

Purdue University North Central

Attracting New Students to STEM Careers

White Paper

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Resources for input to the group:

- University Forum, STEM Blog, Email responses, Group meetings, Classroom discussions
- Chronicle of Higher Education
 - Share of Students in the Sciences Shrinks
 - Report Urges Improvements in Teaching of Science
- Congressional Report –
 - STEM Education Issues and Legislative Options
- National Science Board –
 - Science and Engineering Indicators, 2008
 - National Action Plan, STEM Education System
- Kellogg Commission report (NASULGC) –
 - Renewing the Covenant – Learning, Discovery, and Engagement in a New Age and Different World
- National Academy of Science, National Academy of Engineering, Institute of Medicine –
 - Rising Above The Gathering Storm: Energizing and Employing America for a Brighter Economic Future
- State of Indiana –
 - P – 16 Plan for Improving Student Achievement (PowerPoint)
 - P – 16 Plan for Improving Student Achievement (Phase I report)
 - Preparing All Indiana Students for the 21st Century
 - ICHE – College Portrait
- Morrill Land Grant Act
- Talking Points paper

Objectives:

1. Sustainability
2. Develop programs to communicate better with primary and secondary educators, high school counselors, and potential students
3. Better inform PNC counselors, advisors and STEM faculty on STEM issues

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4. Retention
5. Collaboration with Education department
6. Engage community schools, leaders, and others

Assessment Tools:

Track enrollments and SCH in STEM areas

Track yield rate (percentage of students enrolling in STEM areas at PNC versus percentage of students accepted in these programs)

One conclusion that can be drawn from the yield rate is the number of students that do not attend this university.

Track annual visits to regional schools

Track STEM retention

Retention will be measured as: 1) Transferring students; 2) Students that left the university; and 3) Students remaining with PNC but transfer to another program.

Track the major the student chooses after leaving a STEM major

This will be accomplished by 1) Annual meeting with PNC counselors; 2) Feedback from current STEM students; and 3) Feedback from students leaving a STEM major

Tracking student attitude and note changing trends

Two surveys will be given to STEM students. Entering STEM students will be asked why they chose PNC and why they choose a STEM program. Exit interviews with graduating students (or transferring students for two – year program) to track changing perspectives from the freshman year to graduation.

Exit interviews with graduating students (or transferring students for two – year programs)

Key Recommendations:

- Establish a permanent STEM committee, its charge (Charter), and the process for membership with a working document of STEM issues and opportunities
- Review current STEM offerings and identify areas that should add new BS degree programs
- Provide a critical review of current STEM program resource needs and develop procedures to increase support where needed
- Review opportunities with local school systems and set priorities on actions to be taken
- Focus on diversity enrollment opportunities
- Meet with PNC counselors and Enrollment Management to form a partnership to meet the needs of STEM objectives
- Work with PNC counselors and Marketing to establish STEM web and blog sites
- Provide a careful analysis of individual students and prepare a customized freshmen curriculum when needed
- Start a mid-semester required appointment schedule for each student each semester with the counselor/advisor
- Begin a formal partnership between all of the STEM programs and the Education department
- Develop a plan to engage local school systems
- Determine and assess current efforts of PNC faculty and staff with the regional school systems

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- Enlist local businesses and community leaders to promote PNC and the importance of STEM careers and career preparation, add some of them to the committee as advisors and activists
- Investigate starting a STEM Career night for parents and children interested in these areas with questions about the possibilities, responsibilities, and preparation for such a career

- **Premise:**

National and regional competitiveness in science and technology depend on attracting more students to STEM careers. Several STEM disciplines have experienced declines in student enrollment and graduates. It is essential to develop programs and initiatives to encourage young students (K-6) to stay interested in science and mathematics and develop interests in engineering and technology. The interest in STEM careers needs to follow through high school. PNC will take the lead in the region to assist school systems, enhance PNC’s reputation, increase enrollments of STEM students at PNC, and provide graduates for businesses and communities.

Objective #1: Sustainability

Sustainable programs (both academic and administrative) need to be established. Short term programs (i.e. 1-year programs) will not lead to the results expected from the strategic planning process. Research has shown that the lack of interest in STEM fields begins very early in a student’s educational career. Simply targeting young students (K-6) or high school students will not lead to the attraction and retention of students in STEM fields.

Strategies:

- Establish the STEM working committee as a permanent university committee reporting to the VCAA
- Develop programs with a permanent home at PNC such that changes in administrative personnel will not alter the function or mission of the STEM working committee.
- The STEM working committee will meet four times a year, twice a semester to review current efforts, establish a time table for the semester to evaluate metrics and action items (see below)
- A report on the state of the STEM efforts from the STEM working committee will be provided to PNC through the VCAA
- Work with faculty, administrators, and community leaders to develop additional STEM degree programs at PNC
- Support and strengthen existing STEM programs

Action Items:

- Work with the VCAA and Steering Committee to establish a process for committee membership
- Develop STEM committee in accordance with the membership procedures

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- Contact key constituents and begin the process of sustainability
- STEM faculty will consider areas where STEM degree programs should be added
- Evaluate current STEM programs and make sure needed resources are available for a successful academic program

Key Recommendations:

Refer to page 2 of this paper

Objective #2: Develop programs to communicate better with primary and secondary educators, high school counselors, and potential students

Although STEM disciplines are grouped because of their shared reliance on mathematics and other hard sciences, there are differences in these disciplines. There are local, regional, national and international opportunities for recent graduates from STEM disciplines. It is critical to communicate the opportunities to the community.

