

# **Project PETE: Pathways to Engineering and Technology Education**

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## **Introduction**

This paper details a unique, funded, secondary/post-secondary partnership titled Project PETE: Pathways to Engineering and Technology Education. This partnership between the Indianapolis Public Schools (IPS) Career and Technology Center and the Purdue School of Engineering and Technology at Indiana University Purdue University Indianapolis (IUPUI) provides a variety of pathways for IPS students to attend the various post-secondary programs offered by the Purdue School of Engineering and Technology at IUPUI.

The Indiana Department of Workforce Development, through a competitive grant process, provided funding for Project PETE. The main focus of the grant was to increase academic achievement and therefore, prepare secondary students for admission to certificate and degree programs in engineering and technology offered at the postsecondary level. Underrepresented students within the IPS system were targeted and provided a variety of services in an effort to help them understand the urban mission of IUPUI, the engineering and engineering technology programs available to them at IUPUI and the rigorous academic preparation necessary to gain admission to the IUPUI School of Engineering and Technology

Minority and underrepresented IUPUI students were employed to academically tutor and personally mentor Project PETE students attending the IPS Career and Technology Center. Twenty-two IUPUI mentors were trained by IPS and IUPUI counselors and provided over 700 hours of academic tutoring and personal counseling to IPS Career and Technology Students. In addition, IPS and School of Engineering and Technology faculty partnered to articulate IPS secondary, technical courses with IUPUI courses in an effort to provide a type of “Technology Advanced Placement” opportunity for IPS students. Students who completed their program of study at the IPS Career and Technology center, and who meet admission requirements to the Purdue School of Engineering and Technology, had the opportunity to earn 15 credits toward their postsecondary degree in the area(s) of Mechanical Engineering Technology, Electrical and Computer Engineering Technology, Computer Information Technology, Construction Technology and Computer Graphics Technology. Project PETE made it possible for IPS students to graduate with core academic Advanced Placement credits, Technology Advanced Placement credits, an Indiana Academic Honors Diploma and/or a Certificate of Technical Achievement.

This paper describes in detail the grant proposal, project goals/objectives, sustainability, opportunity for replication and final outcomes for Project PETE: Pathways to Engineering and Technology Education. Finally, recommendations are made for post-secondary institutions wishing to provide similar outreach programs to high school students.

### **Efforts to Promote and Improve the K-12 Pipeline**

The United States Department of Labor projects six million new technology jobs by 2008, however the total number of Science, Technology, Engineering and Math (STEM) majors has been shrinking since the mid-1980's. The United States of America trails all industrialized nations in the percentage of Bachelors degrees in engineering and technology. In addition, women and minorities compose 47% of the total U.S. workforce and represent only 22% of workers in STEM fields<sup>1</sup>. In addition, US companies have spent nearly \$60 billion annually on training, much of which paid for worker training in basic math, science and language (reading, written and verbal) skills that should be mastered at the K-12 level<sup>2</sup>. To meet the needs of business and industry in the STEM fields, and to provide diverse graduates prepared for the global workforce, is a constant challenge for engineering and technology educators.

Clearly there is work to be done by Schools of Engineering and Technology in the areas of outreach, recruitment, retention, persistence and matriculation of America's best and brightest K-12 students, particularly women and minorities, who choose to become a part of the "feeder system" into STEM degree programs. According to Weese (2003) only 11.7 percent of baccalaureate engineering technology degrees were awarded to women, only 8.3 percent to African Americans, only 6.2 percent to Hispanics and only 6.1 percent to Asian Americans<sup>3</sup>. Engineering bachelor's degrees awarded were also dismal considering that only 20.4 percent were awarded to females, 14 percent were awarded to Asian Americans, 5.4 percent were awarded to Hispanics and 5.1 percent to African American<sup>3</sup>.

The low numbers of female and underrepresented students receiving baccalaureate engineering and engineering technology degrees are also represented in the make up of tenure and tenure track faculty within schools of engineering and engineering technology. According to a recent article in *Prism* magazine, a publication of the American Society of Engineering Education, women comprised 8.9 percent of tenure and tenure track faculty in engineering schools and the percentages of Hispanic and African American in the same category were 2.9 and 2.1 percent respectively<sup>4</sup>. The dearth of female and underrepresented faculty came as no surprise considering the low numbers of baccalaureate degrees awarded to these same groups. What is crucial is how post secondary educators will address this critical shortage. Kristina Johnson, Dean of Duke University's Pratt School of Engineering put is succinctly in her testimony to the US Congress in July of 2002 by saying, "What was once a moral obligation to promote diversity by providing equal opportunity for interesting, high-paying careers for all citizens ins now a national imperative. Simply put, unless we bring more women and minorities into science and engineering fields, we will not have the intellectual capital to

<sup>1</sup>“Proceedings of the 2005 American Society for Engineering Education Annual Conference & Exposition  
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address the major economic, environmental, health, and security issues facing our nation. Developing our underutilized human resources can be our competitive advantage<sup>4</sup>.”

