# INCREASING THE APTITUDE AND CONFIDENCE FOR COMPUTER SCIENCE AND ENGINEERING IN TEXAS RURAL HIGH SCHOOLS

Akhtar Lodgher[*], Yonggao Yang[*], Suxia Cui[#]
[*]Department of Computer Science, [#]Department of Electrical & Computer Engineering
Prairie View A&M University
aklodgher@pvamu.edu

## ABSTRACT

During the last decade, there was a steep drop of freshmen undergraduate enrollment in Computer Science and Engineering, especially for minority students. While enrollments are picking up slowly in the last couple of years in the general population, the enrollment of minority students (especially female students) is still considerably behind. Rural high schools in the nation, especially Texas, face specific challenges of funding and teacher availability for incorporating computer science courses in the high school curriculum. The goal of this project is to increase the aptitude and confidence for Computer Science and Engineering in Texas rural high schools. The approach in this project is to use a novel method of introducing computer science and engineering as a "fun" activity in the high school *technology* courses by using a "continuous engagement" model. In addition to this, several other steps were used such as professional development for teachers, many tours of university computer science and engineering departments by high school students, computing competition, as well as summer (fun) computing fiestas (summer workshops) for high school students.

In this paper, the general approach and efforts to achieve the above goal is briefly discussed. Preliminary results of the first two years of the project are discussed. Recruitment of minority students, especially female students, still remains a challenge and some of the lessons learned from the project are discussed.

The project is funded by the National Science Foundation (NSF) under its Broadening Participation in Computing (BPC) program.

KEYWORDS

K-12 High school recruitment, broadening participation, computer science and engineering recruitment

## Background and Introduction

While nationally, the demand for computer systems and design employees is expected to grow rapidly, adding 489,000 jobs by 2016 [1], diversity in computer science undergraduate programs still is poor. In 2007-08, only 4% of B.S. computer science degrees were awarded to African Americans; 6.1%, to Hispanics; and 11.8%, to women [2]. To address the national need for more domestic post-secondary graduates in computing disciplines, the current project, Computing ACES casts a wider net to reach a larger and diverse group of students not necessarily in computer science classes but with potential for computing disciplines beyond a basic, technical nature. These students constitute a large untapped pool of potential students to recruit into computer disciplines. Of U.S. high schools, 73% offer introductory and pre-AP computer science but only 33% require students to take the introductory course. Nearly 89% of high schools offer computing courses other than introductory and AP CS, with the top courses being Web design, computer graphics, computing communications/media, and programming [3].

All Texas high school students must complete one year of a technology course under the umbrella of CTE (career and technical education), which includes business computing, computer graphics, and computer science. Most rural schools offer one or both of these CTE courses: Business Computer Information Systems (BCIS) and/or Computer Media and Animation Technology (CMAT) but no specific computer science courses [4]. The main reason for this is state funding allocated to high schools. Computer science is considered as a science course and the funding received from the state (based on formula funding) for a science course is lower than the funding received for a technology course. Almost all rural high school are strapped for cash and administrators do not like to lose even a small dollar amount based on course offering and will almost always choose to offer the higher revenue generating course. So offering a CS course hits a hurdle right from the gates. In addition, the shortage of teachers who can teach a good CS course, combined with the need for updated equipment, almost always rules out the offering of CS courses in rural Texas schools. In Texas, about 66% of the students take either one of these courses (BCIS or CMAT) [5], a percentage far higher than students taking a computer science course.

Based on the above statistics, Computing ACES leverages its strategy on a rural high school offering these occupational technology courses. Additionally, more than 21% of U.S. youth attend schools in rural areas, where poverty rates, economic distress, and social isolation are high [6] and courses in computer science are less prevalent. In rural areas, greater percentages of Hispanic and African-American students attend a moderate-to-high poverty school [7]. Rural youth are less likely to have parents who attended college or to have contact with college-educated role models [8]. These were the primary motivations for concentrating the project on a high school (Hempstead High School, HHS) of a rural area of social, economic, and educational need.

The main objectives of the project are to: (a) engage high school students' interest in computing disciplines and strengthen their confidence and aptitude in computing and (b) increase high school students' awareness of careers in computing disciplines aligned with their areas of interest and dispel commonly held myths about computing careers – especially for women.

In a previous publication [9] the authors have briefly described the strategies to achieve the above objectives. In this paper, the *continuous engagement* model of the approach is elaborated and described and the results and lessons learned from the first two years of the effort are presented.

