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Ultimate Tech Support:

The Student Technology Support Team

Abstract

High school students above all others care about their school and their school's technology. The Student Tech Support Team harnesses their energy and enthusiasm. At Baltimore City College - which is a high school despite its name, advanced tech students provide tech support schoolwide and play a significant role in maintaining the school's 2400-page school website and the Linux and NT servers. Student Tech Support Team students learn valuable lessons and skills through real-world hands-on experience and interaction with users of all levels - and do wonders for both their own self-confidence and the technology budget.

Both the self-confidence of teenagers and the funding for technology are major concerns in urban public schools, and no more so than at Baltimore City College. We are an all college-preparatory humanities magnet high school and a National Blue Ribbon School and an International Baccalaureate school. Our student population and our funding are pure inner-city public high school. We have about 1200 students, the population is about 60% female, 95% African-American, 40% receive free or reduced lunch, total per pupil expenditure about $5,100. In other words, unadulterated inner-city public high school - except that 96% of our graduates go to college. The Student Tech Support Team addresses the many issues the schools' growing commitment to technology raises.

The dispersal of computers in the schools is growing exponentially as every district seeks to place more computers in more classrooms. Curriculum demands more and more real-life experience - however simulated, a greater emphasis on problem solving, and increased focus on thinking skills for generations of students with ever-growing cyber-sophistication.

This means, though, that what funding the schools do have is going to hardware, perhaps with bundled software, with little left over for teacher training and even less for on-site support. According to a report from the CEO Forum on Education and Technology,

> Although technology is being leveraged in the classroom, lack of on-site technical support in schools may discourage teachers from using technology to its fullest potential. The need for tech support in budget-pressed public schools is beyond question, and schools have attempted to address this question in a variety of ways - with varying success. (http://www.ceoforum.org/)

One approach is to rely on system-wide support by central office technicians. Such arrangements, at least in a large urban system, tend to be unreliable. Technicians in the employ of the schools, which cannot compete economically with the private sector, are of unpredictable abilities, and scheduling a central staff to service several hundred schools frequently results in long delays between problem and solution.

Another approach is outsourcing. Some districts sign a service contract with an outside contractor. Outsourced contract technicians, simply because they survive in the private sector, tend to be more knowledgeable than school system employees, but this expertise commands a high price. Even at a base rate of only seventy-five dollars per hour - the typical school contract rate in Baltimore, if a technician spends eight hours at just one school that's six hundred dollars. Even if the cost is not prohibitive, as with the system technicians, there is a time delay in the scheduling of the contract technician. He (or she) is not onsite for troubleshooting NOW. In addition, someone at the school must coordinate and contact contract work, an added responsibility for administrators who often are too busy already and have little understanding of what needs to be done to keep their information technology working smoothly.

On-site support offers the greatest benefits to instruction simply because of the potential for timely troubleshooting. When a teacher takes thirty ninth-graders to a computer lab and five minutes later comes running down the hall saying "The Internet isn't working!", onsite support, whether in the guise of technology coordinator or system administrator, provides the only practical rescue. Such onsite support is also only a pipe dream for many budget-constrained urban schools. Hiring a full-time Technology Coordinator, let alone a true network system administrator, substantially cuts into the principal's staffing budget, which in turn can reduce course offerings or increase class sizes.

An alternative source of quasi-onsite tech support is community resources and parents, with the accompanying scheduling difficulties and lack of understanding of good educational practice. While these volunteers are valuable resources to be encouraged, it is risky to rely solely on volunteers to manage and maintain a technology program fully integrated into the curriculum.