What may be most revealing regarding the issue of importance and relevance of K-12 education in the post-secondary world is the lack of research into the area K-12 education, recruitment, retention and outreach. In a recent article by Wankat (2004) published in the Journal of Engineering Education (JEE), an analysis of articles and their content, reported sources of support, author information and citations analysis, there were zero articles with the key words “K-12 education” or “K-12 outreach.” The top three keywords in the ten-year analysis of the JEE from 1993 through 2003 were “teaching, computers and design.” According to Wankat, both the keyword and the citation analysis show that the content coverage of JEE is “very broad<sup>5</sup>.” Since engineering education is necessarily broad, this is considered healthy. The keywords reflect both current concerns (e.g. assessment and ABET) and continuing concerns (e.g. teaching and design). Thus, according to Wankat, “the journal appears to be publishing papers of concern to engineering educators<sup>5</sup>.” Clearly, in the past 10 years, as the lack of research on the issues of K-12 education reveals, K-12 issues are not even on the engineering educator’s “research radar zone.”

Recently, the American Society for Engineering Education (ASEE) has embarked on an ambitious effort to promote and improve K-12 engineering and engineering technology education. In the last three years the ASEE has created a new K-12 division dedicated to K-12 engineering education, created a guidebook for high school students called *Engineering, Go for It!* that was distributed to almost 350,000 secondary students, created an e newsletter that reaches 10,000 secondary teachers, guidance counselors, and outreach program leaders, and created a survey to understand what secondary teachers think of engineering as an academic and career pathway for their students. Finally, ASEE brought together leaders from industry and higher education along with K-12 teachers for a Leadership Workshop on K-12 Engineering Outreach, held just before the ASEE 2004 Annual Conference and Exposition in Salt Lake City, Utah. A recent paper detailing the results of that conference and delineating guidelines for how K-12 engineering education works best and defines key challenges confronting the field was recently published<sup>6</sup>.

Clearly, there is a movement by the engineering and engineering technology community to gain a better understanding of the K-12 issues that impact post-secondary institutions, and to generate research to answer the question of how stakeholders from many levels including K-12 teachers, university professors, industry, and government representatives can advance the state of engineering and engineering technology education. Coupled with the information from the aforementioned surveys, the ideas and suggestions from conference attendees and current research in the field of K-12 education, Dougless, Iversen and Kalyandurg (2004) have developed a set of six guidelines for improving K-12 engineering education and outreach<sup>6</sup>.

1. *Hands-on learning*: Make K-12 science curriculum less theory-based and more context-based, emphasizing the social good of engineering and demonstrating how it is relevant to the real world
2. *Interdisciplinary approach*: Add a technological component to all subjects and lessons, and implement writing guidelines in math and science courses
3. *Standards*: Involve engineering in K-12 lessons that map to state standards for math and science. Further, states should follow the Massachusetts and enact state standards for engineering
4. *Use/Improve K-12 Teachers*: Engage more K-12 teachers in outreach efforts and curriculum writing, and increase teacher salaries to attract the best technological minds to teaching
5. *Make Engineers “Cool”*: Outreach to urban schools and females more aggressively, and create more mentors and role models to attract these constituencies
6. *Partnerships*: Create better incentives for all groups to engage in K-12 outreach (especially higher education and industry)

According to Dougless, Iverson and Kaylendurg (2004) there is no magical list of recommendations to promote and enhance engineering education in the K-12 world, but these six guidelines emerge from current outreach efforts and seek to move them a step further, offering a broader base for improving the quality, methodology, and reach of K-12 engineering education<sup>6</sup>.

An outreach program recently funded by the Indiana Department of Workforce Development for one year through a competitive grant process, attempted to follow the aforementioned guidelines in a unique partnership with Indianapolis Public Schools. Minority and underrepresented students were targeted and the main focus of the grant was to improve academic performance thus preparing underrepresented secondary students for admission to certificate and degree programs

### **Project PETE: Pathways to Engineering and Technology Education**

Project PETE: Pathways To Engineering and Technology Education, is an ongoing partnership between the Indianapolis Public School System (IPS) Career and Technology Center and the Purdue School of Engineering and Technology (School of ET) at Indiana University Purdue University Indianapolis (IUPUI). As the name implies, this partnership provides pathways for IPS Career and Technology Center students to attend various degree and certificate programs within the School of ET at IUPUI. In keeping with the goals of this grant, our partnership improved the educational experience for youth involved by increasing academic achievement, developing skills for high-skill/high-wage/high-demand occupations and providing clear pathways to post-secondary transition.

In an effort to “mend the leaky pipeline” of underrepresented students choosing to major in engineering technology areas and provide clear, desirable pathways to post-secondary opportunities, the Purdue School of Engineering and Technology committed to the

formation of the aforementioned partnership. As the most comprehensive school at IUPUI, the school of ET has the largest number of students (nearly 2,500 for Fall semester 2003), a vast array of academic degree programs (13 certificate, 12 AS Degree Programs, 8 BS degree programs and 1 MS degree program) and 16 students organizations with nearly 35% participation from the student body. In addition, the school of ET has a diverse population with nearly 26% of our total student body classified as minorities.

The Indianapolis Public School System has been identified by the Secretary of Education as one of the 25 largest urban school districts in the country with over 40,000 students. Certainly, urban issues come with the territory of being Indiana's largest urban school district. According to a recent report in Education Week (1/24/01), IPS is known as "the leading drop out factory" of the nation<sup>7</sup>. Only 25% of all 10<sup>th</sup> grade IPS students pass the state-mandated Graduation Qualifying Exam (GQE) as opposed to the statewide average of 54%. The overall poverty rate for IPS, based on Federal Free and Reduced Lunch guidelines, is 70%. The minority rate for the five IPS secondary schools, Arlington, Arsenal Tech, Broad Ripple, Emmerich Manual and Northwest, is 70% and the English as a Second Language (ESL) population has grown over 300% in the past five years<sup>8</sup>.