## Approach

The primary premise of the continuous engagement model is to have a continuous engagement with the high school students *throughout* the year. This is very different from other approaches where a college faculty visits the high school once a year, maybe on a College Day and makes a short presentation to the students, or where a set of students are brought to the university for a campus visit maybe once a year. In the continuous engagement model, of this project, the following "continuous" activities were conducted: (a) computing faculty and graduate students of a university visited a high school classroom approximately six to seven times a semester (approximately once every two weeks) (b) students from the high school visited the university for campus visits in small groups (20 to 30 students), approximately three to four times a semester (once a month). In addition to these continuous activities, other activities were also conducted such as a computing competition (at the high school) each year, summer high school teacher training workshops, and summer workshops for high school students.

***Continuous engagement activities***

*(a) High School visits:* Computing ACES' innovation was to introduce modules to teach computing principles within existing business (BCIS) and technology courses (CMAT) using a fun, engaging, and gender-sensitive approach. Intervention modules were designed for completion in an average high school class period of about 45 minutes. The sense of completion and coming out of class with games students have designed on their own serves to increase student confidence and engagement. Several software packages were used over the course of the project. In the first year Alice [10] and Vizard [11] and multimedia computing [12] software packages were used. The purpose was to use modules that incorporate fundamental logic, critical thinking, problem-solving, and programming based on examples using visual animation and multimedia. In the second year Alice, Vizard and Scratch [13] environments were used, and in the third year of the project, Scratch and Gamemaker [14] were used. The primary reason for using different software packages was to provide a variety for students who were taking two different CMAT classes over two years. Also, based on high school teacher input, students liked to use software packages which were more realistic and easier to use.

The project introduced the intervention, that is, the teaching of the above software packages, every two weeks – approximately six or seven visits each semester (Table 1).

***Table 1:*** *Summarization of Intervention modules done in the first year*

| No. | Intervention Module | Engaging Software Tools Used | Computing Concepts |
|---|---|---|---|
| 1 | Introduction to Computing | Interactive Powerpoint Presentation where students select answers | What are some computing & IT fields? Involved sub-areas? Applications? Job market? Salary survey data. |
| 2 | The 1st computer program: A number guessing game | Vizard Graphical Environment | Variables; Looping; Boolean algebra; Compiling; Programming development environment. |
| 3 | The 1st 3D computer environment | Vizard Graphical Environment | Class; Function; Parameter; Color in computer; 3D concept; Digital audio/video files; |
| 4 | Enhance previous environment to a simple game | Vizard Graphical Environment | Decimal; Hexadecimal; Binary; Boolean logic operation (true/false); Data types |
| 5 | The 2nd 3D computer game program | Vizard Graphical Environment | Input/output; Mouse/Keyboard; File operation. Integrate multimedia (digital image and digital audio/video) to the game. |
| 6 | Simple Scene Creation | Alice | Reinforce Class concept |
| 7 | Adding objects to the previous scene & making them interact. | Alice | Additional class concepts of inheritance. |
| 8 | Complex scene creation | Alice | Branching and looping |
| 9 | Introduction to Java Language | Simple Image file manipulation | Language specific construct of variables and looping |
| 10 | Introducing Structures | Advanced Image file manipulation | Function & parameters. |
| 11 | Sound creation | Simple sound file manipulation | Use of arrays & strings |
| 12 | Sound integration | Advanced sound file manipulation | Use of classes. |
| 13 | Student Competition | Pick any one project between Alice, Vizard and Multimedia | Do a project on own from start to finish in one class period |

Intervention classes were normally not held in the last month of each semester at the high school because of tests and various school activities. Since many of the curriculum exercises in the BCIS and CMAT classes are repeated, the 10% of class time needed to accommodate the intervention did not affect the BCIS and CMAT curriculum at all. Based on the experience of the high school teachers, many students are "bored" by the regular BCIS and CMAT curriculum and are looking for new things to do, such as these intervention modules. Class strengths varied from

10 students to 25 students. Project faculty members and student mentors (mostly female) from the university, majoring in either computer science or computer engineering and trained by project personnel, accompanied the faculty member to the high school. The female student mentors served as role models for female students wanting to learn computer science and engineering concepts.