The most cost-effective solution, where possible, may be to give a qualified teacher the task of handling troubleshooting and managing contract resources. If such a person is available and willing, the impact on instruction and budget is much less than with any of the other alternatives. In budgetary terms, releasing a teacher from one teaching period means giving that teacher a one-sixth (in the four-period model) FTE (Full-time Teacher Equivalent) stipend. The Baltimore City School System budgets $42,000 - the median salary - for each FTE. One release period in this sense pays the teacher one-sixth of that rate or $7,000. Even adding a token stipend of $5,000 for a total of $12,000 for the school year, the school is still spending up to eighty per cent less than it would for any other alternative. From this perspective, the impact on course offerings and class size of giving one teacher one release period pales in comparison with the budgetary advantages.

The flaw in the teacher release period solution lies in its practical application. In one period a day one teacher, no matter how competent, compensated, and dedicated, simply cannot maintain a school-full of computers and computer users.

According to a March 2001 eSchool News special report,

> "In the business environment, a full-time computer support person generally is required for every 50 to 75 computer users. A study by Forrester Research found that in large corporations, there was one support person for every 50 PCs, at a cost of $142 per PC, per year. According to this model, a school district with 1,000 PCs would need a staff of 20 and a budget of $1.4 million for support."

In its TCO (Total Cost of Operations) comparison between businesses and schools, IDC (http://www.idc.com/) found that schools have "extremely low" levels of support, usually one person for every 500 computer users, compared to the 1-to-50 ratio it, too, found in the business environment. While the Baltimore City Public School System, for one major urban system, certainly has both more than 1000 PCs systemwide and a central office staff of more than 20 identified as support, the logistics of that support staff meeting the day-to-day onsite needs of technology support in the schools often falls short. To maintain successful technology programs, schools need to provide adequate and realistic tech-support resources. Well-qualified personnel should be readily available to ensure continuous operation. This is where the Student Tech Support Team comes in.

Sophocles wrote in the fifth century BCE, "One must learn by doing the thing. For though you think you know it, you have no certainty until you try." Providing tech support to the whole school is an integral part of my Advanced Tech course. This is an 11th and 12th grade elective, (prerequisite 85+ in Intro and approval of the teacher), and the students repair, expand, cajole, support, train, etc. technology and users throughout the school. A detailed description of the course is posted at http://baltimorecitycollege.org/~edunbar/atlinks.htm. In addition to being a significant part of the grade for the course, Student Tech Support Team work also provides some of the 75 hours of service Maryland requires for graduation from high school.

Students come into the Advanced Tech course, as eleventh or twelfth graders, with a common basic foundation in productivity applications from their Intro Tech course but with technical skills ranging from those who have never opened the box to those who have set up their own networks at home. The opening academic portion of the course, an in-depth collaborative examination of operating systems, establishes standards and reinforces teamwork and collaboration skills. The opening tech support activity familiarizes the team with the technology in the building. Students group themselves into four teams, one for each floor of the building. As we move through the course, each floor team becomes very familiar with the idiosyncrasies of the computers and the users on their floor; in fact, some teams choose their floor based on how well they get along with teachers in the departments housed on that floor.

Before they go out "in the field" the first time, we draw on their knowledge of operating systems to define the first real task - routine maintenance. This serves several useful purposes:

- Every computer in the school has a semi-annual checkup in which students defrag, delete temp files, delete *.vbs files, and scan for viruses
- Every computer in the school is unobtrusively checked against our computer inventory
- Students introduce themselves and their role to the users on their team floor
- Students collect the first set of user requests and problems, thus determining the next support tasks.
- And most important, for the first time the students get to wear their official BCC Advanced Tech Student Tech Team ID badges and wander around the building working independently.

What the students bring back from each support mission determines the tech support skills portion of the course, which further builds their sense of involvement and ownership in the

course. The support skills they need are predictable and with very rare exceptions are already built into the Advanced Tech course curriculum.