The IPS Career and Technology Center serves students from five IPS high schools and Table I below delineates school risk factors for each sending school. Based on this data, 90% of the students involved in the Project PETE program are classified as At-Risk/WIA eligible. In addition, approximately 60% of students within IPS live in single parent households and over 33.6% of parents within the district have not completed a high school education. District data over the past three years shows that the mobility rate of students (enrollment, then exit or transfer to another school within the same school year) in the secondary schools is extremely high and increasing each year. IPS also has the highest youth homeless population in the state and all IPS schools reside in a Federal Empowerment Zone<sup>8</sup>.

**Table 1: School Risk Factors**

<b>Percent</b>					
<b>Risk Factor</b>	<b>Arlington 1,872 Students</b>	<b>Arsenal Tech 2,317 Students</b>	<b>Broad Ripple 1,573 Students</b>	<b>Emmerich Manual 1,358 Students</b>	<b>Northwest 1,714 Students</b>
Poverty Rates	65%	65%	61%	66%	64%
Special Ed. Students	13%	12%	8%	23%	10%
Attendance Rates	87%	88%	93%	88%	87%
Mobility	164%	56%	103%	73%	123%
<b>Number of Incidences</b>					
Number of Arrests	164	177	115	102	115

Tables II and III are clear indicators of the poor academic achievement at the secondary level for all IPS schools. Clearly, the readiness of many 9<sup>th</sup> and 10<sup>th</sup> grade students to engage in Advanced Placement (AP) or any rigorous academic courses which could serve as preparation for successful post-secondary and/or high/skill, high/wage, high/demand career opportunities is questionable<sup>8</sup>.

**Table 2**  
**Trends In Academic Achievement From 1999 to 2001**  
**Indianapolis Public Schools**

<b>Spring Grade 9 CTBS/5 Results</b>							
	<b>Average Reading and Math Scores (Mean NCEs)</b>						<b>Total Score Distribution</b>
	<b>1999</b>		<b>2000</b>		<b>2001</b>		<b>2001</b>
<u>School</u>	<u>Reading</u>	<u>Math</u>	<u>Reading</u>	<u>Math</u>	<u>Reading</u>	<u>Math</u>	<u>% At or Above National Average</u>
Arlington	42.4	41.7	43.3	42.6	44.5	44.8	37.6%
Arsenal Tech	43.4	43.7	45.7	47.7	46.7	48.2	46.9%
Broad Ripple	48.3	44.4	49.7	47.6	49.9	49.4	51.0%
Emmerich Manual	40.2	38.5	43.7	42.4	44.5	42.4	37.8%
Northwest	41.4	40.5	44.7	42.9	43.3	43.4	38.5%

**Table 3**  
**Fall, 10<sup>th</sup> Grade I-STEP Scores**

	<b>Average Reading and Math Scores (Mean NCEs)</b>						<b>% of Students At or Above State Standards</b>		
	<b>1999</b>		<b>2000</b>		<b>2001</b>		<b>2001</b>		
<u>School</u>	<u>Reading</u>	<u>Math</u>	<u>Reading</u>	<u>Math</u>	<u>Reading</u>	<u>Math</u>	<u>Language Arts</u>	<u>Math</u>	<u>LA &amp; Math</u>
Arlington	43.2	50.8	37.9	48.3	37.9	48.3	36%	32%	23%
Arsenal Tech	42.8	50.9	40.6	50.3	41.6	53.5	36%	35%	27%
Broad Ripple	46.6	50.4	43.6	49.7	41.2	48.7	38%	31%	24%
Emmerich Manual	40.7	46.2	41.8	50.0	42.3	41.5	31%	31%	21%
Northwest	39.8	44.2	40.1	45.7	38.8	44.8	38%	27%	19%
<b>INDIANA</b>							68%	65%	58%

The IPS and IUPUI partnership also addresses the issue of recruitment, retention and graduation of women and minorities to non-traditional career pathways. All IUPUI School of Engineering and Technology certificate and degree programs are considered “non-traditional” in terms of gender and racial under-representation. By virtue of partnering with a school corporation that is 70% minority, the Project PETE program recruits underrepresented minority students and females into numerous nontraditional employment opportunities. In addition, 90% to 100% of the IPS students participating in Project PETE will major in nontraditional degrees based on federal estimates for those occupations<sup>8</sup>.

After several meetings, an extensive needs analysis and the involvement of many IPS and IUPUI stakeholders, the following architecture was developed for the Project PETE program:

Goals:

1. To use a variety of resources to recruit, retain and matriculate underrepresented students to the area of engineering technology;
2. To meet the needs of the U.S. economy that will need 1.6 million jobs in the area of engineering technology by 2008<sup>1</sup>;
3. To engage underrepresented secondary students and various other stakeholders (parents, teachers, counselors, principals, business and industry representatives, university students and faculty) in an effort to provide clear and desirable pathways for secondary students wishing to attend the IUPUI School of Engineering and Technology.

Schools:

1. IPS and the IUPUI School of Engineering and Technology will partner and begin a pilot program with the IPS Career and Technology Center. Other IPS schools will be eligible for the Project PETE depending on the results of this pilot program and the availability of funding. If the model is successful, other metropolitan area school districts will be eligible as well;
2. Priority partners will be schools that already have the following programs in place:
  - a. A thriving Career Academy in the area(s) of manufacturing, technology, pre-engineering, transportation, bioscience, information technology and/or other engineering technology related areas;
  - b. A thriving Tech Prep program complete with applied courses in the curricular areas of math, science, technology and/or pre-engineering;
  - c. A Project Lead The Way program complete with the necessary curriculum, labs, equipment and teacher training.

