Learning

The clarity on expectations and the inherent asynchronicity of CBE puts students in the driver’s seat when it comes to their learning. Students are presented with clear specifications for competencies they need to demonstrate to graduate. They can then establish how and when they will acquire these competencies. Some students may be able to go much faster; some will choose to acquire additional competencies outside those prescribed by their curriculum and have them credentialed; some will choose to go at a slower pace, more appropriate for their preparation or outside demands on their time. The sense of control nurtures the students’ intrinsic motivation and helps them explore and deepen their learning.



### Designing for Diversity

Until we reach a 50-50 gender distribution and an ethnic distribution commensurate with the general population, we have a diversity problem. This problem proved to be almost intractable, at least in its present form. CBE, with its potential for flexibility, openness, and personalization, can lead to a breakthrough in finally removing barriers for all, making post-secondary education more accessible, more appealing, and more successful.

### 4.2.2 Our Experiment with Competencies and Badges

#### Adopting Competency-Based Education

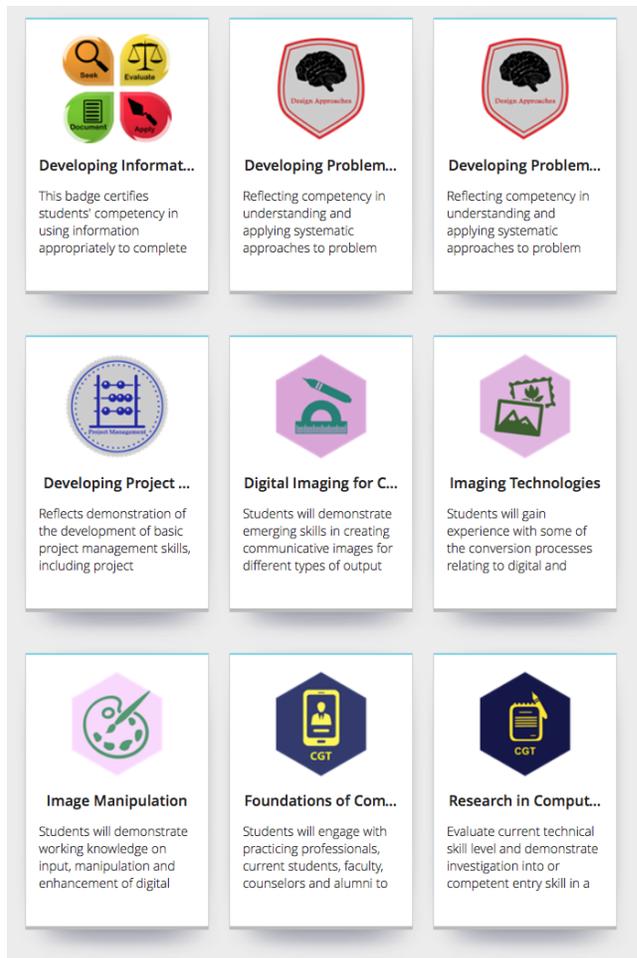
After reading about competencies and badges, we invited Bill Watson, associate professor of curriculum and instruction in the College of Education, to give a seminar about it and about his role in the development of the Open Passport system. A group of faculty fellows decided to pursue this. In Spring 2014, we invited ITaP staff and other CoT department heads to a more focused presentation. The ITaP staff were very enthused about working with us to refine and test Open Passport for a full degree rather than as a support for individual classes, as they have been doing so far.

Over the summer, we extended this effort by starting discussions with the Office of the Registrar to explore the integration of Open Passport with the existing Banner system and the integration of course- and grade-based records with competency-based records.

#### Designing Competencies

In parallel, the faculty started designing the competencies they will be targeting in their courses. A good portion of the design time in the summer was devoted to the development, definition, and materialization of the competencies. This included the design of the learning materials to help the students gain competencies and the challenges that students need to take to demonstrate competence.

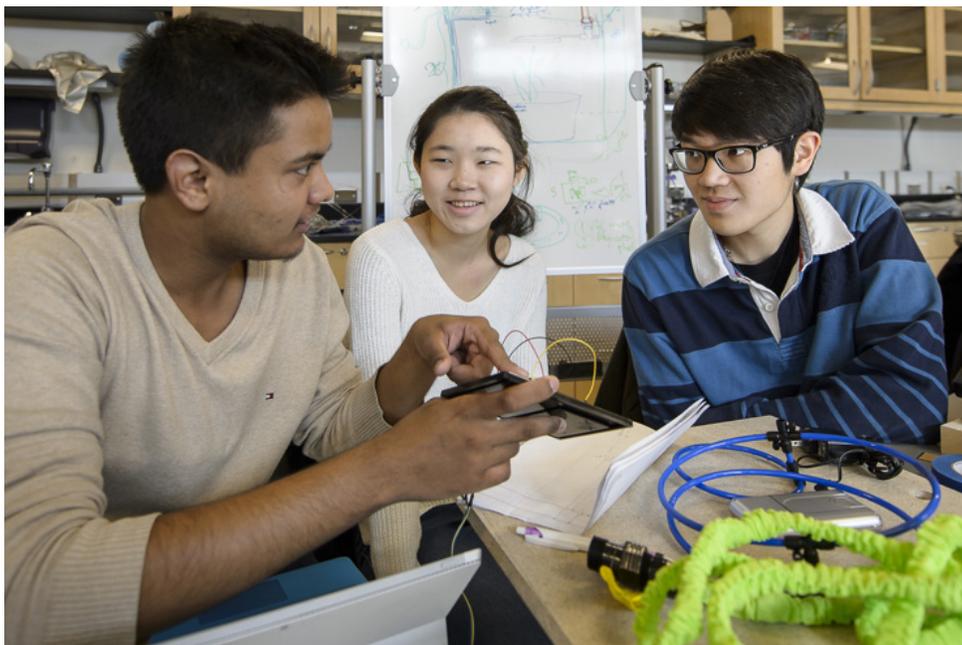
Because most of the material covers the University



