

Lehigh University
Launch-IT (Information Technology)
Annual Report
June 30, 2010

Participants

NOTE: Information has been updated 6/28/10

What people have worked on your project? *PI/Co-PI*

Dr. Glenn Blank
Dr. Henry Odi
Dr. H. Lynn Columba

Launch-IT Program Director: Ms. Colleen E. Solomon

Summer Program

Teachers

Jane Carr, Broughal Middle School
Thomas Derhammer, Louis E. Dieruff High School
Kevin Jones, Liberty High School

Graduate IT Assistants

Isaac Rieksts
James Evans
Gregory Fedynyshyn
Mike Sands

Undergraduate IT Assistants

Luis Adames
Jillian Brodhead
Evelyn Jimenez
Yarcelly Jimenez
Latoya Josephs
Darrell Ray
Harpreet Sembhi
Lissy Brito
Zahir Carrington

Fall/Spring Program

Teachers

Jane Carr, Broughal Middle School
Thomas Derhammer, Louis E. Dieruff High School
Kevin Jones, Liberty High School

Graduate IT Assistants

James Evans
Gregory Fedynyshyn
Mike Sands

Undergraduate IT Assistants

Yarcelly Jimenez
Safiya Nieves
Cieola NeSmith
Chad Solomon
Evelyn Jimenez
Darrell Ray
Edward Wong
Ana-lulia Alexandrescu
Nicholas Anshant
Carolina Velasquez

What other organizations have been involved as partners?

Casa Guadalupe, the Boys and Girls Club of Allentown, Easton, and Bethlehem, TechGyrls, KidsPeace and the Southside Initiative of Bethlehem, PA, all helped to recruit participants for Launch-IT, as well as school administrators and teachers in local school districts and charter schools.

Have you had other collaborators or contacts, including with other NSF funded Projects?

LV STEM Project

Many of the curricula offered were developed through the GK-12 sponsored LV STEM program (www.lehigh.edu/stem) in IT, and in turn Launch-IT curriculum development and evaluation spurred LV STEM.

After six years and \$550,000, the new Dr. John McAdams NASA Space Center (formerly the Mars Yard Lab and the Mission Control Center) construction has been completed and officially opened for operation on May 19th, 2010. In addition to the involvement of NASA GSFC, NSF ITEST and NSF LV STEM GK-12 Graduate Fellows grant projects, twenty-seven local companies and agencies played a significant role in funding the construction of the center, the furniture and equipment provided. Parts of the Center are located in the basement and on the second floor of the school. Over two hundred and fifty guests, including the Director of Education Center at NASA Goddard Space Flight Center, participated in the opening ceremony in the morning and families were invited to several science, technology and engineering interactive sessions in the evening, featuring, Lehigh University faculty, undergraduate and graduate students and local science and engineering related companies. Local media covered these events.

The center was named after Dr. McAdams, Assistant Superintendent for Curriculum and Instructions for Allentown School District and unfortunately he passed away suddenly. He was instrumental in the Allentown School District and Lehigh University collaboration. Other school districts will have access to the center. This center will be useful to the next proposed project if it is funded. It is important to note that this Space Center is one of only two such centers at this level in the country, designed to advance STEM Education at the K-20 levels.

Activities

1. Describe the major research and education activities of your project.

Brief overview of project

The vision of the Launch-IT program is to launch at risk students in the Lehigh Valley towards college and careers in Information Technology (IT). Launch-IT participants are 6th through 12th grade students who are academically and socio-economically at-risk (as determined by their school advisors), especially girls and underrepresented minorities, who need a boost to succeed in school and go to college in IT related fields. The Launch-IT Program has hosted sessions in spring 2007, summer 2007, the academic year 2007-2008, summer 2008, the academic year 2008-2009, summer 2009, and academic year 2009-2010. The 2009-2010 Launch-IT program consist of monthly Saturday meetings throughout the academic year and a three-week summer program.

Launch-IT provided a year-round program where students are exposed to a diverse range of IT inspired projects & activities to inspire and challenge young minds. Students worked with college professors, certified and motivated teachers from middle and high schools in the Lehigh Valley, IT professionals, and undergraduate & graduate students from colleges in the Lehigh Valley area.