3. IPS partner(s) will choose no more than 30 students to participate in the Project PETE program and those students must complete all requirements of the program. Up to 10 IPS Career and Technology Center students will then be eligible for a full tuition scholarship upon meeting the admissions requirements for the School of ET and enrolling.

Students:

1. Students chosen for the Project PETE program will be high school sophomores, juniors or seniors with at least a B average and a recommendation from their counselor and math, science and/or technology teacher(s).
2. Students must maintain a C average throughout their Freshman and Sophomore years of high school, and a B average through out their Junior and Senior years of high school. Students must maintain a B average in their technology, math and science courses throughout their high school academic career.
3. Students must meet minimum admission requirements for entrance into the Purdue School of Engineering and Technology upon high school graduation and must enroll in a degree and/or certificate program to take advantage of the free tuition offer. If more than 10 students from the original and subsequent cohort groups of 30 meet the requirements for the free tuition program and choose to enroll at IUPUI, then criteria will be developed to ensure a system is in place to rank candidates for placement.

IUPUI School of Engineering and Technology will provide:

1. An Academic tutoring/mentoring program for core academic and engineering technology related courses for all students in the Project PETE program. The tutoring/mentoring program will use School of Engineering and Technology students, especially those from our various student organizations such as the National Society of Black Engineers and the Society of Women Engineers. Any tutoring/mentoring program will be customized to meet the needs of the secondary school and will be based on existing state and/or corporation academic standards. In addition, programs will be offered before, during and after school hours.
2. An opportunity for secondary instructors and School of ET faculty to align curriculum via face-to-face and online workshops and professional development. Curricula from engineering technology courses at the School of ET will be compared with curricula from the secondary programs and articulation agreements will be made based on faculty agreement. Both secondary and university faculty will be encouraged to attend professional development conferences and workshops. All IPS Career and Technical students, not just those in the Project PETE program will be able to take advantage of articulated credit. By completing their high school course of study, they will automatically have university credit at the IUPUI School of Engineering and Technology.



3. Guest speakers from the IUPUI faculty, business and industry advisory committees and Dean's Industrial Advisory Committee (DIAC) will be made available to the IPS Career and Technology Center.
4. Members of the Career Counseling Office of the School of ET will work with IPS counselors to provide career, academic and personal counseling for all Project PETE participants.
5. Access to existing School of ET programs will be made available to the IPS Career and Technical Center such as the Summer Minority Engineering Advancement Program (MEAP), Friday Lab Experience, and Summer visits to industry.

In an effort to evaluate the effectiveness of this grant, the following benchmarks were developed and measured after the first year (2003-04 school year) of the Project PETE program was completed:

1. Student Graduation Rate---Project PETE students will graduate from high school at a rate equal to or higher than the average for all IPS high schools;
2. Student Attendance Rate – Project PETE students will maintain an annual attendance rate equal to or higher than the average for all IPS high schools;
3. Articulated Courses—By the end of the grant period at least 15 university credit hours will be articulated between IPS and the Purdue School of Engineering and Technology;
4. University Attendance Rate—Project PETE students will meet IUPUI admission requirements and enroll at a rate equal to or higher than the annual average for all IPS high schools;
5. Speakers Bureau—A speakers bureau of IUPUI faculty and business and industry representatives will be developed and disseminated to all IPS Career and Technology Center faculty. Actual number of speakers will be tracked by IPS Career and Technology Center and number of invited speakers will increase each year;
6. Project Lead The Way Workshops—IPS and IUPUI faculty will attend Summer workshops at Purdue West Lafayette and/or Purdue Statewide sites in an effort to learn more about and determine the feasibility of beginning Project Lead The Way at the IPS Career and Technology Center.

The total budget for Project PETE was funded through a grant administered by the Indiana Department of Workforce Development. The grant program was titled “The Federal Incentive Grant: Youth Innovative Programs.” The budget and budget narrative are delineated in Appendix III.

### **Project PETE Final Report: Grant Outcomes**

The Indiana Department of Workforce Development required all recipients of “Federal Initiative Grants: Youth Innovative Programs” grants to provide a one year summary of the grant outcomes. A specific report form was given to all grant recipients to complete with a series of questions. The narrative and tables submitted to the Indiana Department of Workforce Development, and located in Appendix IV, provides answers to those

questions and summarizes the results of year one (2003-04) of Project PETE: Pathways to Engineering and Technology Education by listing the report form question, the project goals and benchmarks, and providing information about the extent to which the grant outcomes were completed.

This grant had a total of 3 major goals and 6 benchmarks. All goals were completely fulfilled as a result of the data collected to assess the Project PETE benchmarks. The six benchmarks are listed in the report located in Appendix IV and followed by a narrative report and data contained in tables that demonstrate that all benchmarks were met or exceeded.

### **Summary and Recommendations:**

Clearly, both IPS and IUPUI are urban institutions, each with an urban mission. There is a natural “fit” for this partnership considering the student make-up, faculty, location and needs. Any university must make sure this “fit” exists before considering a K-12 partnership. Our partnership came to fruition as a result of conversations between the Area Vocational Director/Principal of the IPS Career and Technology Center and the Director of External Undergraduate Links with the School of ET at IUPUI. The main elements of Project PETE, as delineated throughout this paper, include a mentoring/academic tutoring program to provide career, academic and personal counseling for IPS students and facilitated by School of ET students, a faculty partnership that addresses the need for articulated courses between the IPS Career and Technology Center and various School of ET departments, and a speaker’s bureau composed of faculty, business and industry advisory team members, and School of ET students made available to the IPS Career and Technology Center, to provide career, academic and personal counseling for IPS students. Finally, up to ten IPS Career and Technology Center students who participate in the Project PETE program and met School of ET admission requirements will receive a full scholarship that provides 100% of their tuition costs.