Foundational outcomes as defined by the Purdue University Senate (University Senate Educational Policy Committee, 2012), this document served as a starting point for defining the competencies. We also used their main sources, the Essential Learning Outcomes (National Leadership Council for Liberal Education and America's Promise, 2008) and value rubrics (AAC&U LEAP, 2014) developed by the AAC&U. Among other things, we adopted the Purdue classification of competencies as *developing*, *emerging*, and *proficient*. With the idea that most of the material covered in the first year is *developing* – which is when, for example, a student could become competent (e.g. receive an A grade) in ENGL 106 – most of the competencies we have defined so far are in that category. By contrast, a senior student would be earning

competencies at the *proficient* level (e.g. advanced software design) during his or her senior year.

By the end of Fall 2014, the faculty had created more than 40 competencies encompassing all the courses and learning environments they offered in the fall which go beyond the traditional classes for which the students are typically enrolled. For example, the Seminar course covers all the competencies of ENGL 106 and COMM 114 but took advantage of faculty expertise and interests to add digital communication (video and animations) and audio



communication (ranging from live performance to digital composition).

### Using Competencies

Even though students currently in the program are signed up in credit-based courses for which they receive grades, there was a decision to use 2014-2015 as a learning year, by using the competencies as a way to grade the students. The use of competencies implies different mindsets and processes.

### Autonomy and Asynchronicity

One of the tenets of the competency-based approach is that students gain autonomy in acquiring the competencies at their own pace. There are no barriers to going faster and no penalties to going slower. Students are in the driver's seat; they manage their time and their learning. This self-management aspect, which was something many of them have never practiced, required a large part of the semester to begin to learn. This was the steepest learning curve for all involved. The faculty spent the

semester experimenting with different mechanisms to find the right balance between promoting students' independence and scaffolding their acquisition of the needed independence. We are currently researching software tools to help the students build independent time management skills and to help students and faculty track students' progress.

Another challenging factor here is the marrying of competencies in a highly regulated and standardized semester-based system.

Regulations around the semester-based system dictate a required level of progress (30 credits per year). While the time investment may be linear, the rate of learning for the students may follow a different curve. Ideally, we want to trust students' capacity to learn and let them do so at their pace based on their preparation and prior experience.

### Competence vs. Passing

Competence is defined as a binary attribute that students have achieved, or not yet. This too is a different



mindset for students and faculty. Students are used to submitting work and taking it off their schedule irrespective of the quality of what they submit. The grade-based traditional system has the drawback of finality (especially when they receive low grades) and leads many students to play it safe and only attempt classes in which they can receive a high grade. This finality can also be seen as an advantage in the sense that students can put the assignment/class behind them as soon as they get a passing grade. This is the traditional measure of progress that the students are familiar with: accumulation of credit hours and seat time.

With the competency-based approach, a work submitted is just a work submitted; it does not signal completion until the student reaches competence. Students receive constructive feedback and are supported in learning more until they reach the level of competence.

This latter aspect, shifting from summative (and graded) assessment to formative assessment is unfamiliar and proved unsettling for many students, at least at first. Once they make the transition, they reap the benefits: they understand that we are setting high expectations for them, that we trust that they are able to reach these expectations, and that we are here to help. This aspect as well requires time – differing lengths for different students. Most of them were surprised by the process and a bit frustrated at first. Once they go over that hurdle, they shift their focus to learning and working with their faculty and mentors. For some students it took a large part of the semester. Once they caught on to the process, they felt even more overwhelmed because of the looming end of semester. Faculty kept encouraging students to still strive for the A work rather than settling for just completing. This was a very hard exercise for the faculty and the students especially since we are trying to instill the value of competence in a system designed around credit hours, seat time, and grades. Students and faculty were under many pressures to revert to the familiar approach. I would like to take this opportunity to express many thanks and admiration for the faculty who stood firm and worked very hard with the students one on one.