We address the technical problems through a great deal of work with problem-solving techniques, mostly the IDEAL method based on Bransford and Polya's work in this area. The IDEAL acronym helps students to

Identify the problem

Determine goals

Explore opportunities

Assess outcomes

Look back and learn from the experience

The first major in-class problem-solving activity requires the students to develop and publish on the course website a *Troubleshooting Guide for Teachers*. These guides must address a common computer problem and explain the solution so clearly that "the most totally non-techie teacher you know" will be able to follow the directions and solve the problem. Recent troubleshooting guides are online at http://baltimorecitycollege.org/~edunbar/probguid.htm. In addition to focusing the students' approach to problem solving, this activity teaches several other widely applicable skills. The students identify common problems, they learn to use online and classroom library resources to find out how to solve the problems, they learn to write cleanly and clearly for a particular audience, they refresh their web authoring and design skills, and they create a resource for the school and for themselves and future student tech support teams.

In addition to the predictable technical problems, one of the most important skills the students quickly realize they need is that of dealing with users. The Student Tech Support Team credo has two guiding principles:

1. Do no harm.
2. Don't make the user feel stupid.

We address these principles through constant repetition and application to situations at hand. The most useful technical skill these principles engender is the need to analyze the problem thoroughly, to isolate one thing at a time and determine what the cause - and ultimately the best possible solution. The students learn to explore all possibilities, however unlikely, before reaching a conclusion. Support Team students quickly subscribe to Dunbar's Rules for Tech Support:

- It works better if it's plugged in.
- It works better if it's turned on.

These rules, courteously applied, solve an embarrassing number of computer problems, but they often create a real challenge to the mandate "Don't make the user feel stupid." Interpersonal skills, always important, can be tricky in a situation where a student is working on teacher's computer problem. We spend time in class developing ways of talking with teachers about computers without making them feel stupid.

This has had some unexpected side effects. One unprepossessing student last semester came back from a support call wearing a grin to make the Cheshire Cat proud. A former teacher of his was distraught because her monitor didn't show anything. All the student did was plug the monitor power cord all the way in, but as he reported "She was so impressed that I fixed it so fast, she wanted to know how I knew how to do that..- and after the hard time she gave me in English last year! But you told us not to make the user feel stupid so I made up something technical sounding."

Organization and time management play a big role in deploying the Student Tech Support Team while simultaneously developing the skills they need and pursuing the academic goals of the Advanced Tech course.

The Student Tech Support Team handles the initial routine maintenance and inventory and the service requests they engender throughout the first unit of the course and into the second, the introduction to C programming - which further hones their problem-solving skills as well as their understanding of the magic in the machine. Fortuitously, the time required for first-round tech support diminishes at about the same rate that the time required for learning C grows.

Allotment of the class period changes with the demands of the in-class and tech support tasks at hand. We are currently working in a four-period day with ninety-minute periods. Each class begins with a quick discussion of the previous day's problems and then moves into the tasks at hand. For the initial orientation and maintenance tasks, the floor teams are out in the field for most of the period. They return fifteen minutes before the end of the period to report the day's activities and problems, after which they write a *Daily Learning Log* that is collected and assessed each Friday - their very own DLL.

The *Daily Learning Log* serves many purposes in addition to requiring the students to respond to their daily experience. A no-fault assignment, the Log provides opportunities for students to raise concerns and ask questions they may not want to bring up openly in class, lets them vent frustrations without fear of embarrassment or retribution, and encourages ongoing confidential dialogue between student and teacher in a non-threatening format. *Learning Log* directions are online at http://baltimorecitycollege.org/~edunbar/logdir.htm.

By the second month the Tech Support Team students have greatly improved their problem-identification and user relationship skills and their sense of competence has combined with the wisdom to know when to ask for help. They are competent beginners in the tech support field, each team with a floor whose computers are basically operational. Then the real challenges begin to emerge.

After about a month of heavy use, the technology resources of the school begin to need more sophisticated tech support. At this point we organize service calls in a 3-step process. When a trouble call comes in, the first step is to send out the Student Tech Support Team for that floor. They confirm the problem, assure the user that help is on the way, and try to fix it. If they can't fix it, we move the problem to the second step - as technology coordinator, I try to solve the problem. If I can't fix it, our resource of last resort is the contract technician, who is tentatively scheduled to visit the school every two weeks. Using this three-step system we maintain a maximum two-week turnaround on repairs and in the first semester of this year reduced our service costs by 60%. Doing my job as technology coordinator would be either impossible or impossibly costly without the Student Tech Support Team.

