



HP Catalyst

Case Studies in STEM+ Innovation

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HP Catalyst

Case Studies in STEM+ Innovation

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Global Collaboratory Consortium

Led by the CSIR Meraka Institute

Cairo Cloud Computer

Cairo University
Egypt

Summary

Imagine using the new wave of distributed, powerful computing environments as a means of solving large-scale problems. That is exactly what the Faculty of Computers and Information at Cairo University in Egypt is doing. Specifically, their target is social development problems in Africa. In doing so, the project is investigating how cloud computing impacts the quality of the knowledge comprehension and work produced in both basic and advanced computer science courses for 2,200 students, and ultimately, which courses in particular benefit the most.

The “Cairo Cloud Computing” project is the first of its kind in Egypt, and is using HP servers, workstations, and HP Elite Tablet PCs to allow their professors and lecturers to join forces with other institutions in Egypt and throughout Africa, creating a super cloud offering nearly ubiquitous access for all the researchers who will be participating.

The cloud will minimize the costs of buying and maintaining computer resources for African researchers and maximize the current computing resources. Services will be extended to the scientific community of Cairo University as well, and will not only develop staff awareness of cloud computing, but will also help them solve their computationally intensive problems.

The Project in Action

Project leader Mohammad El-Ramly is working on establishing a cloud computer university, which he thinks will greatly improve the ease of research and other problem-solving activities for students and faculty at Cairo University. Once in place, the advantages of the cloud environment will create opportunities and resources that students in STEM disciplines never had. “What this means is that computing services on HP servers and machines will be offered to students and faculty on demand and will be required for teaching and research projects,” El-Ramly explains. He says that this will facilitate research because students are no longer limited by processing power as they can now reserve HP equipment. In addition, the cloud environment will allow students to complete larger projects from home or their jobs.

El-Ramly and his team are presently involved in the most time-consuming activity in the project, which is preparing the machines for student use. This includes equipping each machine with the teaching materials, tools, and applications necessary for the labs of each particular course. Once the machines are prepped, students will be able to take advantage of

the cloud. "You offer resources to students on demand, but then you have to preset that," he says. "There is a significant preparation phase before offering this service to the students. Otherwise, you give them raw operating systems."

The first shipment of HP equipment arrived just around the time the Egyptian revolution began in January 2011. As a result, the progress of the project was delayed for a time. "When universities reopened in March, our biggest challenge was just finishing the second term," El-Ramly recalls. The project also encountered other issues in the execution of their initiative. "By May, we got the equipment. During the summer, there was a major renovation in the building and where the lab was supposed to be due to some serious construction problems."

By the time El-Ramly and his team received the final shipment of equipment, they were already delayed by almost a year. Despite the circumstances, El-Ramly is optimistic about meeting his goals. "I hope by the end of the project, we'll deliver 70 or 80% of what we promised in terms of having the computers set up and running, and teaching materials and courses rearranged or reinvented to suit or take advantage of the cloud environment."

Many of the obstacles in the project were out of their hands, El-Ramly says. Yet he thinks they could have been more prepared if they had investigated different models for deployment of the cloud before they initiated the project. Currently, the project is in contact with North Carolina University, which has been very helpful. He recommends that any project leader looking to establish a cloud infrastructure should explore the models that are presently in place at other educational institutions.

He explains, "Look for a model that you can adopt, not fully but for a starting point." For El-Ramly, this proved to be a great benefit. "In our case in particular, it's a virtual environment, so North Carolina University offered us assistance and offered us access to the teaching material they did on the cloud."

In addition to the quality of equipment received, what El-Ramly values most about the grant is the type of support he has received from the HP Catalyst Initiative. "It's the whole mentality of reaching out with technology to support education and improve STEM education, the meetings, the webinars, etc. I see this as very inspiring and very helpful."

Technology

The "Cairo Cloud Computer" project received four servers, 40 laptops, and two printers. Along with the equipment, they received the funds necessary to hire an administrator and buy wireless routers to revamp their network.

To create the virtualization environment, they installed Linux, and VMware is installed on the servers. They are also working on advice and training tutorials from the Egyptian Maintenance Company and East Carolina University.

The Challenge of Water Quality Project ***China and United States 'Sister Schools' Seek Solutions Together***

Scofield Magnet Middle School in partnership with Shandong University Middle School
Connecticut, USA

Summary

Water pollution is an enormous challenge, anyone would agree, but is it something middle schoolers could help with? Most people may see this as too complex for anyone but lab-coated scientists and environmentalists, but students at Scofield Magnet Middle School in Stamford, Connecticut are now actively involved in real-world analysis of groundwater. Working with a variety of community organizations and utilizing HP technology, classes track data about quality of water, topography, drainage, flora and fauna, as well as the impact of urban development.

Scofield students are learning first-hand how development in their community impacts local waterways, reading local newspapers depicting the contamination issue, and meeting with environmental reporters to discuss investigative journalism. By working with Shandong University Middle School in China, Scofield hopes to cast an international spotlight on the rapidly growing issue of poor water quality.

The Huangshui River Basin, the focus of the Shandong project, is recognized as one of the most polluted river systems in China. The project is putting students on both continents side by side with scientists and other experts in the field, giving them the chance to practice skills and techniques relevant to science and environmentally related careers. The classes have already begun testing pH, salinity, dissolved oxygen, fecal coliform, turbidity, water flow, water depth and temperature, using GPS, HP Mobile Calculating Lab Probes, HP Calculators, Notebooks, and GIS software to document their findings.

The Project in Action

At its inception, "The Challenge of Water Quality" project was envisioned as an interdisciplinary effort to educate students at Scofield Magnet Middle School about the issue of water quality, both at a local and international level. The project is pursuing those aims through innovative and creative uses of collaboration and technology. Originally, project leader Bryan Olkowski and his colleagues at Scofield Magnet Middle School had created a sister school relationship with the Shandong University Middle School based on traditional cultural exchange programs, but with the help of the HP Catalyst Initiative they joined the Global Collaboratory Consortium.