Initially, the project used relatively simple modules, piloting them during the first half-year of the project. The high school teacher learned along with her students, and was able to introduce the intervention exercise in other sections. The intervention was done in three to four sections of the class each semester, for the three year duration of the project. The teachers were trained about the general modules in summer workshops before the academic year in which the modules were introduced. This gave them the knowledge and confidence to conduct the intervention in additional sections of the courses they taught, in which university faculty were unable to do the intervention. This approach contributed to the continuous engagement of computing with students and sustainability because teachers were able to implement the modules on their own.

*(b) University campus visits:* To keep students continuously engaged in computing awareness, the Computing ACES project hosted groups of HHS students to tour the university computing facilities and meet with faculty. Typically, three to four visits were arranged during each of the Spring and Fall semesters, resulting in approximately six to seven visits per year. HHS provided the transportation for the students. Each tour consisted of approximately 25 to 30 students. While it was not required for a student to have taken or be currently enrolled in the CMAT and BCIS courses, most students were in those categories. This was because it was easier for the instructors of those students, to get the signed paperwork from parents for the off-campus visits. The primary purpose was to encourage as many different students to go for the tour as possible, so that they become aware of the opportunities in the field of computing.

Students boarded the buses and left HHS around 8:30 am, and arrived at the university around 9:00 am. Upon arrival, they were split in two groups of approximately 12 to 15 students each. The groups would do two activities simultaneously of 45 minutes each, and then rotate. The activities were different for different years, and consisted of the following: (i) visit to the multimedia and virtual reality lab, (ii) visit to the radio frequency identification (RFID) laboratories, (iii) visit to the computer engineering laboratories (iv) general tour of the campus (v) visit to the smartphone software demonstration (vi) demonstration of other projects by computer science faculty. At the end of the tour, the students would meet at a conference room where a faculty member (several times a female CS faculty member) would talk to them for a few minutes about general computing careers, and encourage them to pursue careers or joint careers related to computing. The Dean of the College of Engineering or the department head of computer science would also occasionally address the students. The students would then complete a survey of the visit, conducted by the high school teachers, and then get to eat their lunch  - pizza and soft drinks.

*(c) Summer workshop for teacher training:* Workshops and seminars are the most effective methods for delivering professional development to computer science teachers [15].  Computing ACES project offered Computing Curriculum Development Summer Workshop for high school teachers, for three summers. Materials and lesson plans that would be introduced in the intervention classes during an academic year at the high school were covered in the summer workshop held in the summer prior to the academic year. After the first year, a half-day session was included, in the second and third year agendas, to discuss lessons learned from previous years and to make necessary corrections.

This strategy exposed the high school teacher to the materials before it was introduced in the classroom, resulting in a tremendous confidence building exercise. All questions were addressed, and they were given enough time and help to complete all exercises. A high school teacher teaches five to six periods during a school day. The intervention exercises by the university faculty were conducted in only three to four section (mostly three) once every two weeks. With this strategy, the high school teachers were able to introduce the intervention modules in the other classes that they taught (without intervention), resulting in a higher exposure of the modules to other students. Also, interested students who continued working on the intervention modules after class or during their free time, could ask and get the necessary assistance from the teacher.

Materials covered in the three annual summer workshops included programming environments such as Alice, Vizard, multimedia programming, Scratch, Gamemaker, as well as simple Android programs. The teachers were given a stipend (cost included in the grant), as well as continuous education training certificate. Teacher surveys were conducted at the end of the workshops as well as at the end of the academic year to gather independent survey opinions about the project.

*(d) Summer computing Fiesta (workshop) for high school students:* The Computing ACES project hosted a summer day camp at the university in Years 2 and 3 of the project. In keeping with the idea that computing is fun, the camp was promoted as a Computing Fiesta. While the goal was to provide computer science/engineering based learning during this period, it was necessary that students be involved in fun activities. The Fiesta was for five days. The schedule was arranged such that learning activities happened in the morning sessions and fun activities happened in the afternoon sessions, after a nice lunch. In Year one, learning activities included advanced modules from Alice, Vizard and multimedia computing.  In Year two, learning activities included Scratch, Gamemaker, and Android programming.

Each camp was designed for 20 students, selected by high school teachers, from students in the CMAT and BCIS classes participating in the project's module activities. Teachers were aware of individual students' potential to benefit from the camp and nominated the students for attendance, with preference given to rising seniors. Nominated girls  were especially encouraged to attend. Students arranged their own transportation to and from the university. The attending students were offered a stipend for participating in the fiesta, because many were economically disadvantaged and had to work during the summer.