### 4.2.3 Our Experience with Student Mentoring

A key tenet of what we want to do is to transition from the division of labor whereby faculty teach and students somewhat passively receive to a setting where students take more active roles with learning and faculty take on the roles of coach, mentor, and guide. In this spirit, we wanted to assign all students a mentor who will stay with them throughout their studies and establish a significant relationship which goes beyond the specific discipline they are teaching and the specific time frame of a semester. The mentor will therefore supplement the functions fulfilled by the faculty in the classroom and the role fulfilled by the professional advisor.

We assigned every student to one of the faculty before they arrived with the understanding that they once we get

to know each other, better selections can be made.

The student-mentor relationship was meant to work within a mentoring team whereby students will interact with the following:

- A faculty mentor who they get to know from their first semester until they graduate and beyond. Faculty will know their students well and play the role of caring knowledgeable mentors for all aspects of their students' growth.
- Faculty in the classroom who interact with the students during specific semesters and primarily within the scope of the material being learned.
- A professional advisor who helps students navigate the administrative aspects of student life and point them to the right resources.

For a variety of reasons, this mentoring team concept was probably our weakest link during the fall semester. The faculty mentor role needed a bit more definition and refinement. We needed a uniform understanding of what this involved and what visible processes needed to take place to maximize its success. This being said, it will take longer than one semester to assess the effectiveness on students of this burgeoning relationship.

The level of comfort and mutual friendship that all students exhibit with faculty is unique and rewarding – a bright spot of the fall semester. The number of students who came to the end-of-semester potluck and the number who volunteered to return to campus one week early to participate in the January retreat are welcome and visible manifestations of the culture shift in progress.

Professional advising was the most problematic point for us during the fall semester, although some of it was

inherent to the newness of our program and the complexity of our operation. The lack of uniformity of messages received by the students and the lack of coherence between the messages led to quite a bit of confusion, anxiety, and miscommunication. Much of this was resolved when we assigned one advisor to all of them.

The advising issue is temporary and will resolve itself naturally as we achieve our dedicated degree with a dedicated advisor. Refining the definition of mentoring was on our agenda for the January retreat.



## 5 The Degree

The Purdue Polytechnic Educational Research and Development team designed the Bachelor of Science in Transdisciplinary Studies in Technology to capture the values and aspirations of the project and also serve as a living permanent laboratory for research and development related to education. The new degree proposal embodies all the values.

### 5.1 Transdisciplinary

Professor Jeff Evans published a blog entry titled “What is Transdisciplinarity?” on the transdisciplinary characteristic of Purdue Polytech. An excerpt is included here:



#### Transdisciplinarity and the Purdue Polytechnic Institute

One of the core ideas of Purdue Polytech is to intentionally integrate knowledge acquisition and skill development into a more meaningful whole. Beginning learners will be immersed in group environments that promote the ideas of design thinking and project management, culture, and communication narratives that transcend many forms, including audiovisual. Besides learners being immersed in these group environments, faculty from these diverse fields will also be immersed in these environments. Discipline-specific skills can be acquired “just-in-time” from a faculty mentor (or mentors), and in the context of larger, real-world problems. This has at least two advantages:

- 1. Relevance:** The learner can identify with the skills needed to address open-ended problems, making them relevant, and
- 2. Timeliness:** The knowledge or skill is acquired when it is needed, not “in case” it is needed.

These two advantages help one to enhance his natural curiosity, promoting a characteristic that education calls “life-long learning.” Regardless of your preference, it is this characteristic that helps individuals be more adaptable and responsive to changes in the labor force over a lifetime.

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**What is Transdisciplinarity?**

[tech.purdue.edu/what-transd](http://tech.purdue.edu/what-transd)

## 5.2 Student-Driven, Faculty-Mentored

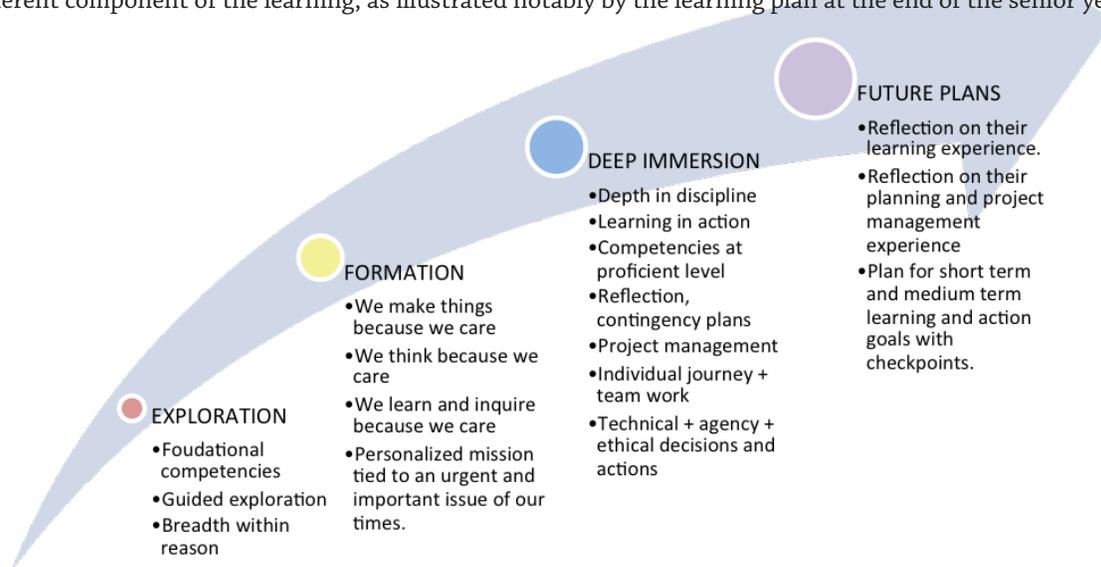
Another signature of the degree architecture is in the level of autonomy and control it provides the students. This is driven by theoretical and experiential research on human motivation, human learning, and the characteristics of incoming generations of learners.