In order to promote and support academic achievement in the classroom, Launch-IT students have tutoring sessions every Launch-IT Saturday with college students & teachers. To empower students to strive to be college-bound, Launch-IT students are exposed to information about college through guest presentations about the admissions process, financial aid and career paths. With continued parental involvement, support from local middle & high schools, and the enthusiasm & work ethic of our Launch-IT teaching teams, we seek to launch students into their academic futures with confidence & curiosity.

Launch-IT Student Participation

2009-2010 Academic Year (please note significant increase in participation this year)

Number of Students Enrolled	-	140
Males	-	83
Females	-	57
Hispanic/Latino	-	65
African American/Black	-	28
Caucasian	-	38
Asian	-	5
Other	-	4

Summer 2009

Number of Students Enrolled	-	88
Males	-	61
Females	-	27

Hispanic/Latino	-	42
African American/Black	-	14
Caucasian	-	25
Asian	-	3
Other	-	4

A Description of Key Activities:

During the three week 2009 summer Launch-IT sessions, the Launch-IT students worked with the iRobot Create platform, which is an educational version of the well-known Roomba vacuum-cleaning robot. The focus of the robotics workshop was navigation and planning. Students began by programming the robots to navigate an obstacle course using geometry to directly program the sequence of movements of the robot and finished with programming a more behavior-based scheme, where the robots were able to make decisions on their own.

By pre-programming a determined route, the robot is able to navigate through a specific environment. In real world robotics situations, however, robots must be able to navigate through a changing environment and must be robust enough in its decision-making to successfully navigate around obstacles not necessarily foreseen during programming. After using geometry to pre-program desired routes for the robot to navigate, the students investigated more intelligent methods of navigation.

Instead of pre-programming a specific route, the students programmed the robots to perform certain actions when encountering obstacles, thus allowing the robot to negotiate any obstacle no matter what their shape or size. When pre-programming a specific route, the intelligence resides within the students doing the geometry. When programming a more generalized response to obstacles, the students shifted the intelligence and decision making into the robot. It's one thing to tell a robot where to go, but it's much more impressive to tell a robot how to learn where to go.

In computer science, when given a problem, it is best to not only address the problem, but to address foreseeable problems that may arise in the future. When a solution does not only address foreseeable problems, but also successfully addresses problems not foreseen, the solution exhibits true computer science elegance. This is especially true in the field of robot navigation, where there are so many unforeseen obstacles.

The Robotics team was broken up into two different phases. The first phase project enhanced the knowledge of the students in the field of robotics. The students were introduced to Robots, from simple Robots like line followers to more complex robots like those used in the DARPA Grand Challenges. Students also learned the binary number system, as well as basic logic statements using logic gates. Phase two consisted of the students further understanding of basic software/automation, which includes elements such as rocketry and structural engineering.

The Fuego Flash team students have been able to successfully complete most ActionScript tasks. The more advanced students are in the game programming section of the Fuego Flash group. They are considered advanced because they successfully created a Jukebox and attended the

program in the summer. One purpose for creating ActionScript tasks is it serves as an excellent indicator for individual student understanding. It is a way to individualize instruction, especially since this group of students is working independently as the other group needs more instruction in the completion of their jukebox. There is an increase in students' self-confidence in using ActionScript through problem-solving. This is important for their comfort level in using Flash. The more confidence they have with this technology the more tenacious they become in using Flash. Students also collaborate with one another thereby building teamwork skills. For a student to solve a problem, they must first understand the game play. The tasks are very interactive. Students first play the game, and next look at the code. The tasks are specific, yet challenging.

For the first time, the Launch-IT fellow and teacher introduced Microsoft Silverlight and C# instead of Java. Silverlight offers a path to animation and video development in a modern programming environment, which we believed would engage our students more than Java. Also Microsoft offers their Expression and Visual Studio programming environments to student for free. The students learned basics of Silverlight and C# programming, including variables, functions, basic constructs (for and while loops), as well as, the principles of object-oriented design. Using these skills they were challenged to create programs that exercised what they had learned. They were provided with a framework of code (generally some sort of game) and tasked with using the concept they just learned to finish the code and either make it work or alter some aspect of the framework. Students who excelled at these projects were then provided with other challenges that required them to research and apply some concept of programming.

During the summer sessions all of the students took a field trip to the Franklin Institute in Philadelphia, PA. The students had an exciting adventure in science by seeing exhibits, theater programs, live science shows and demonstrations. This was a perfect field trip for the Launch-IT students, as it was exciting and educational for all age groups.