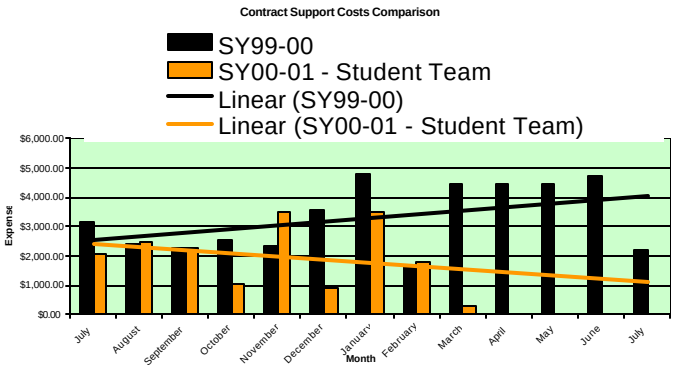
Time demands increase as the problems become more complex. About this time in the course the students decide to split the week, spending three days in the classroom all period (except for true emergency service calls) and two days in the field. This shift often coincides with the dreariness of November and March, and the schedule change revitalizes the students in both academic and tech support areas.

Network problems and requests develop about November and March, too, serendipitously coinciding with the networking unit in the course. Armed with a thousand-feet of cat5 cable, boxes of RJ45 connectors, and a couple of crimpers and patch cable testers, the Student Tech Support Team moves into this area enthusiastically. They install and debug Network Interface Cards, build and replace patch cables, set up hubs, and design and install a LAN for the teacher who suddenly wants five computers in his room, all with Internet access. No problem.

This is probably the area where the Student Tech Support Team saves the school the most money, also. Students seem to actually enjoy building patch cables and pulling them through ceilings - and they don't expect a hundred dollars an hour for doing these thankless tasks.

Building networks from scratch also tests their user interaction skills. They patiently explain to one teacher after another why she doesn't want one computer in each corner of the room and a fifth in the middle, all networked, or why it really would be more sensible to move the teacher's desk than to run a seventy-five-foot cable to the drop. On the other hand, when the principal decides they should run a patch cable a hundred feet to another office to save the cost of adding a drop, they mutter a lot, but they build the cable and run it.

Success in putting a Student Tech Support Team in place depends on multiple factors in the school. District technology policies must permit student technical assistance. The building administration must be amenable to permitting students the higher level of responsibility and access to sometimes-sensitive areas. The faculty must be receptive to accepting help from students. The Technology Coordinator and the Advanced Tech course teacher must be able and willing - and funded - to handle both the administrative tasks and the training and troubleshooting challenges of turning students into technicians without interfering with their education. The curriculum must support project-based learning and include a course that can validly spawn the Student Tech Support Team. The parents must agree with the goals and implementation of the program. And above all the students must concur in the philosophy and the principles of student tech support.



The numbers alone go a long way towards convincing a principal. The accompanying chart shows the impact on the technology support budget at Baltimore City College High School. Selection criteria to guarantee qualified students for the program assuages concerns about security and access to sensitive areas. Both the budgetary impact and the appeal of hands-on instruction can influence the Technology Coordinator. While significant savings accrue, the

technology budget must include needed parts and tools. The teacher of the including course is of course critical. In addition to being comfortable with project-based learning, the teacher must possess and be able to help the students develop the needed technical and interpersonal skills. Course design is as important as the teacher who implements it is. Instruction must be teacher-directed but heavily student-centered. The flexibility and the vision required for effective project-based learning are critical. The curriculum must include both a solid introductory technology course and a place for an upper-level advanced elective such as this course. Attention to scope and sequence in technology education is paramount. Last, and most important, the students must buy into the concept.