Strategies:

- Each STEM program has different issues from the others. Work with STEM faculty to identify the needs and issues with each discipline.
- Use national data to determine job opportunities for each discipline. Obtain salary data and national and regional demand for each discipline
- Provide a clear statement as to opportunities for success (only a few percent of biology majors will be accepted into medical school)
- Provide career options (such as compatible minors) that can lead to additional job opportunities, and direct counseling for paths leading to the desired occupation
- Provide annual advising to current students on their progress, PNC expectations, and career counseling
- Target high school counselors for providing information about each discipline including the opportunities at PNC
- Provide a realistic picture of career opportunities and educational requirements in a manner that can be readily communicated to high school counselors, students, and parents
- Provide workshops for high school teachers in the STEM fields
- Encourage and expand dual credit courses that are STEM related
- Create engineering and technology courses for high schools
- Continue and expand summer offerings with the Michigan City Area Schools (MCAS) for all grade levels
- Expand the lego experience to train teachers to bring the sets into their classrooms during the academic year to reach a broader audience than the summer programs
- Provide specific encouragement for girls and minorities in K-12, and especially K-6
- Work with the PNC Marketing department to focus on STEM issues and how to best communicate opportunities to the community
- Greatly increase efforts to raise private funding for scholarships and the Chancellor’s College Bound program
- Work with the school system to create STEM Clubs
- Learn what excites students about STM disciplines and train local K-12 teachers to be empowered to create and nurture such excitement in the classroom
- Set up web sites and blogs specifically directed at STEM issues and opportunities

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- Work with high school teachers and students, as well as incoming freshmen, to learn which ways high school students communicate (web sites, blogs, MySpace, etc.) and focus on these areas
- Work with Enrollment Management (EM) to help recruit new students in STEM areas and learn from their EM knowledge
- Work with PNC counselors (next objective)

Action Items:

- Create working document of STEM issues and opportunities
- Review opportunities with local school systems and set priorities on actions to be taken
- Focus on diversity enrollment opportunities
- Make sure STEM is well represented at Career Fairs

Key Recommendations:

Refer to page 2 of this paper

Objective #3: Better inform PNC counselors, advisors and STEM faculty on STEM issues

The PNC counselors and advisors represent the front line of introduction to the university for many students and their families. Faculty are also important advisors, especially after the freshman year. These groups must be provided with much of the same information as the high school counselors.

Strategies:

- Provide all advisors with the latest data associated with the STEM disciplines with special emphasis on PNC’s goals for changing current trends
- Provide advisors the career options and job opportunity information made available for the high school counselors
- Design and implement a two hour workshop for counselors that will disseminate PNC’s current strategies and goals. This workshop will be given as part of the pre-fall semester workshops
- Work with deans to provide time for STEM committee members to speak with faculty at the first of semester department meetings
- Work with counselors to develop a plan for meeting with high school counselors and communicating STEM issues
- Encourage counselors to help develop and maintain the STEM web page material and blogs
- Work with the counselors to set up high school visits to STEM related classrooms
- Create a public relations campaign that will inform high school teachers of these initiatives and goals
- Seek advice from the counselors as to the best ways to increase STEM programs

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- Identify STEM areas that are in most need of increasing women and minority participation and develop an action plan to improve the situation

Action Items:

- Meet with PNC counselors and EM to form a partnership to meet the needs of STEM objectives
- Create a working document (notebook) specifically for PNC counselors/advisors
- Work with PNC counselors and Marketing department to establish STEM web and blog sites
- Make the diversity plan a priority

Key Recommendations:

Refer to page 2 of this paper

Objective #4: Retention

Attracting students to STEM programs at PNC is only part of the job. Efforts must be taken to ensure retention, success and graduation. Success is also reached when a student is accepted to another four-year program at another university that meets their goal needs.

Strategies:

- Every STEM student successfully admitted to a program should receive appropriate attention, guidance, and information to ensure success. This requires that the full picture of students is understood. This allows advisors, faculty, and the student to identify and address challenges in a timely manner. In addition, advisors and faculty can identify opportunities that will improve a student’s employability or acceptance to higher degree programs.
- The “gate keeping” course (courses that normally cause the greatest problems for new students) for each discipline must be defined for the freshmen and sophomore year
- Preparation for the gate keeping courses must be emphasized and a starting curriculum based on the needs for the proper preparation designed for each student
- Develop freshmen bridge courses
- Design freshmen and sophomore courses with proactive features, provide opportunities to evaluate individual students to determine their individual challenges and provide one-on-one assistance. These pro-active efforts must be integrated into the for-credit part of the course because at risk students do not take advantage of opportunities on their own.
- Tutoring opportunities are important and should be expanded, with the understanding that at risk students typically do not take advantage of these opportunities
- Additional opportunities such as internships and research experiences should be encouraged to provide real-world experience
- Encourage even freshmen and sophomore students to attend career fairs to develop an appreciation of the diversity of STEM careers