Fall/Spring 2009– 2010

After an orientation meeting in October 2009 with all of the parents and students, we started off our first session of the year with ice breakers, and educational games that would allow the students to get to know each other since they will be working together all year. In November 2009 Launch-IT featured a guest speaker for all of the students. Her name is Jennifer Ellsworth, who is the CEO of Frog Pong Production. She specializes in producing multimedia, and the students found her very insightful.

In January, for the morning session we had guest speaker, Dr. Gary DeLeo, who is a professor of physics at Lehigh. He presented to the students of Launch-IT last year, and since he was so well received we brought him back for another presentation. His program was entitled: "Pictures, Illusions, and Human Vision". Dr. DeLeo explored the science (and art) of capturing images, and the strange tricks our eyes and brain can play on us, called optical illusions. As rays of light pass through a lens - clear material of the right shape - they bend and merge to form an image. This process takes place in a camera and in the human eye. A photograph might show just what our eyes would have perceived had we been there. However, our view of the world is complicated, involving two eyes and the brain. The image recorded by our brain is quite different than that of a picture projected on a screen. In fact, we see in three dimensions and we are easily fooled by optical illusions. Once again, the students were intrigued by his presentation.

We had many other guest speakers, and all of it was to enhance and help our students think about their future.

Daily Activities

After each morning session the students broke out into their team assignments based on grade level. Each team had their own curriculum and IT projects.

During each Launch-IT session students had tutoring time to receive help from undergraduate and graduate students on their school subjects and homework assignments. Lehigh was not the only college to support Launch-IT tutoring with undergraduate volunteers, as Cedar Crest College and their community service organization arranged for undergraduate student volunteers to travel to Lehigh University to work with Launch-IT students during their tutoring time. Those students that were having difficulty in a subject received additional support while other students were working ahead in subjects, and some students utilized online tutorial programs such as Math 24 and PSAT prep programs for high school students.

Launch-IT is fortunate to have graduate teaching fellows whose research and studies explore the issues facing our at-risk Launch-IT students concerning their involvement in the information technology. We are proud that in addition to working with at-risk students our graduate teaching fellows are developing and exploring solutions to the recruitment and retention of students interested in studying information technology.

College Plans for Launch-IT Seniors

A good number of our graduating seniors are going on to college to pursue the information technology field, and have stated specifically that Launch-IT has helped them realize how important this field is. One of the parents has said: "His (Daniel Coronel) self esteem was boosted when he realized how easy it was for him to learn and comprehend all the hardware and software programming and robotics being taught during this three week period. Daniel is more confident in knowing that computer science and robotics is what he truly wants to do in life." Some of the graduating seniors and their college majors are:

Processes used and materials developed including field-testing and acceptance by target communities (e.g., Informal institutions, school districts)

Impact information

Please refer to evaluation by external evaluator, Jean Russo, for student impact data, in a separate attachment.

Processes used for participant (Youth-based) recruitment and retention (include parental involvement, if appropriate).

Launch-IT made an effort to establish and maintain parental investment in the program by creating an Opening Ceremony orientation and question and answer for parents and guardians. Throughout the year parents were invited to attend college preparation presentations by representatives from the Admissions Office and Diversity Recruitment Office and the Office of Financial Aid. The Closing

Explosion is the end of the year student presentation and reception for parents to experience a taste of what their children have accomplished during the program. At the Closing Explosion each team had a chance to share all of their IT projects completed during the year. The team presentations are fun way to get other students interested in the projects of the other teams, reinforcing the benefits of remaining in the program and graduating to the next team.

Student Recruitment for summer and academic year sessions was conducted in April, August and September 2009.

Student recruitment is an essential aspect of the Launch-IT program and provides certain challenges as in comparison to other established youth programs as Launch-IT is only in our third year of carnation. Colleen E. Solomon; the program director, was able to visit about 25 schools each twice during the recruitment process. The allowed the Launch-IT materials and information to be personally delivered, and teachers and guidance counselors were better informed about Launch-IT. By personally delivering the material, this ensures that the students will have a better chance to learn about Launch-IT, and hopefully apply. During the 2009-2010 school year, the Launch-IT program had a record breaking number of students apply. Over 200 students applied from the local middle and high schools. Unfortunately some students had to be turned away, but the students we did accept made an extreme effort to work hard and learn the valuable lessons taught in the Launch-It program.