A school that is not comfortable with implementing a Student Tech Support program on its own has other options. The Kentucky State Department of Education has a Student Technology Leadership Program described by Jennifer D. Burke, Program Coordinator, Educational Technology Cooperative Southern Regional Education Board, in an email as

> [a] project-based service-learning program [in which] students are trained extensively and offer technical support to their schools and community, teach parents about technology and computers in after-school resource rooms, make presentations at the state technology conference, set up the technology operations (networking, Internet connections, hardware/software, etc) for the state technology conference, and lots more.

This originally federally funded program, which might serve as a model for schools outside Kentucky, is described at http://www.kde.state.ky.us/oet/customer/stlp/default.asp. The link from there to http://www.kde.state.ky.us/oet/customer/stlp/providers.asp holds a description of Kentucky's program with goals and examples of projects and organization of the program.

GenY's GenSCI (Students Caring for Infrastructure) apparently fee-based program includes various levels of student-based tech support along with a set of Web-based tools available for managing contracts, tracking student performance, and providing online work spaces via which students can consult and collaborate with other students working on similar projects/topics/issues from around the world. http://genyes.org/gensci/ contains general information on the GenY programs.

In the StRUT program - **St**udents **R**ecycling **U**sed **T**echnology - in place in Oregon and some other states, Intel donates 90 percent of its used PCs and components to the Northwest Regional Education Service District (ESD) for students to upgrade for use in schools. Information about the Oregon program at http://www.open.k12.or.us/strut/index.html shows how one Oregon high school benefited from this program which might serve as a model for partnerships between manufacturers and schools in other parts of the country.

The Baltimore City College Advanced Tech Student Tech Support Team differs from these existing programs in several significant ways. Foremost is that the student support work is totally integrated with the academic curriculum of the Advanced Tech course so that hand and head work together in continual mutual reinforcement of learning. Tech support work is fully integrated into the student's total educational experience. Because City's program is entirely school based and school funded, it functions independent of external factors. Because the students are providing real and needed service to the faculty and students of the City College community, the hours of service learning accrued enable them to fulfill the state-mandated hours of community service graduation requirement. The Advanced Tech Student Tech Support Team

advances the students' education, supports their school, adds a brilliant facet to the total school community - and a good time is had by all.

Resources

Baltimore City College High School. National Blue Ribbon application. http://baltimorecitycollege.org/blueribbon/

Bransford, J.D. & Stein, B.S. (1993). *The Ideal Problem-Solver: A guide for improving thinking, learning, and creativity*. Freeman

Burke, Jennifer D. Email. Re: [WWWEDU] need K12 example of student consulting. 16 Jan 2001 13:41:11

CEO Forum on Education and Technology. http://www.ceoforum.org/

Dunbar, Elizabeth. Baltimore City College Advanced Technology Systems CourseWeb. http://baltimorecitycollege.org/~edunbar/atlinks.htm

Dunbar, Elizabeth. Daily Learning Log. http://baltimorecitycollege.org/~edunbar/logdir.htm

Generation Yes. http://www.genyes.org/

Kentucky State Department of Education. Student Technology Leadership Program. http://www.kde.state.ky.us/oet/customer/stlp/default.asp

Moskowitz, Steven. *Technology Management -- Twelve Steps To Trimming Your TCO.* eSchool News. eSN Special Report. http://www.eschoolnews.com. March 01, 2001

Polya, George. *How to Solve It*. Princeton University Press, 1971

_____, *Mathematics and Plausible Reasoning.* Princeton University Press, 1990

Selfe, Dickie. Email. Re: k-12 tech support 16 Jan 2001 15:41:47 -0500.

Students Recycling Used Technology (STRUT). http://www.open.k12.or.us/strut/index.html

World Wide Web in Education List. WWWEDU@LISTS.LIGHTSPAN.COM