Clearly, academic achievement of urban, high school students can improve if the aforementioned elements are in place. Most importantly, the mentoring program must be strong and include career, academic and personal mentoring. A mentor training session is strongly advised and the university students who choose to mentor must be in constant contact with the university representative, high school representative and parents of the high school student being mentored.

The issue of providing a smooth pathway for secondary students who show interest in engineering and engineering technology degree programs can be greatly facilitated by post-secondary and secondary faculty working together to ensure courses are articulated whenever possible. This provides an opportunity for high school students to save money and time as they work towards a degree. In addition, a partnership of this nature keeps both secondary and post-secondary instructors abreast of the latest developments in various engineering and engineering content areas. Vertical and horizontal alignment of

curriculum and assessment can only serve to enhance the educational experiences of all students.

Finally, it is important that K-12 partnerships such as Project PETE not be sustained only through grant money but that they become the focus of ongoing research among the engineering and engineering technology communities. Administrators must design these partnerships so that an initial, one time investment, can produce long lasting results and so that the outcomes can be researched and shared with other stakeholders. In the case of Project PETE, the initial \$50,000 was used to pay secondary and post-secondary faculty to examine curriculum, labs and assessment tools and, whenever possible, create course articulations. Once these articulated courses are in place, they require little maintenance and they provide the spark for secondary and post-secondary instructors to develop long lasting professional and personal relationships. The IUPUI students who were paid to mentor the Project PETE high school students were essentially used as a “beta” test. Their training, mentoring relationships, and feedback will be used to create a permanent mentoring program using engineering and engineering technology student service groups such as SWE, NSBE and Tau Alpha Beta. In addition, certain courses that require student service components can be developed and students taking these courses can also become mentors. The actual cost for developing mentoring components is negligible after the first mentors have been a part of the program.

While not easy, K-12 partnerships at all levels must be a priority for Schools of Engineering and Technology. We must begin thinking of these partnerships in terms of a “feeder system” for students choosing careers in Science, Technology, Engineering and Math (STEM) fields. Athletics has a feeder system that begins in pre-school as children begin playing basketball, baseball, soccer and other sports, music has a feeder system that begins in grade school as students are recruited for choir and band. Unfortunately, I know of few high schools that have an “engineering” or “engineering technology” club. If STEM fields are to prosper, indeed if they are to survive, K-12 partnerships must be embraced, created, and sustained.

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**Appendix I**  
**Articulation Agreement Template**

MEMORANDUM OF UNDERSTANDING  
Between the  
Purdue School of Engineering and Technology (IUPUI)  
And  
Indianapolis Public Schools Career and Technology Center

The Purdue School of Engineering and Technology, Indiana University Purdue University Indianapolis (IUPUI), and the Indianapolis Public Schools Career and Technology Center hereby voluntarily enter into this articulation agreement effective January 1, 2004 for students who have completed the following course(s) of instruction **Architectural/Mechanical CAD II** while attending secondary school.

The purpose of this agreement is to:

1. Encourage students who are attending Indianapolis Public Schools Career and Technology Center to further their careers by enrolling in an advanced course of study at the Purdue School of Engineering and Technology.
2. Eliminate repetition and unnecessary duplication of academic experiences already acquired while enrolled in their secondary school program and aid in more appropriate placement in an undergraduate curriculum of their choice.
3. Encourage increased dialogue between administrators, staff and teaching faculty of both institutions in order to promote academic and occupational awareness, information exchange, and understanding.

The agreement:

1. During the senior year at Indianapolis Public Schools Career and Technology Center, the individual student should make application to Indiana University Purdue University Indianapolis and successfully fulfill all admission requirements for an academic program offered within the Purdue School of Engineering and Technology.
2. The student will complete all placement tests that may be required for admission and enroll on campus as a student. Enrollment may be on either a full-time or part-time basis as the student may determine. Under terms of this agreement, if matriculation at IUPUI is delayed for any reason, enrollment must occur within a period of 12 months following high school graduation to earn credit.

3. The student will furnish the Purdue School of Engineering and Technology an official high school transcript verifying work completed on the secondary school course(s) identified above with a grade of “B” or above in each course.
4. Upon completion of steps 1 through 3 as listed above, the student should report to the IUPUI School of Engineering and Technology Department awarding the articulated credit and obtain the signature of the Department Chair. The Department Chair will forward a completed and signed Indiana University Special Credit to the School of Engineering and Technology Associate Dean for Academic Affairs office for signature. The Office for Academic Affairs shall then notify the IUPUI Registrar that the student is to be awarded three semester hours of academic credit for **CGT 112—Sketching for Visualization and Communication** without additional charge. This credit will be recorded as “Special Credit” on the academic transcripts, without a specific grade, and will be excluded when calculating the student’s grade point average at IUPUI. There will be no cost to the student for Special Credit obtained in this manner.
5. The Purdue School of Engineering and Technology will make available to students a description of all college level courses, which are offered through an articulation agreement and identify how these courses will be considered in enabling a student to fulfill academic requirements for a degree.
6. Indianapolis Public Schools Career and Technology Center will identify and publicize this opportunity in an appropriate manner for all eligible students.
7. Indianapolis Public Schools Career and Technology Center agrees each year to routinely coordinate and review the course syllabus with an appropriate Purdue School of Engineering and Technology representative. All parties understand that any changes made in the course syllabus, in instructional contact, or in instructional equipment or laboratory experiences afforded to the student may result in immediate termination of this agreement.