In addition to visiting local high schools, the Launch-IT Program Director visited middle schools and elementary schools Allentown, Bethlehem and Easton areas. It is important to include elementary schools whose students go up to 5th grade. Those schools that were familiar with the Launch-IT program from recruitment from last year received updated Launch-IT promotional materials and Launch-IT applications. Guidance counselors across the board were eager to encourage their students to attend the Launch-IT program due to the free admission into the program and free transportation provided for students to and from the Launch-IT.

In addition to reaching out to local schools for student recruitment throughout the Lehigh Valley, connections were made with local service organizations and after-school programs. Launch-IT promotional materials were sent to the Boys and Girls Clubs of Allentown, Bethlehem, and Easton. Other organizations included Casa Guadalupe in Allentown, KidsPeace in Bethlehem, TechGyrls in Bethlehem, and the Southside Initiative in Bethlehem, PA.

Cost Sharing sources and amounts (per award letter) if this is applicable.

The P. C. Rossin College of Engineering and Applied Science awarded a Dean's Assistantship providing tuition support for 2009-2010 to graduate student Gregory Fedynyshn, matching the stipend support from NSF ITEST,

Additional support from sources other than NSF (e.g., industry, academic, government)

Academic Outreach at Lehigh University

Project goals for the year and short overview

- Recruited over 200 students to participate in a full year of Launch-IT programming, however due to space constraints, we were only able to enroll 140 students.
- Launch-IT students, grades six through twelve, were recruited from throughout the Lehigh Valley

Area including five districts Easton Area, Wilson Area, Bethlehem Area, Allentown Area and Salisbury Township.

Recruited undergraduate and professional IT assistants

- During the academic year there were ten IT assistants hired to assist teachers in the classroom and serve as role models to the Launch-IT students. Three IT assistants were returning from the 2009 summer sessions.

Assistant Training Session, July and October 2009

- Launch-IT volunteers and IT assistants attended a workshop to learn the program expectations and their specific responsibilities as teaching assistants, tutors, and mentors. All members of the Launch-IT support staff signed commitment letters explaining their job responsibilities and Launch-IT program expectations.

Recruited Volunteers from local colleges

- Launch-IT partnered with The Community Service Organization at Cedar Crest College in Allentown, Pennsylvania. Cedar Crest provided an enthusiastic, experienced group of volunteers during the academic year to tutor in the classrooms helping students with science, reading and math.

College exposure and preparation for Launch-IT students and parents

- Representatives from Lehigh University's Financial Aid Office and the Office of Admissions and Diversity Recruitment presented pertinent information to the Launch-IT students and parents. The events were scheduled to start to get our Launch-IT students thinking and planning for their college bound futures. Parents were invited so they could continue or begin to engage their children in the planning of applying to college and finding financial aid opportunities.

Closing Explosion

- Students, parents, guidance counselors, school administration, and Launch-IT teaching teams celebrated the end of the Launch-IT academic year with presentations from Launch-IT students. Each team had the opportunity to present their collection of IT projects; the presentations included a Java coded word game, jukeboxes, Flash animated public service announcements, WebPages, Power point presentations, and robots that the 6th and 7th grade teams built.

Staff Recruitment

The PIs recruited a new program manager, Colleen E. Solomon, after the summer 2008 program. Ms. Solomon is committed to remain with the program through its completion and has done an excellent job expanding our recruitment of Launch-IT students from across the Lehigh Valley.

In terms of Launch-IT staff, we expanded the number of college students involved and recruited nine undergraduate information technology assistants, with various college backgrounds. In addition to having staff members with IT background, it was important to have a multifaceted group of college students involved providing different role models and success examples for the Launch-IT students.

In addition to having undergraduate representation on the staff, Launch-IT had five graduate students who had been recruited as LV STEM (GK-12) graduate fellow participate in Launch-IT for a week, as part of their orientation for their LV STEM appointment. These graduate students served

as a valuable asset to the classrooms, as they added to the diversity of our teaching staff in terms of their educational background and career aspirations.

Volunteer Recruitment

For the 2009-10 Academic year Launch-IT was able to attain 20 volunteers between Cedar Crest and Lehigh University, which is the most the program has had. Because of this, more students were able to get the attention they deserved and the help they needed to succeed in school. All Launch-IT volunteers and IT assistants attended a training session before beginning to work for the Launch-IT program. The workshop reviewed all expectations and responsibilities and provided staff a chance to meet and greet.