"We issued a proposal that was really and truly a global collaboration," Olkowski recounts. In addition to building their own curriculum unit, he says, "We wanted to teach our school in China to build their capacity through this unit we're doing in Stamford. So last year, as a result of the HP Catalyst Initiative, we were able to send teachers to China ...to teach their teachers how to do water testing, how we were doing water testing, and share some of the curriculum and materials that our teachers developed."

Olkowski recalls that the turning point in the project was receiving equipment and funds from HP that was the catalyst for transforming Scofield Magnet Middle School into a learning

environment where teachers are effectively and creatively using technology to enhance their instruction and engage students in STEM learning areas. In fact, the project team has been so successful in this that they have been invited to meet with local congressmen and a senator in Connecticut. "We spoke before a room full of policymakers and legislators ...about our HP project and our testing unit and things we were able to do and how we were handling instruction using technology," he recounts. "Ultimately, our major thing was that it doesn't replace the teacher but it makes the kids more engaged and makes the teacher more efficient."

After receiving an extension grant from the Catalyst Innovation Fund launched at the HP Summit in India last year, the project team has been able to accomplish most of its goals: integrating technology and wireless Internet into the middle school, gaining the ability to do water testing, sending teachers to China, receiving a delegation of students from China and taking them water testing with their students, and watching students become much more interested in STEM areas.

The team experienced a challenge in getting geographic information systems to enable the students to track the data collected from water testing and create maps. Though GIS software was not in their original grant proposal, they were able to purchase it using HP Catalyst funds, and obtained training by collaborating with professionals at the HP Summit. Chief among them was a professor from the University of Northern Arizona who they flew in to train the teachers, one of whom went to Arizona to receive training so that she could offer a GIS class to the students.

Going forward, the team is looking to integrate GIS into the water quality-testing unit in time for the next HP Summit in April 2012. The team is also working to resolve another challenge: working around Chinese governmental regulations to enable communication between the students in Connecticut and China. Recently, the founder of ePals heard about the project on a webinar they did with New Media Consortium, and he is working to have the Ministry of Education in China allow ePals to be a collaboration platform for the students.

Technology

Through "The Challenge of Water Quality Project," HP provided Olkowski and his colleagues at Scofield Magnet Middle School with two fully stocked laptop carts, a printer, and \$15,000 in funding toward implementing the project. Olkowski credits the HP equipment with becoming "the seed from which everything else grew out of."

For example, when the city of Stamford saw their donations, they gave the school 15 to 20 access links, which enabled the school to go completely wireless. Students use the technology for research and GIS for the water quality project, as well as in multiple interdisciplinary capacities, which teachers are using to enhance their normal curriculum. The new technology has allowed for a computer-based writing course and "virtual fieldtrips" in language arts classes.

Development of East African Computational Chemistry Infrastructure

Masinde Muliro University of Science and Technology
Kenya

Summary

Have our students learned, and learned well? At Masinde Muliro University of Science and Technology (MMUST) in Kenya, one measure is if students can use the knowledge they gain to help improve their community. MMUST is exploring how to use a collaborative online learning environment to address two major social challenges in East Africa: mitigation of environmental toxins and the development of natural anti-malarial products.

Through a grid service infrastructure for computational chemistry (via an HP server) that links to other institutions, students and researchers at MMUST and its partners will share access to high quality chemistry resources at Binghamton University that would normally be out of reach due to cost. The platform will be connected to the existing Brain Gain e-infrastructure and will allow access to molecular databases and support computer techniques as a means to explore and alleviate Africa's ongoing struggle with malaria and other environmental issues.

The project is also determining the best combination of computational and chemistry teaching techniques, tailored specifically for students with a background in the African educational system, and aimed at solving real problems that exist in East Africa. Because computational chemistry has grown to be an essential component and research tool for the curriculum, all chemistry departments must maintain a high level of expertise to remain effective. The "East African Computational Chemistry Infrastructure" project is providing the means for the next generation of scientists in East Africa to gain these skills.

The Project in Action

Project leader Isaac K'Owino and his colleagues at MMUST are dissecting the way 21st century students learn STEM subjects, and exploring methods of education that incorporate technology in this learning process. K'Owino has is working to expand teaching possibilities through his project "East African Computational Chemistry Infrastructure."

The benefits of implementing technology in the classroom have already become evident, as high school students across Kenya engage in more in-depth science curriculum than ever before. Isaac K'Owino notes, "We are in the process of scaling up our project. Our greatest achievement so far is the implementation of the virtual chemistry program in selected high schools. The impact of this aspect of the project has been enhanced by the trainer-to-trainer model of implementation. We managed to acquire a virtual laboratory coordination center at MMUST, which will be accessible to all students."

Thus far, K'Owino and his team have implemented the virtual chemistry program in four schools: Hafumbure Secondary, Humwend Secondary, Lukhuna Girls Secondary, and Isidikho Secondary. Partnerships with the latter schools have been extremely fruitful and K'Owino is looking to expand collaborations to other institutions soon. "We are currently exploring the modalities of working with Kenyatta University (virtual curriculum development), Loodwing University (e-textile to be implemented in Mumias Girls High School), and University of Washington (construction) on certain aspects of virtual science," K'Owino explains. The team

hopes to implement the virtual chemistry program with many institutions across East Africa, eventually developing a virtual science curriculum for the region.

This HP Catalyst project has proven beneficial for project participants and administrators, but it has been a learning process as well. One major challenge has been lack of resources. Most partnering schools did not have rich facilities, and workstations were shared across the project. This required project administrators to visit schools on a rotational basis, to ensure all schools had the necessary equipment to complete the project.