This agreement will become effective upon approval by the Indianapolis Public Schools Career and Technology Center and the Purdue School of Engineering and Technology for all students who are enrolled in the course noted above during academic year 2003-2004 and thereafter. The agreement will continue on an annual basis until one of the parties shall notify the other of its termination. Articulation agreements, however, are not retroactive prior to the specified period.

SCHOOL DISTRICT/CORPORATION

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Indiana University Purdue University Indianapolis

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**Doug Acheson**

Director  
Computer Graphics Technology  
Department of Mechanical Engineering Technology  
School of Engineering and Technology  
Indiana University Purdue University Indianapolis

**Appendix II**  
**Project PETE Students, Faculty, Counselors and Administrators**

<b>Project PETE – IUPUI Student Mentors Name and Hours Spent</b>		
<b>Fname</b>	<b>Lname</b>	<b>Total Hours (Max. 41 pp)</b>
Ron	Adams	15.5
Tysha	Ahmad	10.5
Ugo	Anyaoah	15
Melissa	Anwar	86.5
Moses	Avant	51.5
Odessa	Cobb	25
Kenneth	Davis	55
Pamela	Green	55
Andrea	Holland	58.15
LaTanya	McCann	60
Leilan	McNally	6
Bobby	Miller	9
Lisa	Miller	32
Jeffrey	Morris, Jr.	5
Nathan	Mott	38.5
Jessica	Rodgers	21
Tyrone	Rutherford	26.25
Antonio	Singleton	36
Terence	Watkinson	47
John	Watson	51.25
<b>Total Hours</b>		<b>688.65</b>

**Indianapolis Public Schools  
Project PETE Instructors:**

**All IPS instructors can be reached by calling 317-693-5430 and requesting the school operator to connect with their rooms.**

John Bannister  
 Computer Repair, A+ Certification  
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**\*In depth information (teaching, research and service) can be accessed by visiting the School of Engineering and Technology Website at [www.engr.iupui.edu](http://www.engr.iupui.edu)**

**Appendix III  
Project PETE Budget and Budget Narrative**

<u>Category</u>	<u>Grant Amount</u>	<u>Administration</u>	<u>Total</u>
Stipends	\$42,000.00	\$4,200.00	\$46,200.00
Materials/Supplies	\$ 1,000.00	\$ 100.00	\$ 1,100.00
Travel	\$ 2,445.00	\$ 245.00	\$ 2,700.00
<b>Total</b>	<b>\$45,455.00</b>	<b>\$4,545.00</b>	<b>\$50,000.00</b>

**Budget Narrative:**

Administration—this grant allows up to 10% in administrative costs to be included. = \$ 4,545.00

Stipends – 10 IPS and IUPUI faculty & 2 IPS and IUPUI counselors = \$30,000.00  
(based on \$25.00 per hour X 100 hrs. total per person)

Stipends - IUPUI student mentors X \$10.00 per hour X 1200 hrs = \$12,000.00  
(based on 2 hrs. per week X 30 IPS students X 20 weeks)

Materials and Supplies—30 IPS students X \$33.33 per student = \$ 1,000.00  
(all pens, pencils, notebooks, and printed material will come from this budget line)

Travel --- Mileage for faculty and IUPUI student mentors @ .28/mi. = \$ 2,455.00  
and registration and travel expenses for attendance at Project Lead  
The Way Workshops/Training sessions (total travel not to exceed  
\$2,455 and all travel will be reimbursed using attached Indiana  
State Travel Guidelines)

<b>Total</b>	<b>\$50,000.00</b>
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## Appendix IV

### **Project PETE: Pathways to Engineering and Technology Education Final Report Submitted to Indiana Department of Workforce Education June30, 2004**

*Report Question #1: What were the goals for this grant, do you feel they were met, and why?*

This grant had a total of 3 major goals and 6 benchmarks. The goals of the Project were:

1. To use a variety of resources to recruit, retain and matriculate underrepresented students to the area of engineering technology;
2. To meet the needs of the U.S. economy that will need 1.6 million jobs in the area of engineering technology by 2008;
3. To engage underrepresented secondary students and various other stakeholders (parents, teachers, counselors, principals, business and industry representatives, university students and faculty) in an effort to provide clear and desirable pathways for secondary students wishing to attend the IUPUI School of Engineering and Technology.

All goals were completely fulfilled as a result of the data collected to assess the following Project PETE benchmarks. The six benchmarks are listed followed by a narrative report and data contained in tables and appendices that will demonstrate that all benchmarks were met or exceeded.

1. Student Graduation Rate---Project PETE students will graduate from high school at a rate equal to or higher than the average for all IPS high schools.