Creative Activity Time

In addition to exposing at-risk students to the field of information technology and college opportunities, Launch-IT incorporated an additional educational feature to stimulate students. Students were exposed to a creative activity time that focused on teamwork and communication skills, self-expression, and games intended to exercise the imagination. These activity sessions were designed to increase self-confidence, generate appreciation and respect for one's peers, enhance public speaking abilities, and broaden their imagination. Students responded positively to the creative activity time as it provided a great balance to the educationally rigorous program and allowed students to continue their personal development socially & artistically.

Publications and Products:

Chien-Sing Lee, Glenn David Blank: Reference Curricular Structures and Pedagogical Flexibility in Encouraging Reflective Practice in Technology-Enhanced Learning. *ICALT 2009*: 546-550.

Hammond, T., **Columba, L.***, & Waddell, L. (2010). On the map with Google Maps. In Math by the Month, L. Columba (Ed.). *Teaching Children Mathematics*, 16(9), 522-523.

Columba, L.*, O'Donnell, P., & Frick, A. (2010). Speedy Gonzalez. In Math by the Month, L. Columba (Ed.). *Teaching Children Mathematics*, 16(8), 456-457.

Columba, L., & Waddell, L. R. (2009). A treasure trove of triangles. In Math by the Month, L. Columba (Ed.). *Teaching Children Mathematics*, 16(5), 272-273.

Waddell, L. R., **Columba, L.***, & Hammond, T. C. (2009). Let's take a trip. In Math by the Month, L. Columba (Ed.). *Teaching Children Mathematics*, 16(3), 148-149.

Columba, L.*, Hammond, T. C., & Waddell, L. R. (2009). Fun with fascinating and fabulous frogs. In Math by the Month, L. Columba (Ed.). *Teaching Children Mathematics*, 16(2), 88-89.

Wilburne, J., & **Columba, L.*** (2009). Medieval Times. In Math by the Month, L. Columba (Ed.). *Teaching Children Mathematics*, 16(1), 16-17.

Columba, L. (2009). Tantalizing thirteen. In Math by the Month, D. Islas (Ed.). *Teaching Children Mathematics*, 15(9) 540-41.

Contributions:

PI Glenn Blank supervised the development of a prototype Fractions Tutor, an intelligent tutoring system which helps students who struggle to perform operations on fractions. Throughout the academic year, James Evans; Graduate Assistant for the Fuego Flash team, had been working on an Intelligent Tutoring System focusing on fractions. The system mimics how a teacher would teach the subject of fraction mathematics. This is done through an Expert Module, a Pedagogical Module, a Student Module, and the Interface. When the Expert Module finds a student's answer to be incorrect, the Pedagogical Module will look at the student's proficiency in various concepts needed to solve fractions, and will provide lessons and drills to bolster weak areas of understanding. Through testing, we found statistically significant results showing with 95% certainty that use of the tutor over a period of 25 minutes would improve a 6th grade class' ability to answer 2.21 to 4.46 more questions correctly, when used in between an identical 20-question pre-test and post-test. Running the same evaluation on a group of 7th graders showed statistically significant improvements on average ranging from 0.23 to 1.56 more questions answered, again with 95% certainty. Based on student performance and survey responses to the last round of fractions tutor evaluation, lessons and drills will be added or improved, with a planned testing session during the summer Launch-IT program. Results will be submitted to educational technology and mathematics teaching conferences.

PI Glenn Blank also supervised the development of a Debugging Tutor, an intelligent tutoring system which helps students learn how to diagnose and correct bugs in Java programs. Debugging is a crucial problem solving skill for successful computer science students and software developers and a potential stumbling block for novices. Debugging is difficult to teach in a classroom setting, since it is primarily learned through practice. The Debugging Tutor presents students with snippets of Java code, which students can edit and compile (within the tutor). They can also request hints from the tutor, which it gives in increasing levels of detail upon request. The tutor monitors each student's progress in a dynamic student model, selecting problems based on the success students have had thus far with problems covering a range of concepts. Launch-IT graduate fellow Mike Sands continued developing the Debugging Tutor and performed preliminary evaluation in a local high school, which have been promising. Further evaluations are continued in this summer program of Launch-IT, leading to publications in a computer science education conference.

Addendum

Dr. M. Jean Russo's evaluation report is a separate addendum.