One of our sources of inspiration for the degree architecture came from an educational event organized by the D-School at Stanford envisioning Stanford in 2025. In this event, the notion of mission over major was a predominant theme. This theme is also consistent with many employers' surveys, notably the AAUC 2013 survey (Association of American Colleges and Universities and Hart Research Associates, 2013) where it was emphasized that cross cutting capacities were much more important than the specific major for the vast majority of employers.

## 5.3 Implementation

Students in this degree gain depth and mastery in at least two different fields of study, one of which must be technology.

Students are guided in the process by their own passions and by their faculty mentors and their advisor to ensure a successful and coherent path. The plan of learning reflecting students' chosen direction is determined after their first semester. The plan is reviewed and revised on a regular basis to reflect their progress and findings. Planning and reflection are an inherent component of the learning, as illustrated notably by the learning plan at the end of the senior year.



## 5.4 The Approval Process

The degree underwent positive reviews by the College Curriculum Committee and was approved by the College's faculty Senate on December 10, 2014.

It will now be forwarded for approval by the Office of the Provost, the President, and the Board of Trustees (BoT). We are targeting the BoT meeting of February. The next step is Indiana Commission of Higher Education (ICHE) and the Higher Commission of Learning (HCL), our regional accreditation body. Copies of the proposal have already been shared with ICHE members for their initial feedback.

## 6 Living and Breathing the Institutional Transformation

### 6.1 Our Partners

The talent and passion from the College of Technology that have been invested in this have been overwhelming. This leadership role in breaking new grounds and blazing new paths is a natural fit for the College. It fits its history and mission. Most of all, the wealth in expertise, dedication, and can-do attitude on the part of the faculty is unique. The pioneering faculty fellows have a very strong sense of mission.

At the same time, the enthusiasm around the Purdue campus has been tremendous. We continue to be contacted on a regular basis by faculty and leaders from other units who would like to be part of this.

The College of Liberal Arts has a significant presence with a department head (Communication), program director (American Studies) and five additional faculty: one from English, one from Communication, one from Visual and Performing Arts, and two from History. Purdue Libraries is participating with two faculty members; Education has one; Science (Physics) has one; Engineering Education has a faculty affiliate.

The Office of the President, the Office of the Provost, Enrollment Management, the Registrar, ITaP, and the Open Passport team have opened many doors for us and continue to work very hard at making this project succeed.

The Center for Instructional Excellence and the Discovery Learning Research Center have been instrumental partners as well. They opened their doors and are collaborating with us on various research aspects of this project.

This effort is also attracting a high level of support from outside Purdue.

We were contacted by ASEE and invited to submit a short feature article about this degree to include in their ASEE annual report to come out this month.

Fatma Mili is member of the ABET Academic Advisory Council. Competency-based education is one of the items brought by the AAC to the ABET leadership.

The Competency-Based Education Network (C-BEN) invited us (Purdue University) to apply to become a member of the second cohort. The first cohort, selected in 2014, includes 18 institutions and two public systems serving 42 campuses. The members take part in a research-and-development phase, funded by Lumina Foundation, to provide an evidence-based approach to advancing high-quality competency-based education capable of serving many more students of all backgrounds.

The Purdue Polytechnic Advisory Board includes some of the most prominent educational innovators. They have been actively engaged with us in the process and were among the writers of letters of support.

There is increasing awareness of the need for accreditation agencies to update their processes to adequately handle CBE programs. See [goo.gl/h2E8Pv](http://goo.gl/h2E8Pv) in *Inside Higher Ed*, for example, which mentions among other things the active role that The Competency-Based Education Network might play.

The U.S. Department of Education has created the Experimental Sites Initiative. This allows selected universities to use federal financial aid for competency-based programs of study while collecting research data to help improve the process and fine-tune the regulations associated with Financial Aid. Purdue University has submitted an application to be part of the next round. We have not heard back yet.