Fiesta activities were as much hands-on as possible. During the afternoon sessions, students were exposed to virtual reality equipment where they could work with head-mounted displays, motion trackers, and data gloves. Other activities included campus tours, talks by female CS and engineering faculty members, college recruiting personnel who would address questions about completing applications for admissions to Texas universities, financial aid, etc., University faculty and female graduate students from computing disciplines coordinated and taught the activities.  Using female teachers encouraged the attending female high school students to see them as appropriate role models.

## Results

***Teachers Summer Workshop***

Teacher surveys were conducted by an external evaluator at the end of the three teacher workshops [16]. The summary of the results of the survey are given below. During each year, the same three teachers from HHS, who taught the BCIS and CMAT courses attended the workshops.

*(a) Teacher Surveys Summary Results Year 1:*

For year 1, all the teachers indicated that they had a good understanding of Computing ACES project focus on increasing interest in computer science by high school students, especially minority students and females. The teachers also had a good understanding of the project's planned activities at HHS in computing classes and at the university with student field trips and summer workshops for students and teachers.

Teachers were excited and pleased with the faculty's choice of software and with the materials they had developed to use the software with the high school students.  They believed their students would really like and find it easy to use Alice but would find Vizard more challenging. They appreciated the opportunity to have open discussions with the faculty about the materials, software, and planned classroom implementation.

Teachers were concerned about the faculty's implementation of the materials and software with students because of their lack of experience in working with high school students.  The teachers encouraged the faculty to use "attention getters" that will quickly engage the students. They discussed cultural differences between high school and college students with the faculty. The teachers shared that their role is to facilitate and assist in implementation of the materials and software and to help faculty work with the students in a manner that engages but does not overwhelm them.

After the workshop, teachers were optimistic about the opportunity for their students to participate in the project and its potential impact for helping students to be more interested in computer science. However, they expressed concern about how faculty will handle classroom management and adjust to the different environment of a high school and about where funds will be found for substitute teachers during field trips to the university and for purchasing Vizard software if students really become excited about it.

*(b) Teacher Surveys Summary Results Years 2 and 3:*
The survey results for year 2 (Y2) and year 3 (Y3) are given below.

The teachers were asked to identify the best descriptor of how much they gained in understanding of and ability to do various tasks as a result of their participation in the workshop. Their responses are provided below.

| **How much did you gain in…** | **Some** | **Quite A Bit** | **A Lot** |
|---|---|---|---|
| 1. (Y2) Programming using Alice | 1 | 0 | 2 |
| 1. (Y3) Programming using YoYo Games | 0 | 1 | 2 |
| 2. (Y2) Programming using Vizard | 0 | 1 | 2 |
| 2. (Y3) Programming using SCRATCH | 0 | 1 | 2 |
| 3. (Y2) Using various multimedia features | 0 | 1 | 2 |
| 3. (Y3) Using various Android/Apple Games | 1 | 1 | 1 |

Teachers were asked to indicate the best descriptor of their confidence in teaching their students various skills. Their responses are provided below.

| How confident are you in teaching your students … | Somewhat Confident | Confident | Very Confident |
|---|---|---|---|
| 4. (Y2) Programming using Alice | 0 | 2 | 1 |
| 4. (Y3) Programming using YoYo Games | 0 | 1 | 2 |
| 5. (Y2) Programming using Vizard | 0 | 2 | 1 |
| 5. (Y3) Programming using SCRATCH | 0 | 1 | 2 |
| 6. (Y2) Using various multimedia features | 1 | 1 | 1 |
| 6. (Y3) Using various mobile game development environments | 2 | 0 | 1 |

When the teachers were asked to indicate their level of agreement with four statements, they either agreed or strongly agreed with all of the statements. Their responses are provided below.

| What is your level of agreement/disagreement with … | Agree | Strongly Agree |
|---|---|---|
| 7. (Y2) I have a good understanding of my role in the Computing ACES project for the 2011-2012 school year. | 2 | 1 |
| 7. (Y3) I have a good understanding of my role in the Computing ACES project for the 2012-2013 school year. | 2 | 1 |
| 8. (Y2) I am better able to advise my students about careers in computing as a result of my participation in the Computing ACES project. | 2 | 1 |
| 8. (Y3) I am better able to advise my students about careers in computing as a result of my participation in the Computing ACES project. | 1 | 2 |
| 9. (Y2) I feel confident in advising my students about ways to go to college. | 1 | 2 |
| 9. (Y3) I feel confident in advising my students about ways to go to college. | 1 | 2 |
| 10. (Y2) I have enough knowledge about the university's Computer Science and Computer Engineering degree programs to share with my students. | 2 | 1 |
| 10. (Y3) I have enough knowledge about the university's Computer Science and Computer Engineering degree programs to share with my students. | 0 | 3 |