In hindsight, K'Owino wishes he and his colleagues had included computers for the secondary schools when designing the project. Additionally, a defined virtual curriculum did not exist when his team initiated the project. K'Owino explains, "We had to evaluate the level of the learners, their subject content needs and their understanding of the use of computers before implementing the work. We had also to adopt a training model that will give us the required number of students per school."

Technology

HP provided the "East African Computational Chemistry Infrastructure" project team with workstations, laptops, Virtual Room licenses, white board screens, servers, and various related equipment. During each school visit, K'Owino and his colleagues transport and utilize workstations to complete fieldwork for the project. MMUST researchers use the laptops to explore best practices and outcomes of the technology-based learning. The server, Virtual Rooms, and other equipment support the virtual learning process and allow the secondary schools to communicate with HP Catalyst project administrators at MMUST.

K'Owino was very cognizant of the varying skill levels in the use of technology when designing this project. Project participants were provided with extensive professional development workshops in the Microsoft Office suite, the virtual science concept, virtual chemistry laboratory, and data interpretation. This eased the transition towards incorporating technology in the secondary classrooms.

Hands-on Information Technology Virtual Laboratory Powered by Cloud Computing for Global Collaboration

East Carolina University
North Carolina, USA

Summary

The speed of scientific and technological advances, along with ever-present resource constraints, makes it very difficult for academic institutions to maintain technical currency in instructional labs. At East Carolina University (ECU) in Greenville, North Carolina, however, information and distributed computing technologies (IDCT) make it possible to share computing capacity and deliver remote hands-on learning experiences effectively and efficiently. IDCT also brings unprecedented collaborative opportunities between well-equipped schools and less-funded schools, and between developed countries and developing countries. The project is leveraging existing and new cloud computing systems and building a repository of virtual environments to share among faculty and students in secondary and tertiary educational institutions globally.

Virtualization technology allows a single physical computer to run multiple isolated virtual machines concurrently. Advances in virtualization and distributed computing have facilitated the development of cloud computing — a model of delivering information technology applications and services, on demand, over a private or public network. The ECU team is demonstrating how virtual labs provide a cost-effective way for schools to stay constantly connected and up to date. Their research includes establishing which collaborative tools are most effective so they can share this acquired expertise globally.

Teachers involved in the project have access to tools to design online laboratory modules, where students can perform experiments to better understand abstract concepts in science, technology, and engineering. Additionally, a repository of research and information will live in the virtual environment, so that instructors and students can easily contribute their ideas in real-time.

The Project in Action

The “Hands-on Information Technology Virtual Laboratory” project will be instrumental in demonstrating the educational potential of virtualization technology and cloud computing. Project leader Peng Li, of East Carolina University, emphasizes this point, stating, “I think cloud computing technology can be very useful in STEM education for different institutions and it can provide opportunities which were not available before.”

Thus far, they have developed two major phases of the project. First, they installed a private cloud system using HP servers, an independent VMware vCenter Lab Manager System. In addition, they built the network-attached storage using the HP Virtual Storage appliance, meaning that the entire private cloud system is running on HP hardware.

This HP Catalyst project team has also successfully developed and deployed virtual labs using VMware vCenter Lab Manager in several courses. This part of the project was based on some previous projects the team had started, and that the HP grant helped them to develop further. Li says, “The HP grant has helped us out in several areas like we are able to have our

in-house private cloud system to develop new labs, to test the new labs, and to deploy the new labs." Currently, the project team is collaborating with several partner institutions, such as the University of Cairo in Egypt to develop new content for the cloud systems.

The team has faced some obstacles with technical support. Specifically, tasks such as installing, maintaining, and developing the cloud system have proved challenging at times, and the project team acknowledges the importance of their having a sound technical support team for help with such issues.

Technology

HP provided this project with 15 HP servers, which have enabled East Carolina University to set up the in-house private cloud system. Currently, the team is using VMware vCenter Lab Manager and ProxMox Virtual Environment as systems to house the virtual private servers. In addition, HP provided an HP Virtual Storage Appliance. Without it, Li says, "We would not be able to manage the network attached storage. We could use some other open source technologies but they're just not as good as this one."

According to Li, technology training for this particular project has not been necessary. Li attended virtualization workshops in the past and the team already has experience working with virtualization. He notes, "Virtualization is very closely related to cloud computing. It is not cloud computing, but virtualization is an important foundation for cloud computing technology."

Learning to Create a Better Built Environment
Activity-Led Learning with ICT for a 21st Century Collaborative Global Education
Coventry University
United Kingdom

Summary

Communication is highly relevant to all industries, but is rarely a focus in disciplines, such as science, mathematics, and engineering, that will fill the jobs that build out our world. The Department of Civil Engineering, Architecture and Building at Coventry University in the United Kingdom and the Department of Architectural Science at Ryerson University in Canada are incorporating that explicit focus into their undergraduate programs for exploring global multi-disciplinary collaboration using a real case project with the main purpose to enhance communication and teamwork skills of future built environment professionals.

Students are participating in the project during their formative freshman year. During the first six weeks, freshmen in civil engineering and building courses are dispersed into small groups, and with each new task, the groups and each student's role therein continuously change to foster diverse experiences. Because of the fast-paced, changing nature of the students' workgroups, the communication of the initial design must be accurate. HP Elite Tablet PCs help students become fully immersed in collaborative activities and allow them to listen to podcasts that explore distinct communication styles. Ultimately, the impact of communication is illuminated and measured in their teamwork skills.

In the final year of the project, all undergraduate students will work in eight-person, competitive teams in UK and Canada to produce a design of a building, including outlines, costs, overarching company policies, and a construction plan — drawing upon their communication skills. This activity runs in one full academic year, culminating in the presentation and exhibition of the work in front of industry practitioners.