### 6.2 Our Unique Opportunities

The Purdue Polytechnic Institute is similar to a growing number of educational innovation initiatives (e.g. iFoundry at UIUC, SUSTAIN at Cal Poly) but is in a unique

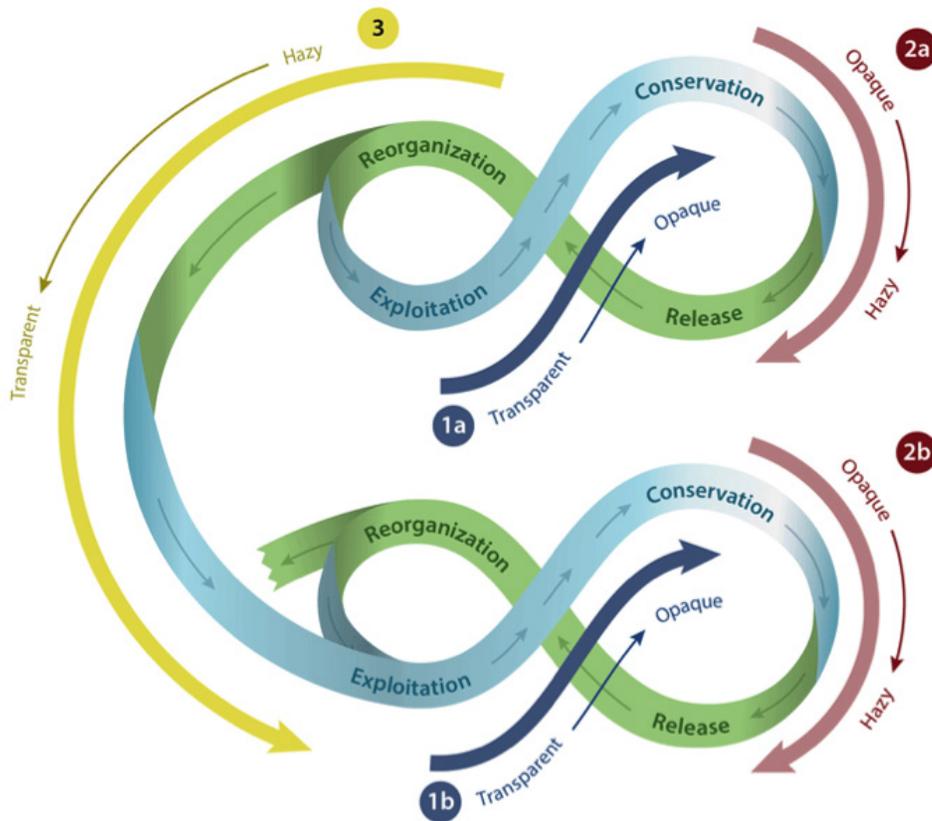
position in terms of the level of support it has from all levels of the Purdue administration, especially from the President and the Provost.

### 6.3 Our Remaining Challenges

Researchers in the social sciences focusing on institutional transformation describe the natural cycle that ecosystems undergo as they grow (1.a), get disrupted by natural or human-made phenomena (1.b). Disruptions lead to a temporary release of resources which enables the generation of new ideas and new forms of organization. Resilient systems have the capacity to quickly recapture these resources and reincorporate them in the existing system, further strengthening the status quo and growth. Under the right conditions, the released resources can be reorganized to exploit and materialize new ideas and new orders. This is when transformations happen. This is represented in the figure below taken from (Westley, et al., 2013).

Dorado (Dorado, 2005) describes the ideal conditions that promote transformation over resilient conservation: transparency. An Opportunity Transparent environment is characterized by two aspects: a) a moderate level of institutionalization to provide structure and stability, but not too high to the point of stifling innovation, and b) multiplicity of institutional referents, i.e. actors who are exposed to a variety of institutions or institutional structures and organizations.

While we are progressing in increasing the transparency of the system, most of our challenges stem from an occasional excess of institutionalization and a low multiplicity. In terms of administrative structures and resources, the Purdue Polytechnic Institute brought significant additional resources to the College – but for these resources to be attached to innovation, new organizational structures need to be in place to facilitate innovation and remove some of the barriers. We are in the process of creating a unit to serve that purpose.



## 7 Statewide

The efforts of the Purdue Polytechnic Institute span the whole college with its West Lafayette campus and statewide locations. Some of the discussions, design decisions, and resources were fully shared; others were conducted in parallel.

The South Bend campus modified their first-year program by integrating MET, ECET, and ET students' projects. The New Albany faculty designed an integrated senior project involving students from all the disciplines involved.



## 8 Diffusion in the College



### 8.1 First-Year Experience Team

In order to support the diffusion of the transformation, departments identified two faculty members per program to participate in the redesign and delivery of the freshman year. This group started in the fall with discussion meetings and participation to some events in DLR. The goal is to gain familiarity with the experience in the Incubator, learn from it, and adapt and scale to the college.

### 8.2 Competency Task Force

The Transdisciplinary Studies degree proposal won the CBE challenge set forth by Mitch Daniels in January 2014, and we are receiving infrastructural support from all offices in the university administration. Key to this effort, though, is the definition and delivery of the competencies.

A task force consisting of faculty from key disciplines is being finalized and will be undertaking the work of defining competencies related to existing courses. This will, among other things, create a database of equivalencies between traditional courses and competencies.