Art Laker, the IPS counselor responsible for Project PETE, has compiled data indicating that 80% of students who started with Project PETE in March of 2003 are on track to graduate in May 2004 or May 2005 depending on their status as 11<sup>th</sup> or 12<sup>th</sup> grade students at IPS. Of 20 Project PETE students who have taken the Indiana Graduation Qualifying Exam, 16 have passed both the Language and Math portions of the test, 17 have passed the Language portion and 19 have passed the Math portion of the GQE. This 80% pass rate for both sections of the GQE is over 25% better than IPS as a whole<sup>9</sup>. (See Table #5)

**Table #5**  
**Indiana Graduation Qualification Exam (GQE) Scores**  
**IPS Student Totals vs. Project PETE Totals**

GQE Test Scores 2002-2003 – IPS Total		GQE Scores – Project PETE Students	
10 <sup>th</sup> Grade Language	Total Tested=138	10 <sup>th</sup> Grade	Total Tested=1
	79 Below Standard	Language	542
	59 Above Standard	Math	548
	43% Passed		100% Passed Both
10 <sup>th</sup> Grade Math	Total Tested=141	11 <sup>th</sup> Grade	Total Tested=6
	81 Below Standard	Language	1 Below Standard
	60 Above Standard		<b>17% Below Standard</b>
	43% Passed	Average Score	491.7
		Math	5 Above Standard
11 <sup>th</sup> Grade Language	Total Tested=168		83% Passed
	74 Below Standard	Average Score	523.7
	94 Above Standard		
	56% Passed		
11 <sup>th</sup> Grade Math		10 <sup>th</sup> Grade	Total Tested=13
		Language	2 Below Standard
	Total Tested=165		85% Passed
	65 Below Standard	Average Score	502.6
	100 Above Standard		
	<b>61% Passed</b>	Math	1 Below Standard
			92% Passed
	Average Score		526.5

2. Student Attendance Rate – Project PETE students will maintain an annual attendance rate equal to or higher than the average for all IPS high schools.

Art Laker, the IPS counselor responsible for Project PETE, reports that all Project PETE students have maintained a higher average daily attendance rate than the IPS average. Project PETE students attend school at a 94% daily average, while IPS students as a whole attend school at an 89% daily attendance average<sup>9</sup>.

3. Articulated Courses—By the end of the grant period at least 15 university credit hours will be articulated between IPS and the Purdue School of Engineering and Technology.

The faculty participants from both IPS and IUPUI have worked extremely long and hard hours to ensure the success of this particular benchmark. As of May, 2004, there are 15 articulated credit hours (5 3-credit hour courses) between various IPS courses and IUPUI departments. IPS courses in Machine Tool, Construction Technology, Architectural and Mechanical Computer Aided Drafting, Computer Graphics and Computer Information Technology were articulated with the following IUPUI courses: CGT 110: Computer Graphics Communication, CGT 112: Sketching for Visualization and Communication, MET 242: Manufacturing Processes II, ART 155: Residential Construction, and ART 165: Materials and Methods of Construction (See Appendix I for articulation agreement template)

4. University Attendance Rate—Project PETE students will meet IUPUI admission requirements and enroll at a rate equal to or higher than the annual average for all IPS high schools.

As of August, 2004, 5 Project PETE students have enrolled at IUPUI and been accepted to the School of Engineering and Technology. One student has been accepted to the Computer Engineering BS degree program, one in the Mechanical Engineering BS degree program, two in the Construction Technology BS degree Program and one in the Mechanical Engineering Technology BS degree program. All students admitted to their respective programs unconditionally and received Project PETE scholarships. Two students who enrolled in the Computer Engineering and Mechanical Engineering programs are Chancellors Scholars meaning they received a \$1000 - \$1500 dollar annually renewable scholarship in addition to the Project PETE scholarship. The overall rate for Project PETE students who have participated in the Project PETE Program, have graduated from high school and enrolled in any post-secondary institution is 80%. This is 22% higher than the average post-secondary enrollment for all IPS students, which is 58%<sup>9</sup>.

5. Speaker's Bureau—A speakers bureau of IUPUI faculty and business and industry representatives will be developed and disseminated to all IPS Career and Technology Center faculty. Actual number of speakers will be tracked by IPS Career and Technology Center and number of invited speakers will increase each year.

A speaker's bureau has been created from IUPUI faculty, business and advisory committee members and student volunteers. This data base was given to Luberta Jenkins and Art Laker of the IPS Career and Technology Center and was distributed to all IPS faculty and posted on the Career and Technology Center website. The website is located at: <http://www.engr.iupui.edu/diac/>

6. *Project Lead The Way Workshops*—IPS and IUPUI faculty will attend Summer workshops at Purdue West Lafayette and/or Purdue Statewide sites in an effort to learn more about and determine the feasibility of beginning Project Lead The Way at the IPS Career and Technology Center.

A number of discussions and meetings were held throughout the duration of this grant regarding a partnership between Arsenal Technical HS, the IPS Career and Technology Center, and the IUPUI School of Engineering and Technology to implement Project Lead The Way. During a meeting on February 12, 2004, attended by Sue Becker of IPS District Office, Luberta Jenkins of the IPS Career And Technology Center, Stan Irwin of Arsenal Technical HS, Ken Thompson and Dave Wilkinson of the Indiana Department of Education and Indiana Department of Workforce Development, Jerry Foster of Purdue Statewide Technology at IU Kokomo and Charlie Feldhaus of the IUPUI School of Engineering and Technology, it was decided that Arsenal Technical HS, the IPS Career Center and the IUPUI School of Engineering and Technology would partner to deliver the first Project Lead The Way course to IPS students in the Fall of 2004. This consortium was awarded a \$30,000 Tech Prep planning and implementation grant by the Indiana Department of Workforce Development by March 15, 2004. Two IPS faculty will be trained to teach the Engineering Principles and Design course and it will be offered at Arsenal Technical HS and the IPS Career Center in the Fall of 2004. Both schools have registered as PLTW sites, IPS teachers attended PLTW training during the Summer of 2004 and necessary classroom space, lab equipment and software programs were purchased to begin the PLTW course

*Report Question #2: If any of the grant's goals were not met, please explain.*

This report and supporting data prove that all goals delineated in this grant were fulfilled.