The Project in Action

"Learning to Create a Better Built Environment" project leader Robby Soetanto and his colleagues at Coventry University are breaking ground in multi-disciplinary fields related to the built environment. Their mission to simulate collaboration within this sector will provide his team with insights on how to adopt the most appropriate pedagogy practices for harnessing communication and teamwork skills to undergraduate students. Soetanto notes, "Apart from having different professions within construction and within the built environment sector, we also have to communicate and cooperate [with] our colleagues whether we've known them before or not across the distance here, and cooperate around the world globally. We try to simulate situations in our project."

The Coventry University team has gained a lot of traction in their project. They have been diligent about keeping project participants abreast on all project information so that students would be comfortable with assignments once the project began. The first participating course began in October of 2011 and will continue until April of 2012. During this time, undergraduate students have been busy working on collaborative projects.

When the class concludes in April, Soetanto and his colleagues will analyze data on the students' experience and outcomes of the technology-based collaborations in the course. "We plan to do at two least cycles to get meaningful data. The second cycle will start in September this year until April next year," Soetanto says.

Soetanto and his colleagues agree the greatest challenge in this HP Catalyst Project has been mitigating the scarcity of time and resources. Soetanto notes, "[We need] somebody who can help me collect the data and somebody who can help me to input the data on the software. That is very time consuming." The Coventry University team mitigated this issue by maximizing their personal time to complete the project. Soetanto notes another area where a future project leader may run into trouble. "We have to let the student know in advance what we need to do. [We] talk about six months beforehand." Full disclosure of project information from the beginning is key to establishing support for the project at both the administrative and the student levels.

Technology

Through "Learning to Create a Better Built Environment," HP provided Coventry University with Tablet PCs, desktop computers, and access to the HP Virtual Room. Students and teachers use the desktops and Tablet PCs for class projects. "We purchased a very modern and sophisticated trolley, which can host the laptops inside it. We just push the trolley to the classroom," says Soetanto. Thus far, the HP Virtual Room has been underutilized because students seem to prefer Skype, Dropbox, and email to keep in touch and share project materials.

According to Soetanto, no training was needed in the use of the HP technology as students and teachers were very tech savvy. While the HP Virtual Room has not been used to its full potential, students and teachers are finding it intuitive to use.

**Learning to Create a Better Built Environment
Experiential and Contextual Learning (ECL) with Information and
Communication Technology for a 21st Century**

University of Washington Foundation
Washington, USA

Summary

The University of Washington College of Built Environments (UW – CBE) believes that university curricula should be designed to promote critical thinking and problem-solving that targets real world issues. As such, UW-CBE is working to embed experiential and contextual learning concepts into courses at the University of Washington to bridge the gap between what students learn in class and how they can effectively apply that knowledge in settings outside of school. The current built-environment (BE) subjects architecture, engineering, construction, and urban planning will be infused with some of the most imminent challenges, including urbanization, globalization, and sustainability (UGS). UW-CBE activities under the HP Catalyst Initiative are led by faculty with the Department of Construction Management and administered through the University of Washington Foundation.

One of the goals of the project is to understand how cloud computing expands opportunities for teaching and facilitates the learning of skills and strategies needed for global collaboration on UGS challenges. Juniors and seniors, as well as adult learners in the Graduate Certificate program at the university will work with HP Touchscreen Mini Notebooks to engage in coursework where they are faced with resolving challenges in their communities. The plan is to increase retention and recruitment among marginalized students by making learning opportunities more relevant to them.

The learning activities, along with the technological infrastructure, will be located in the newly completed Pacific Northwest Center for Construction Research and Education. The University of Washington plans to share the outcomes of the project with other institutions in the Global Collaboratory Consortium and suggest new ways for incorporating experiential and contextual learning in BE disciplines through technology-supported methodologies.

The Project in Action

Giovanni Ciro Migliaccio is one of the five principal investigators working on “Learning to Create Sustainable Built Environments,” a project title that entails a number of activities designed to answer three questions: (1) Do cloud computing and technology facilitate the learning of the skill and strategy needed for global collaboration in regards to the built environment disciplines like urbanization, globalization and sustainability? ; (2) Does access to technology facilitate experiential and contextual learning? ; and (3) Does global collaboration using cloud computing facilitate recruitment and the subsequent retention of marginalized students into STEM disciplines?

Having received the HP technology in October 2011, Migliaccio explains that they are in the beginning stages of their initiative as it took some time to familiarize themselves with the capacities of the technology. There are, however, two activities in progress that are addressing these questions.

Currently, one of Migliaccio's colleagues and fellow principal investigator, Ken-Yu Lin, aims to prove that technology and virtual reality support experiential and contextual learning in a way that is superior to traditional learning and testing methods. For OSHA, Lin created a video game that simulates different situations in which a student must be able to recall best safety practices and regulations. The PIs believe this type of assessment is preferable for a student in the built environment discipline, because a written test cannot replicate a construction site. Migliaccio describes the virtual method of assessment: "They have a video game with a virtual reality environment where they navigate a job site and identify flag hazards and select what the worker should do instead. It's a better assessment because it's more real."

The grant from HP also supports an activity that demonstrates the efficiency and advantage of cloud computing and technology in regards to facilitating global collaboration. Co-principal investigator Carrie Dossick is overseeing the CyberGRID, an avatar-based virtual work environment. Already in its second year of existence, the CyberGRID is still benefiting from the latest technologies available. The number of Elite Tablet PCs provided by HP has introduced the possibility of integrating a touch/stylus component to the virtual platform, which will improve communication by allowing team members to present and share their sketches in the CyberGRID.

One more virtual activity that focuses on global collaboration is the HP Virtual Room where the graduate distance learning class takes place. This tool allows students from University of Washington to collaborate with students in India, the United States, the Netherlands, and Finland on project design and construction.