## 9 National Exposure

In addition to diffusing within the College of Technology and collaborating with other colleges at Purdue, we reached out to several educational innovators to be exposed to national leaders and to gain from their experience. Our guests included the following people:



**Tony Wagner**

Expert in Residence at the Harvard University Innovation Lab  
*March 6-7, 2014*



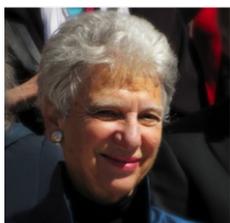
**Roger Burton**

Institutional Transformation Consultant  
*March 13-14 and November 24-25, 2014*



**Jonathan Stolk, with Rob Martello and Mark Somerville**

Pioneering Faculty and Educational Researchers, Olin College  
*Three visits, including one via video conference*



**Elizabeth Coleman**

President Emeritus and educational reformer, Bennington College  
*October 1, 2014*

## 10 Our Hopes and Ambitions for 2015

// Like an empty Moleskine notebook, the possibilities are exciting. Why not exceed them?

*Seth Godin*

I am extremely proud of the work that the faculty fellows have been able to accomplish in 2014 and am humbled by their passion and dedication to this common goal. At the same time, the work undertaken so far has allowed us to discover many potential paths to take in this common exploration of the potentials and challenges of education in the 21st century.

### 10.1 Educational R&D Mission

We are looking forward to starting the new degree and providing the students the temporal and intellectual space to explore, create, and discover a guiding mission for their education.

This space will allow us to deliver the newly developed curriculum while we continue to learn, and evolve the learning contents, materials, and processes. This is meant to be a continuous process of testing hypotheses, collecting data, and fine tuning both the theory and the way in which we put it to practice.

A large portion of the January 2015 retreat agenda was devoted to deepening the design of the new degree, especially in light of the experience of the fall. Our experience also brought to light a number of areas to explore. Some will be explored this year; others constitute a longer-term endeavor. These include the following topics:

- The balancing between student's autonomy and need for scaffolding to transition from highly prescriptive K-12 towards a more autonomous learning environment.
- The exploration of processes and tools that can support the student and faculty in the growth of the student's autonomy and time management.
- The process of developing the competencies brings up a number of interesting design problems that will require an iterative design involving many stakeholders.
- Identifying the right balance between cross-cutting



capacities and deep immersion in specific disciplines.

- Managing competencies in a time-based system (semesters and academic year) so as to remain faithful to the spirit of CBE while navigating administrative regulations.
- Distinguishing between formative assessments; helping the students to gain competence through constructive feedback, peer review, and self-reflection; from summative assessment, the granting of the competence. The two types of assessments are conflated in the traditional grade-based system. CBE gives us the opportunity to distinguish clearly and use different resources and processes for each.
- Identify/discover what a natural progression is for students in a CBE system so that we balance between personalized learning and student autonomy on the one hand and the ability to advise students and help them progress as best as they can.
- The new curriculum and new role for the faculty require faculty development that may otherwise be different from their needs. We need to understand the nature of this development and begin to identify resources and make them available.
- Instilling risk-taking and innovation. In the long run, we dream of creating an environment where students who enter the program with a stark fear of failure will learn to risk and to fail, absorbing and learning from the failures and being formed and changed in the process. We look forward to gaining a

firmer connection between elements in the curriculum and the graduates sense of venture.

- Curriculum, Delivery, and Equity. Our ambition is to draw applications from a sizable number of interested women and minority candidates, and we will select as many of these students as we can to provide them with a rich learning environment and to benefit from the diversity they bring. We see this as a design problem first and foremost. The relationship between elements in our design and the extent to which they meet the needs and aspirations of a diversity of students is of prime interest.

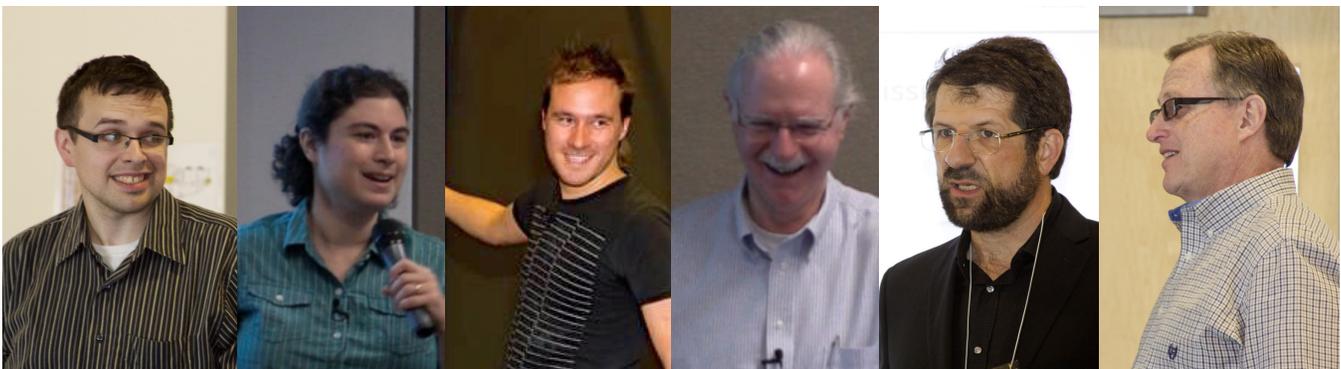
## 10.2 Research Agenda and Mission

Along with the charter, in 2014 we also defined a research agenda that reflected the vision and our state of progress at that time. At the January 2015 retreat, we revisited the research agenda and refreshed it, encompassing all the points listed in section 10.1.