***Student Surveys:***

*(a) Intervention Survey Results:*

Three Student surveys were conducted and analyzed by the West Texas Office of Educational Research (WTER). A pre-survey was done at the beginning of the intervention sessions (in September 2010, in the first class, 33 students participated). An intermediate survey was done in

January 2011 (27 students participated), and a Final survey was done in May 2011 (25 students participated). The purpose of the surveys was to see if there was an increase in the interest of computer science after conducting the intervention classes. The survey combines the results from the BCIS and CMAT classes, and there were a few students (less than 10%) who were in the intervention classes from one year to the next (those students who took both the BCIS class and the CMAT class in successive years, and happened to be in the section in which the intervention was done). There were no students who were in the intervention sections for all three years. Students from any of the high school grades could take these classes. While the survey tracked their class year, the analysis of the number of students of every class each year has not been done. The preliminary first year results show that based on pre survey 28% were somewhat to very interested in computer science whereas 40% students in the final survey indicated that they were somewhat to very interested in computer science (an increase of 12%). Also, in the pre survey 48% they were not at all interested in computer science whereas in the final survey 36% indicated that they were not at all interested in computer science (a decrease of 12%).

For the second year, the preliminary results show that based on the intermediate survey 40% were somewhat to very interested in computer science whereas 60% students in the final survey indicated that they were somewhat to very interested in computer science (an increase of 20%). Also, in the intermediate survey 55% indicated little to no interest in learning computer programming whereas in the final survey 35% indicated little to no interest in learning computer programming (a decrease of 20%).

*(b) Field Trip Survey Results:*
Field trip surveys were done at the end of each field trip and based on the survey results, more students indicated interest in computer science and engineering after the visit to the university. More detailed analysis of the surveys are ongoing.

*(c) Student Summer Fiesta (workshop) Survey Results:*
A survey was conducted each year at the end of the student workshop (Fiesta). The purpose of the survey was to see if attending the Fiesta increased their interest in pursuing a career in the computing discipline. 14 students completed the survey in the first year. The overall results indicate that 28% were interested in a career in computing before the Fiesta whereas 51% indicated they were interested in a computing career after the Fiesta. For year 2, 15 students completed the survey. All 15 students had indicated that they had little or no interest in computing before the Fiesta. At the end, 8 students indicated that they were somewhat to more interested in careers in computing after the Fiesta.

## Discussion and Lessons Learned

(a) *High School visits:*
(i) For any high school interaction program, it is important to have a champion in the high school administration, who can propagate the goal and purpose of the project to the higher administration. In rural high schools, resources such as funds, teachers, staff, etc., is always quite limited. If there is anything that has to be done that is not subjected to administration approval, it just cannot be designed and implemented. Due to turnover of administration and teachers, it is quite challenging to keep the relationship proceeding smoothly. For this project, the main champion who was a technology teacher, died in a tragic car accident at the beginning of the third year. While the two other teachers helped tremendously, the champion who could convince the administration (principal, superintendent – both of whom were also changed) was not there, resulting in a lower awareness of the project at a higher level in the district. Before the beginning of the project, a three year agreement was signed by the then superintendent, which was honored by the new principal and superintendent, but not with the same zeal. The importance of having a champion was reinforced by the fact that the project initially began with three high school teachers of CMAT and BCIS, with the intent that other math or science teachers would get involved. However, over the three year course of the project, in spite of several efforts, teachers from other subjects never got interested in the project.

(ii) Certain lessons in the intervention curriculum were planned to be done in pairs. However, due to the many differences of student academic levels within a class, as well as class duration, gender, race, language barriers, etc. and on the advice of the high school teachers, the idea was not pursued. Another major issue was the computer equipment setup. Due to network issues, on several occasions, students could not log into a computer on which they normally work and would have to move from one station to another until they could log in.