Shortly after their proposal was accepted, Migliaccio and his team were dismayed to find that their original planned partnership with Coventry University could not be carried out due to a change in leadership in the other institution. This development was especially disappointing since Coventry University also has a program in construction management. Migliaccio says that seeking out potential collaborators will be a bit more challenging. "All other institutions are in chemistry and computer science," he explains. "It's quite difficult; we have to learn about their discipline to start to think of how we could collaborate."

The logistics of integrating the technology have proved to be time consuming, which is why Migliaccio recommends that a project leader in a similar situation should anticipate all of the support that is needed to ease the transition. In this case, the team has trained a student to provide T1 support in every classroom that is equipped with a Mobile Workstation. Migliaccio thinks that this is absolutely necessary. "If you have technical issues during the test, it's a problem. You have stress on the students and stress on the faculty," he says. This measure will prevent frustration that could potentially lead students and faculty to turn away from the new technology.

Technology

The project leaders use most of the technology in the classroom, while 10% is used to support research. The University of Washington Foundation received touchscreen and non-touchscreen Netbook PCs. Since the netbooks could not run the software originally intended, they are now used to support student and faculty research.

Each project leader is assigned a certain number of HP Elite Tablet PCs for the development of their activity or for use in the classroom. Participation in the CyberGRID is now taking place using the Elite Tablet PC, as well as participation in another virtual platform for the graduate distance learning class. The video game assessments take place on Mobile Workstations provided.

Along with this hardware, the project is also in the process of integrating the HP Server, which will hopefully provide more bandwidth and allow students to take advantage of the access they have to professional applications that support architectural design and construction management work.

Thinking Global, Acting Local **Engaging Learners in Geospatial Technology**

GeoTech Center Partnership, Del Mar College
Texas, USA

Summary

Professors at Del Mar College in Corpus Christi, Texas, believe that implementing solutions that educate and improve communities begins in the classroom. The Global Geospatial STEM+ project arms students and teachers with the services and technical expertise to research local problems and engage in solutions that not only alleviate those problems, but also impact global issues.

One of the initial projects involves tracking immunization rates and their statewide impact. By utilizing innovative HP lab equipment, Hispanic students at Genesis Academy High School in Phoenix, Arizona can generate historic immunization maps and key in data layers that reflect immunization rates down to the county level. The emerging patterns in the maps illustrate to healthcare institutions the geographic areas where parents are electing not to immunize their children. In Texas, students at the Moody High School Innovation Academy are using HP lab equipment and computers to help local government agencies eradicate invasive plant species that are causing erosion by consuming precious water in semi-arid South Texas. Students from Moody spend time outdoors in streambeds collecting GPS points and plant descriptions and then return to their GIS lab to develop maps of the invasive salt cedar species. They overlay these maps with new and historic remote sensing satellite images to detect change over time as the invasive salt cedar encroaches on native plants.

Students at both locations are gaining a broader perspective on environmental and social issues. Acquiring such hands-on technical and analytical skills at a high school level opens up a series of doors for economically challenged students; the experience not only builds skills required for university study, but has clear and relevant application to the workplace as well.

The Project in Action

Faculty at Del Mar College adopted a new approach to secondary student learning by developing a collaborative HP Catalyst project with Genesis Academy and the Moody High School Innovation Academy. Project leader Phillip Davis notes, "We're trying to get [students] the critical thinking skills employers say are so important and to prepare them to go onto college. We do this by trying to take science, engineering and math they would learn in a traditional setting and expand it into real world projects and engage them with professional organizations and other projects that allow them to practice basically project based learning."

The "Thinking Global, Acting Local" team is about three-quarters of the way finished with its HP Catalyst project. Students at Genesis Academy and the Moody High School Innovation Academy have been heavily engaged in ongoing assignments. "Those projects are having an impact already," Davis remarks. Regarding students' progress at Moody High School Innovation Academy, Davis says, "We're starting to see output in terms of maps and reports they're producing." Students are equipped with mobile HP technology and have been working in the field, identifying invasive plant growth and recording it on maps. "Those maps can be given to crews out in the field who literally go out with brush hogs and they cut down

these certain types of plants,” Davis remarks.

Genesis Academy students have had great success in their project as well. Students have been busy tracking immunization trends in the area. Davis explains, “What’s interesting, the early results of that last year were of enough interest to the health department that they expanded to all 14 counties instead of just Maricopa County. So that was real successful. They’re producing maps that are going to be published on the Arizona Health Department’s website showing those.”

While “Thinking Global, Acting Local” has been largely successful, Davis and his colleagues at Del Mar College have encountered obstacles. The largest challenge has been integrating the project in the secondary schools’ stringent time and curriculum constraints. “It’s very difficult to come in and bring a new project and add something to an already busy year particularly for students because of the No Child Left Behind and because every state has mandated tests and teaching to the test and the curriculum really has no flexibility,” Davis notes.

This HP Catalyst project team worked around these restraints at Genesis Academy by working closely with GIS teacher Louis Blueze, who helped blend the project into an after school program. They alleviated this problem at Moody High School Innovation Academy by leveraging the project into the school’s Academy of Excellence, a program within the school that allows for a more flexible curriculum in the Innovation Academy for Environmental Science.

Davis and his team have learned a lot through this HP Catalyst project and suggest that future project leaders pick partners carefully. Davis notes, “The success or failure lies greatly upon the partnerships within the project. Be sure that participating teachers and students are dedicated to the project but also that their superiors are as well. Administrative support is equally important so teachers have support to take the extra time and effort needed to complete the project.” He also suggests that project administrators be realistic about their project’s potential and not try to achieve the impossible.