### 10.2.1 Research Agenda

In addition to the research topics related directly to students learning, we are interested in the broader issues of educational and institutional transformation and the interdependence between all processes in academia and beyond. Among research topics of interest we mention:

- The role of governance in the effective design and implementation of an educational laboratory with a



short cycle of iterative changes.

- Institutional transformation in academia. There is extensive research in the challenges and opportunities in natural and social systems. Academia is notoriously resilient and conservative. The understanding and sharing of insights and lessons learned by us and others is of particular interest.
- As an instance of the problem above, we are interested in continuing the process of strengthening and growing the community of support to the Purdue Polytechnic Institute within the College of Technology and beyond. Several methods of integration and diffusion are currently in process.

### 10.2.2 Dissemination, Publications

In the past year, the faculty fellows have produced close to 30 publications and submissions. This is in addition to a number of blogs and white papers to which different fellows contributed.

We see the dissemination as a collective responsibility with collective credit. We strongly believe that teaching and learning are deserving of our highest form of scholarship and therefore must be given the resources to be visible and successful. During the fall semester significant amounts of data and insights were collected. Much of this data was collected by faculty who were too occupied in the classrooms to find the time to process it all. We are hoping that the spring semester will provide these same faculty members with the bandwidth to capture much of what they have learned.

At the same time, we will be putting efforts together to seek funding from federal agencies and foundations in 2015. See the appendix for a complete listing.

### 10.3 Partnerships with K-12

There are several K-12 institutions that are driven by common or overlapping philosophies and motivations. While we believe that the approach adopted by the Purdue Polytechnic broadens our appeal to a broader student profile, it is also critical to partner with high schools where students are already used to this approach. Some of the schools identified so far are Warren Central High School, Indianapolis; Weidner School of Inquiry at Plymouth High School, Plymouth; and Beacon Academy, Indianapolis.

### 10.4 Partnerships with Employers

One of the three driving motivators for the Purdue Polytechnic effort is the need to better align with the skills needed by our graduates for the 21st century (Wagner, 2010) and the fact that unless we deliberately focus on these skills, students are not making sufficient progress in them during their school years (Arum, 2010). Similarly, the concept of competencies and their use in hiring and promotion is familiar in industry and in many professional organizations. This being said, we need to make a deliberate effort to engage industry more actively and more intensely in design of the curriculum, as well as in the formulation of the competencies and their presentation in the transcripts. Overall, we need to build a strong partnership with current and future employers of our students.

## 11 Summary

2014 was a very busy and exciting year thanks to all who envisioned, supported, and worked very hard to make it a reality. We built very strong relationships and developed solid foundations, and we realize that we still have a lot of work ahead of us. We look forward to continuing the work next year by strengthening what we built and growing its reach and scope.



*A vegetable grows in one of the “garden in a box” student projects during Fall 2014*

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## THIS REPORT IS AVAILABLE ONLINE:

[tech.purdue.edu/incubator/report2014](http://tech.purdue.edu/incubator/report2014)