(iii) Teaching a class at a high school is very different than teaching a class at a university. Important differences are: the pace at which the material is covered, the amount of repetition, ensuring that the entire class (without the exception of even a single student) is at the same step of the problem solution, discipline in the classroom, accent of person making the presentation. Students have several levels of distractions, and there would always be students who listen to their personal music devices, play a game on the internet, just stare at the computer, fall asleep, disturb the neighbor, continuously ask for help, or disturb the class. Students get called from the class for various reasons – athletics, discipline, doctor's visit, etc. The presenter has to be prepared to deal with students leaving or arriving with incomplete work and knowledge of steps covered in the class. These "interrupted" students would then start asking the neighbor for what they had missed, or keep raising their hand for help.

Dealing with such student behavior at the high school is quite different than at the university level. Faculty and graduate students teaching the materials have to be quite cognizant of these issues and have to be counseled and trained before being allowed to teach. There were a couple of times where the project had prepared a particular person to teach the material but then had to change that person after a couple of tries because they were unable to resolve class issues.

(iv) Amount of material covered in different types of classes varies quite a bit. For example, when four sections were taught, one after the other – one section consisted of academic level students, and the next section was of advanced students. The amount of material that could be covered between the sections varied quite a lot, and the instructor had to be prepared to make the switch, and have extra material to cover – along with the change in pace.

(v) Due to security and badging process, all university personnel had to arrive at the high school at least ten minutes before class time to ensure they could get their badges and security cleared.

*(b) University campus visit:*
(i) Each school and district has different rules for allowing students on campus visits. Many students indicate their interest and get the completed paperwork to the teacher until the time of boarding the bus. The exact number of students would remain unknown until the bus departed, which gave university faculty very little time to make adjustments for visit setup changes and food quantity changes. A stricter policy of early notification was not implemented because that policy would be counter intuitive to the goal of the project. The project would just work with fluctuations of students where sometimes thirty students are expected and only fifteen students would show up, or vice-versa.
(ii) The project had initially planned to split the arriving students into two groups using gender, race, academic level, etc., as criteria to study if any of these categorizations would make a difference in their aptitude towards the computing discipline. However, due to the large fluctuations in group sizes, this separation based on categories was not pursued.
(iii) Having food (pizza) and soft drinks is an important component of any high-school student visit. Pizza is the most popular food and there were many students who would signup because of this reason.

*(c) Summer Teacher workshops:*
(i) To get full participation from high school teachers, it is necessary to have a good stipend, as well as to issue a continuing education certificate. Without either of these, interest in workshops will be low.
(ii) Schedule the workshops in the weeks immediately following the school year. Teachers have summer travel schedules, and it is best to get them to attend in the early part of the summer. There is a disadvantage to this approach – they may forget what they have learned over the summer, when classes begin in Fall. Attempts at scheduling the workshops in the weeks

preceding the Fall semester were not successful due to travel schedules of university faculty, students, and high school teachers.
(iii) Treat high school teachers as one would treat a regular conference attendee – that is ensure that parking passes are provided at no cost to them, nice food during lunches, appropriate snacks and drinks during breaks, clean conference rooms and facilities, etc.. These "intangibles" increase their eagerness to learn and ensures full participation.
(iv) Payment of stipend to full-time high school teachers has to be worked out in advance so that they are using appropriate "leave" mechanisms within their systems. Most districts do not allow a teacher to be paid "twice". This also restricted the university faculty in conducting "additional make-up" training classes during the semester during school days because they could not be compensated with a stipend.

*(d) Summer student workshop (Fiesta):*
(i) While the capacity of the camp was limited to 20 students, in each of the two years, 20% more students were nominated by the high school teachers, to accommodate for last-minute cancellations. In spite of this planning, the number of last minute cancellations exceeded expectations, and only about fifteen students completed the camp each year. Some of the reasons for not attending were summer job schedules, friend not attending, or ride issues.
(ii) Having a nice lunch (kid friendly) and appropriate snacks to keep up the expectation. Scheduling non-learning activities in the afternoons was a good idea.

## Conclusion and Future Directions

The Computing ACES project team has completed the project tasks and has collected the survey results. While some of the results of the surveys have been processed and reported here, other survey results are in the process of data compilation. The results of those surveys will be reported at a later date. Preliminary results indicate that the project is successful in meeting its goal of increasing the aptitude, confidence and engagement of students in computer science and computer engineering. The school system does not track the career path of specific students, and it was not possible to track the post-high school path of the students involved in the project. Anecdotally (from teacher interaction) three students progressed to computing paths at the end of year two (two to engineering and one to computing science).

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