Technology

Through their HP Catalyst project “Thinking Global, Acting Local,” Davis and his colleagues at Del Mar College received desktop computers, HP Elite Tablet PCs, and a server. The Genesis Academy partnered with a local YMCA to create a technology room within the YMCA building. Here Genesis Academy students completed project work on one of the 20 desktops connected wirelessly to the HP server. Students used GIS software installed on each of the computers to track public health and immunization information.

The Moody High School Innovation Academy project requires more mobile technology. Davis explains, “At Moody we were using the Tablet PCs with the pullback screen to be able to go out and do basically field data entry.” Students import their findings into a database to create digital maps tracking invasive plant growth. As the teachers involved in the project specialized in GIS, little outside training was needed. Davis organized a system for technical issues that would arise in the project. “What we did was got a GIS technician, John Nelson, who works with GeoTech. And, John provided basically technical support for both Louis, [at Genesis Academy,] and Charlene, who is a GIS teacher over at Moody High School.”

The Measuring Learning Consortium

Led by Carnegie Mellon University

Centrale EAT Innovation Framework *Adapting Training to Companies' Needs*

Ecole Centrale de Lyon
France

Summary

What is the secret to taking academic knowledge and transforming it into workplace skills? The Ecole Centrale de Lyon in Ecully, France, is committed to answering that question, putting it into place in their classes, and ensuring that their students are workplace-ready when they leave. Their Innovation Framework includes both a classic course syllabus and a list of the real-world skills students will need and learn for every course. A balanced mix of traditional lectures, self-study, team projects, and internships provides the means to put those skills into practice.

HP Elite Tablet PCs are an important part of the mix, providing engineering students more mobility and encouraging them to collaborate more frequently — both within and outside of the classroom. Ecole Centrale de Lyon uses a web-based e-portfolio for teachers to collect and validate a student's work, in tandem with a secure web service called Knowledge Broker. Knowledge Broker is used to catalog core competencies for various organizations, but what makes the tool especially useful to students is that the students who preceded them at the Ecole Centrale de Lyon have written all of the definitions of the knowledge necessary to master each competency. The current crop of students will be expected to refine the descriptions and add new ones for future classes.

One of the hypotheses that Ecole Centrale de Lyon is exploring is the impact on learning when a student transfers his or her knowledge through Knowledge Broker to the next generation of students. Does writing the content provide the student with a better understanding of the knowledge? A related research question is what is the place of the teacher in this model: moderator, corrector, or mentor?

The Project in Action

Jean-Pierre Berthet is the Chief Information Officer at Ecole Centrale de Lyon and the project manager of this HP Catalyst Initiative project. Berthet is implementing a curriculum that uses HP technology to measure and test skills acquisition among student engineers. "Our goal in the project is to measure how to validate skills of students instead of measuring only the learning about domains," explains Berthet. "We are working on the different ways to test skills during lectures, teamwork projects, internships in companies, and so on." Berthet is paying attention to the group acquisition of skills as well.

In partnership with EMLYON Business School, Ecole Centrale de Lyon is working to establish The Learning Lab, a training center where teachers will learn to implement new software and

technologies in their courses. According to Berthet, teachers may also have the opportunity to learn from existing models. He says, "We will, of course, try to organize trips around the world for a group of teachers in order to see what happens in other places and how other universities try to change the way the students are learning, especially those universities where they're working on skills and how to manage group acquisition, for instance."

The schools have paired together to create a new program for a master's of science called Innovation, Design, Entrepreneurship and Arts, which will incorporate cutting edge technologies. Berthet considers their relationship to be complementary. "We really think there will be a strong link between the two consortiums because we are in the Measuring Learning Consortium, and they are in the STEM-preneur Consortium." With similar strategic projects, he sees their collaboration as long-term.

To implement a similar initiative, Berthet recommends looking at other engineering schools and seeing how skills are integrated into their curriculum, and then to consider the nature of professional skills that are being sought by different companies — both short and long term. "You will need to look at what skills the students we are training will need in the next 10 years," he says. He believes that technology will help provide the comprehensive training students need to meet the demands of their industry as professionals. "You need both," Berthet says. "The short term skills needed by companies, but also long term skills — what they have to acquire independently of what kind of job they will have."

One challenge Berthet has encountered is characteristic of initiatives that integrate technology into curricula. A few teachers must be persuaded of the benefits that come with changing the standard from classical learning to a focus on skills acquisition. "It's very difficult to make teachers answer to this new way of thinking about their courses, and their thinking of the way to measure learning," Berthet says. To ease the transition, Berthet recommends educating as many of the participant instructors as possible about skills acquisition before implementation.

Technology

As part of the HP grant, Berthet received HP Elite Tablet PCs and a Virtual Room, which are used by teachers and students. The HP Elite Tablet PCs provide access to electronic portfolio software, and can be used to show proof of acquisition of skills, either numerically or with drawings and sketches. The Elite Tablet PCs also serve as tools to annotate students' work. To familiarize the teachers with HP technology, Berthet organized meetings where teachers could exchange experiences. In these sessions, he introduces them to new software and provides a space where they can share ideas about how to best implement the tools.

Currently, HP and this project manager are working on a new product called the Touch Mount Presenter. This device will help adapt the Elite Tablet PCs to large audiences. Berthet says, "We worked with HP in Europe with one product, the all-in-one PC, with digital inputs and the possibility to annotate." The Touch Mount Presenter connects the PC to a projector and will allow for flexibility in presentation modes. To give an idea of the two possible positions, Berthet explains: "A presentation board you have in front of the audience and in three seconds you can move it to a vertical position and use it just like a whiteboard." An annotation function will also be employed.