## Appendix

### Papers and Presentations

1. Evans, J.\*, Exter, M., & Lukasik, C. (2014, June). *Transdisciplinary Collaboration: Perspectives of Faculty Stakeholders*. Presented at the Polytech Summit 2014.
2. Exter, M. E.\*, Dionne, R.\*, Lukasik, C. (2014, July). *Design of a Learner-centered Seminar-/Studio-based Polytechnic Institute*. Presented at the AECT Summer Research Symposia, Jacksonville, FL.
3. Exter, M., *Integrating Cognitive Science with Innovative Teaching in STEM Disciplines*. CIRCLE Conference, September 2014.
4. Mili, F., Alter, K., Herrick, R., Frooninckx, T., Bertoline, G., *T-shaped support for T-shaped Professionals*. Institutional Transformation for STEM Education, October 2014.
5. Herrick, R., Mili, F., *Our Big Move in 1000 Steps*. Institutional Transformation for STEM Education, October 2014.
6. Dionne, R., Newport, S., Round table discussion on space design, active learning, and growth mindset. Lilly Conference on Teaching and Learning in Traverse City, Michigan, 2014.
7. Dionne, R., *Can the Studio/Spiral Model of Technology Training for Theatre Inform Undergraduate STEM Education* at the Transforming Institutions: 21st Century Undergraduate STEM Education Conference, 2014.
8. Dionne, R. (in review). Panel chair for presentation on studio instruction in theatre technology and STEM education. United States Institute for Theatre Technology (USITT) national conference 2016.
9. Dionne, R., *Problem-based learning in Theatre Technology*, USITT national conference in 2015.
10. Exter, M., Dionne, R., *Increasing STEM Student Success in Higher Education*. PKAL-Ohio Spring 2015 conference.
11. Fosmire, M., Van Epps, A., and Mili, F., *New Challenges and New Opportunities: Competency-based Education and the Libraries*, submitted to the International Library Conference
12. Ashby, I., Exter, M., Matei, S., and Evans, J. (in press). *Lifelong learning starts at school. Competencies and badge system case study at the Purdue Polytechnic Institute*. In Muilenburg, L. & Berge, Z. (Eds). *Digital Badges in Education: Trends, Issues, and Cases*. New York, NY: Routledge
13. Exter, M\*, Dionne, R\*. & Lukasik, C. (in press). *Design of a Learner-centered Seminar-/Studio-based Polytechnic Institute*. In Hokanson, B., Clinton, G., & Tracey, M. (Eds.) *The Design of Learning Experience: the future of educational technology*. New York: Springer-Verlag.
14. Leach, S., Piller, J., and Perusich, K. *Innovative Interdisciplinary First-year Course for Engineering Technology*. ASEE National Conference. June 14-17, 2015, Seattle, WA.
15. Ashby, I., Exter, M. (submitted). "What's in it for me?" A look into first-year students' perceptions of a digital badge system. ASEE National Conference. June 14-17, 2015, Seattle, WA.
16. El Debs, L., Shaurette, M., Dionne, R., Exter, M. (under review). *Problem-solving in a multidisciplinary environment: observations from a newly developed program*. ASEE National Conference. June 14-17, 2015, Seattle, WA.
17. Exter, M. E., Ashby, I., Shaurette, M. (under review). *Entering the first year of a multidisciplinary, hands-on, competency-based learning experience: Hopes and concerns of students, parents, and faculty*. ASEE National Conference. June 14-17, 2015, Seattle, WA.
18. Ashby, I., Caskurly, S., Exter, M. (under review). *Millennials in the Driver's Seat: Preparedness for and Progress in a Discovery Learning Environment. Why students choose to join and leave a new transdisciplinary, competency-based degree program*. Submitted to the Association for Educational Communications and Technology annual conference.
19. El Debs, L., Miller, K., Exter, M. (under review). *A student's perspective on different teaching methods*. Submitted to the Association for Educational Communications and Technology annual conference.
20. Exter, M., Shaurette, M., Dionne, R., Evans, J. (under review). *Program evaluation challenges for a new transdisciplinary degree program with an exploratory curriculum plan*. Submitted to the Association for Educational Communications and Technology annual conference.
21. Exter, M., Askby, I., Caskurly, S. (under review). *Why students choose to join and leave a new transdisciplinary, competency-based degree program*. ASEE National Conference. June 14-17, 2015, Seattle, WA.
22. Fosmire, M., A.S. Van Epps, and F. Mili (2015, accepted). *New Challenges and New Opportunities: Competency-Based Education and the Libraries*. In Proceedings of the 36th Annual IATUL Conference, July 5-9, 2015. Hanover, Germany.
23. Fosmire, M., A.S. Van Epps, and N. Johnson (accepted). *Badging your way to information literacy*. In Proceedings of the ASEE National Conference. June 14-17, 2015, Seattle, WA.
24. Evans, J.J, Van Epps, A.S., Smith, M.T., Matei, S., and Garcia, E., (accepted). *A Transdisciplinary Approach for Developing Effective Communication Skills in a First Year STEM Seminar*. June 14-17, 2015, Seattle, WA.
25. Evans, J.J, Van Epps, A.S., Fosmire, M., Smith, M.T., Matei, S., and Garcia, E., (submitted). *An Assessment Architecture for Competency-Based Learning: Version 1.0*, *Frontiers in Education* 2015
26. Evans J.J. (submitted). *Competency-based Introductory Computer Programming*, *Frontiers in Education* 2015.
27. Garcia, E., Exter, M., (submitted). *Teaching digital imaging in collaborative and flipped classrooms*, HASTAC 2015.
28. Garcia, E., Connolly, P., Hassan, R., Bertoline, G., *Transforming a Computer Graphics Department from Traditional Education Methods to a Polytechnic Approach*. ASEE Annual Conference 2015.

### Grant Proposals

1. Fosmire, M.J., Douglas, K.A., Pilotte, M., Purzer, S., Van Epps, A.S.. (2015, submitted). *Information-Rich Engineering Design to Promote Innovation and Lifelong Learning*. NSF IUOE proposal.
2. Shaurette, M., Exter, M., Dionne, R., Huston, D., *Exploratory Research to Develop and Evaluate Procedures and Protocols for Assessing Design Thinking Competencies in an Experimental Transdisciplinary Undergraduate Program*. NSF HER Core Research proposal.