*Report Question #3: Please describe the innovative program and how the grant funds were used to improve academic achievement and the development of skills for high-skill/high-demand/high-wage occupations.*

Project PETE is innovative in that it helps high school students currently enrolled in vocational programs at IPS Career and Technology Center make a smooth and easy transition to similar programs offered at the Post-Secondary level. Through the use of a diverse group of underrepresented students currently enrolled at the IUPUI School of Engineering and Technology, a mentoring program was devised for Project PETE students. Twenty-two IUPUI students were paid \$10.00 per hour and provided nearly 700 mentoring hours for this grant. IUPUI mentors were trained by IPS and IUPUI counselors and provided academic tutoring and personal counseling to IPS Career and Technology Students. IUPUI students created a website (<http://purdue.iupui.edu/PETE/>) so that homework problems could be shared, chat rooms could be created and information about Project PETE could be disseminated. In addition, IUPUI and IPS faculty worked together to provide a smooth transition for IPS students wishing to enroll at the Purdue School of Engineering and

Technology. A total of 15 credit hours were articulated through agreements signed by both the IPS and IUPUI faculty. Many students attending the IPS Career and Technology Center who choose to take high level math courses and combine them with a vocational program such as Construction Trades, Machine Trades, Computer Aided Design Technology, and/or Electronics can now receive 3 university credit hours upon graduation from high school and enrollment at IUPUI. All degree and certificate programs at the Purdue School of Technology produce employees for high-skill/high-demand/high-wage occupations. Both IPS and IUPUI faculty and counselors (12 participants total) were paid \$25.00 per hour for their services and devoted nearly 1400 total hours to Project PETE. Finally, IPS students who participated in Project PETE had higher attendance rates, academic achievement and enrollment in post secondary programs than other IPS students.

*Report Question #4: Is the program replicable? If so, should it be replicated and why?*

The Purdue School of Engineering and Technology is the largest school on the IUPUI campus with nearly 2500 undergraduates. There was significant interest on the part of School of Engineering and Technology students to participate as mentors in Project PETE. In addition, IUPUI faculty represented each degree program in the school. This program should be replicated because everyone involved wins: the state of Indiana receives high-skill/high-demand/high-wage employees who *stay in Indiana* and prevent the “brain drain” (over 80% of IUPUI graduates stay in Indiana to work after graduation!), high school students win as they are academically tutored and socially mentored by underrepresented university students who are then paid a small stipend for their services, and, both IPS and IUPUI faculty win as they create relationships, partnerships and articulate courses to provide a smooth pathway for high school students to enroll in high-skill/high-demand/high-wage training programs, and they are paid a small stipend for their effort. This program could be replicated with a large number of school corporations throughout the state of Indiana.

*Report Question #5: Will the program be sustained? How will it be sustained?*

The relationships built between IUPUI and IPS students, faculty and counselors as a result of Project PETE can not be broken. As part of the articulation agreements, IPS must inform all IPS students of the existence of the articulated credits. This will be done by IPS counselors, administrators, and faculty. In addition, the Purdue School of Engineering and Technology has committed to provide 10 scholarships to IPS students who have participated in Project PETE and choose to enroll in a degree program offered by our school. Currently, courses are being developed for IUPUI students that require a “community service” component, and mentoring for IPS students will be a part of those courses. Finally, IPS faculty has been invited by IUPUI faculty to teach a variety of courses as adjunct faculty, and this will ensure communication between the two schools.



*Report Question #6: Were any new partnerships between secondary schools, area vocational schools, post secondary institutions, adult education providers and workforce investment boards created? Please describe.*

The entire Project PETE grant is built on partnerships among the aforementioned organizations. In addition to the unique partnerships already described in questions 1-5, the Project Lead The Way partnership will provide additional partnerships involving adult education providers, labor representatives, workforce investment boards and various craft advisory committees from both IPS and IUPUI.

*Report Question #7: Identify the most important impacts of outcomes for students that were created through this program. Please include numbers of students, youth or teachers that have been affected by the program.*

Nearly 70 secondary students, post secondary students, faculty, counselors and administrators have been impacted by the Project PETE Grant. Our accomplishments for students are these:

1. creation of a mentoring program using underrepresented post-secondary students to academically tutor and socially mentor Project PETE secondary students (we feel both the IPS and IUPUI students have been positively affected as a result of the mentoring piece of Project PETE);
2. creation of 15 articulated credit hours in a variety of high-skill/high-demand/high-wage post-secondary degree programs;
3. creation of a Speakers Bureau of incumbent workers willing to visit IPS classes and discuss skills and competencies required for high-skill/high-demand/high-wage jobs;
4. creation of Project Lead The Way courses that will prepare IPS students for rigorous academic performance required in the Purdue School of Engineering and Technology degree programs;
5. creation of 10 full tuition scholarships available only to IPS students who have participated in Project PETE and who enroll in a degree program within the Purdue School of Engineering and Technology at Indiana University Purdue University Indianapolis. Five of these scholarships have been awarded and 5 more will be awarded in 2005.
6. (See Appendix II for rosters of students, faculty, counselors and administrators involved)