**Critical Support Systems to Enhance the
Development of 21st Century Expertise in Engineering Students
Using Tablet PCs and Associated Technologies, the Framework for 21st
Century Learning, and Guidelines from Research on How People Learn**

Fundación Universidad de las Américas, Puebla
Mexico

Summary

The engineering department at Fundación Universidad de las Américas, Puebla recently generated new curricula for its undergraduate degrees of chemical, food, and environmental engineering. During this project, they will design courses based on technological advances and extensive research on the learning and cognitive processes that foster skill mastery. They will use formative and summative assessment models to evaluate students' attainment of 21st Century Skills in order to develop the most effective teaching methodologies.

The goal of Fundación Universidad is to develop a critical support system that measures students' subject comprehension so instructors can adjust their pedagogies in real time. In building this system, they will create instruction activities, professional development opportunities, and student-centered learning environments. Students will each have their own HP Elite Tablet PC in order to complete assignments, communicate with teachers, receive feedback on their work, and collaborate with each other.

Each instructor's Elite Tablet PC will be connected to a projector to communicate lessons to the students. Through InkSurvey, a web-based tool developed by the Colorado School of Mines, teachers will pose open-ended questions to students and receive real-time responses. Students will also be able to add their own annotations to course materials on the instructors' Elite Tablet PCs using Classroom Presenter.

The Project in Action

HP Catalyst project "Design of Critical Support Systems to Enhance the Development of 21st Century Expertise in Engineering Students" is re-inventing the way professors and administrators at Fundación Universidad de las Américas, Puebla look at education. Project leader Enrique Palou and his team are utilizing recent pedagogical and psychological research findings to shape the way classes are taught at the university level. Palou explains, "So the idea is to use the framework for 21st Century learning and guidelines from research on how people learn in order to define standards for the chemical, environmental, and food engineering 21st Century expertise."

Palou and his colleagues at Fundación Universidad de las Américas embarked on their project September of last year. Since then, they have successfully designed the curriculum for courses in which the student evaluation technology will be implemented. Palou remarks, "We're working with several PhD students and the course instructors and we're developing this learning environment and the formative and summative assessments and designing instruction activities in several courses." Upon course completion, the project team will collect data on the effectiveness of the new technological learning tools in the classroom.

This HP Catalyst project incorporates a great deal of collaboration with previously HP-funded organizations. "We have been using several technologies developed by other members of the original HP project. And some of them are in the same consortium as we are. We have been using the associated technologies developed by the University of Washington and the Colorado School of Mines." Palou and his team utilize the University of Washington created "Classroom Presenter" and the Colorado School of Mines created "InkSurvey" as a means of wirelessly connecting students to their teacher for real-time feedback.

While Palou and his colleagues have accomplished a great deal since the inception of their project, they have also experienced a few challenges. Regarding the teachers participating in the project, Palou explains, "They don't know how to use a Tablet PC and some of the associated technologies. In some cases they are afraid of using them." This obstacle has been largely overcome by peer-to-peer interaction.

A few of the teachers quickly became comfortable with the Elite Tablet PCs, which has had a great influence on the rest of the group. By encouraging and supporting their project participants, the project administrators have motivation force within the group. Palou remarks, "Also, for example, some students that took a course the past semester, they are now expecting to use the Tablet PC and the associated technologies in the following course. Now the instructor is like being pushed by the students."

Palou recommends that anyone interested in launching a similar project at a university spends ample time planning out who will participate in the project and incorporating them as much as possible in the project plan. He notes, "In our case, we work with every teacher of our department to define standards for each of the curriculum. That has been very helpful because everyone was involved from the beginning."

Technology

Through their project, Palou and his team at Fundación Universidad de las Américas, Puebla were provided with HP Elite Tablet PCs and laptops. The classrooms used for this project contain 20 tables with four students at each table. Students from the participating classes are assigned an Elite Tablet PC, which connects wirelessly through a server to the teacher's tablet. The "Classroom Presenter" and "InkSurvey" software programs are connected to the server and enable students and teachers to communicate throughout the lecture as a means of evaluating student understanding of the new course material.

Palou explains, "Each student uses one Elite Tablet PC and he or she is able to respond to open ended questions by the instructor and the instructor will receive in real time the student responses. And then this instructor is able to make real time technological adjustments if needed." PhD students at Fundación Universidad de las Américas, Puebla, use the HP-provided laptops to generate learning objects and activities to be tested by students on campus.

Palou and his project team have been working with participating teachers on a one-to-one basis in the use of the technology. However, in hindsight, Palou expresses that it would have been better to design a formal professional development workshop to get the teachers more comfortable with using the Elite Tablet PCs in the classroom. He suggests that anyone looking to launch a similar project keeps this in mind when developing the project plan.

HP Learning Lab
Collaborative Assessment Platform for Practical Skills
(CAPPS) for K-16 STEM
Amrita University
India

Summary

In rural India, many schools lack high quality resources for STEM learning, including laboratory equipment, as well as anywhere near the number of teachers necessary to educate the hundreds of millions of students under age 25 across the country. Amrita University plans to address the postsecondary aspect of this, and to reach many more students via a multilingual collaborative platform that can be used remotely to teach language, promote adaptive learning, and run virtual experiments. The platform will include a framework for the assessment of reporting and procedural skills, so that students can better concentrate their efforts on the subject areas they need to master.

The platform uses Amrita University's cloud-based eLearning Network, which will make it possible for a pilot group of 3,400 K-12 students across several rural Indian schools to comprehensively test the platform. The participating learners will use HP Mini Notebooks and Elite Tablet PCs to run virtual experiments and watch simulations and animations focusing on key STEM concepts over a period of six months.

As the students use the collaborative platform, they will be subjected to continuous learning assessment. A feedback loop will provide them with personalized attention and interventions that are attuned to their skill levels and styles. To evaluate the outcomes of this project, Amrita University will use qualitative and quantitative analysis to measure changes in a number of key outcomes, including student attitudes, learning, motivation, and high order thinking skills, as well as the collaboration between the teachers who are developing and using the online material.