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- Mid-year appointments with students and advisor/counselor will be encouraged for each semester of the freshmen and sophomore year
- Advisors will use the mid-semester evaluations of student progress to evaluate current progress and plan course corrections for the next semester and/or provide students with information about assistance with a problem course
- Assess current freshman and sophomore retention rates in STEM fields. Compare these retention rates to those of similar institutions of higher education. Set targets for future freshman and sophomore retention rates. Evaluate retention rates at the end of each semester both years.
- Contact students that have left a program with a questionnaire or exit interview, to determine their reasons for leaving
- Improve the course evaluation process for each course, provide specific questions for the course in addition to the standard questions, include a next-semester course evaluation when students have a better feeling for whether the previous course met their needs

Action Items:

- Provide a careful analysis of individual students and prepare a customized freshmen curriculum when needed
- Identify “gate keeping” courses in each curriculum
- Design bridge courses for the freshmen year
- Add significant proactive features in bridge and “gate keeping” courses
- Establish a continuous improvement program for bridge and “gate keeping” courses that includes better course evaluations
- Start a mid-semester required appointment schedule for each student

Key Recommendations:

Refer to page 2 of this paper

Objective #5: Collaboration with Education department

Recruiting more students from high school to PNC will increase the university’s “share of the pie”, but it will not increase the “size of the pie”. Retention plays a role in increasing the total numbers, but the real long-term difference can only come from working with elementary schools and teachers to increase awareness about STEM opportunities and to provide training and resources for them to create and maintain interest with students. The K-6 education area also provides an additional opportunity to broaden the participation of women and minorities in STEM careers.

Strategies:

- Develop a partnership between STEM programs and the Education department at PNC by including Education faculty on the STEM committee
- STEM faculty and Education faculty should collaborate on a Transition to Teaching program

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- Develop courses in the STEM disciplines for education majors that provide basic modules that can be used in the classroom to interest and stimulate students in STEM fields
- Work with counselors, Education department faculty, and school systems to develop a plan to visit classrooms and to provide special teacher preparation programs related to STEM fields
- Work with regional schools to establish STEM Clubs in elementary, and middle schools
- Provide workshops for regional school teachers on specific topics such as Legos and how to use kits that are readily available
- Meet with school systems to learn about their specific needs and interests
- Continue and expand the collaboration with the Gifted and Talented Student (G&T) program in MCAS
- Identify other school districts that do not use PNC as a resource and begin to forge relationships to encourage collaborative efforts
- Work with the Education department to ensure that the implementation of the science and math courses for Elementary and Early Childhood Education majors do reflect the content and pedagogical knowledge to teach those areas to all children
- Offer on-site refresher workshops for elementary teachers in science technology, engineering, and mathematics
- Work with Education department faculty and regional teacher groups to learn what works and what does not work with younger children
- Use local schools to “test drive” ideas and basic modules, maybe the student teachers can play a role in this effort
- Encourage all STEM faculty to think about how their discipline can be translate into age appropriate projects for K-12 students
- Keep the STEM committee apprised of changes in student interests in STEM disciplines
- Monitor the efforts and success of these programs
- Engage the community to assist in getting the message out about the importance of STEM education in the elementary schools and the need for resources

Action Items:

- Begin a dialogue between STEM programs and the Education department with the ultimate goal of formal partnerships between these groups
- Develop a plan to engage local school systems
- Assess STEM faculty interest in the areas needed to meet the strategies of this objective
- Determine the resources necessary to perform the actions listed in the strategies section
- Determine and assess current efforts of PNC faculty and staff with the regional school systems

Key Recommendations:

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Objective #6: Engage community schools, leaders, and others

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For these efforts to succeed, PNC will need to form a partnership with area community leaders, area schools, parents, and students. Increasing interest in STEM careers will require the efforts of all of these community members

Strategies:

- Establish a School Mentor program where a STEM faculty member is assigned to a school and maintains a continuous relationship with the faculty, administration, and student body
- Work with the Development Office to search for funding opportunities to fund new programs
- Become more active in Project Lead the Way programs
- Visit local companies to determine how many are engaged in the local schools and develop collaborations with them
- Take a lead role in bringing more school special programs to the PNC campus (such as the G&T program at MCAS)
- Encourage local businesses and community leaders need to promote PNC and the importance of STEM careers and career preparation
- Create a STEM Career night for parents and children interested in these areas. Provide a forum to discuss the questions about the possibilities, responsibilities, and preparation for such a career should be developed
- Add community leaders to the committee as advisors and activists

Action Items:

- Enlist local businesses and community leaders to promote PNC and the importance of STEM careers and career preparation, include these leaders on the STEM committee
- Investigate the possibility of starting a STEM Career night for parents and children interested in these areas and with questions about the possibilities, responsibilities, and preparation for such a career

Key Recommendations:

Refer to page 2 of this paper