The Project in Action

"HP Learning Lab Collaborative Assessment Platform for Practical Skills (CAPPS) for K-16 STEM" seeks to improve the state of India's STEM education approach at the secondary level. Project Investigator Raghu Raman states, "STEM has both a theory component and a practical component. And the practical component is neglected quite a bit." Raman and his colleagues at Amrita University aim to bridge this gap through their pioneering HP Catalyst project.

This need has long been identified in rural Indian primary and secondary schools, and the Indian Government sought to partner with universities such as Amrita University to rectify this. Thus, Raman and his team at Amrita University were able to jump quickly into meeting their project's goals.

The project was implemented in five secondary schools in Kerala and the positive impact of the cloud-based eLearning Network has already become apparent. According to Raman, "A survey from the deployment showed that the students found the content beneficial to their learning process, and felt that the topics were well-covered. Seventy-six percent agreed that O Labs improved their understanding of the subject. Ninety one per cent of the teachers felt

the lab environment was well-simulated and found the animations effective." Raman and his group are currently refining their data collection and continuing to the next phase of measuring learning outcomes within the project.

The team's strength comes not only from within the Amrita University community, but also from its strong partnerships at the national and international level. Amrita University works closely with the Indian Government's Department of IT in the Ministry of Communications and Information Technology, and Department of Science and Technology. The group also collaborates with the Central Board of Secondary Education and Intel Teach to the Future. "Recently we started discussions with University of Colorado's Interactive Simulations project called PhET," Raman notes. The team is eager to see where this potential future partnership will take them.

While Raman and his team have accomplished much throughout the project, they have also overcome multiple obstacles. The largest challenge was integrating the computer-based labs into the teaching timetable so that this became part of the teaching curriculum. The team also struggled with availability of enough computers for one-to-one computing, and wished they had procured more equipment.

Technology

Through "HP Learning Lab Collaborative Assessment Platform for Practical Skills (CAPPS) for K-16 STEM", HP provided Amrita University with laptops, Elite Tablet PCs, and Virtual Room software. The project team distributes the laptops and Elite Tablet PCs to participating schools for student use at a one-to-one ratio. They also install a learning lab using the laptops and other digital learning tools for practical skills curriculum in STEM subjects. The technology is incorporated in the teachers' lessons, as students access the online learning lab to conduct interactive projects based on what they are learning in the classroom.

Raman explains, "Under this project a HP-based infrastructure will be created that will enable online experimentation and collaboration among 3000+ users from 27 K-16 institutions across 4 geographically distributed states." According to Raman, the hope is that "students on this project will connect directly with other students in HP Consortium partner organizations using freely available communication tools like Skype, Google talk, Google Docs, etc. to share their ideas."

So far, the students and teachers participating in the project have been very computer literate so basic technical training has not been necessary. However, over 90 teachers were provided a hands-on workshop on computer-enabled simulation based practical experiments. Once the students learn how to use the technology for experiments, teachers have seen a vast improvement in their interest in science. "You ask them to write on a piece of paper and sit and watch a teacher performing and they're so bored. In this way, they have full command and control of the computer," says Raman.

Measuring Learning in STEM+ Classrooms Using Tablet PCs for Real-Time Formative Assessment

Colorado School of Mines
Colorado, USA

Summary

Students are used to raising their hands with a quick answer, but what if their responses were expected to demonstrate the depth of their real-time understanding? For six years, the Colorado School of Mines (CSM) in Golden, Colorado, has been using student responses to measure their mastery of concepts in real time. When instructors pose questions, students are expected to construct robust responses on their Elite Tablet PCs that go beyond words, incorporating graphs, diagrams, equations, and more. The answers are then transmitted to teachers instantly via the school's web-based, platform-independent software, InkSurvey.

A related component of the project is designed to improve student creativity, ingenuity, and the ability to innovate. A special physics course was created to hone these skills through active, collaborative learning and then to measure their growth via real-time formative assessment. InkSurvey, the open source platform that supports both components of the project, is made available to anyone at no charge.

In addition to making learning more engaging for students, the CSM model provides immediate and insightful feedback to teachers. The project is currently underway with nine instructors, whose classes will provide a test bed for analyzing the value and impact of the approach. The ultimate goal for the Colorado School of Mines is to extend its best practices to other classes and other universities.

The Project in Action

Susan and Frank Kowalski are the leadership behind this HP Catalyst project, which builds upon the existing InkSurvey software that was developed in a previous HP-funded project. "First of all, we're trying to understand what obstacles people would have in implementing this [software] in their own classroom and figure out what are the best practices that we can tell them so that everyone doesn't have to learn that for themselves," says Susan, "and then the other phase of our project is trying to use this InkSurvey in a more novel context. And that is trying to promote creativity in science and engineering."

While the team at Colorado School of Mines has achieved a great deal, perhaps the most salient accomplishment is its breadth of partnerships. When asked about collaborative efforts, Susan comments, "Well I guess from our perspective we feel we have something to share with other people and we just love to see people use it."

Relationships with other project leaders in the consortium, such as with Ronald Maniglia at Rancocas Valley Regional High School and Tonia Lovejoy and Heather Halstead from Reach the World, have provided new perspective on the value of the technology and how it is being implemented in the K-12 setting. They have also gained valuable insight into the international perspective through contact with Fundación Universidad de las Américas, Puebla in Mexico.

Frank and his fellow project administrators have been gathering and analyzing data from Colorado School of Mines students and teachers who participated in courses in which the technology was implemented. They have also published their findings and are sharing it with other members on campus and throughout the Measuring Learning Consortium. One interesting discovery is the fundamental shift back to the Socratic Method, which is now possible with the technology. By receiving real-time student feedback in class, which requires more depth than the traditional multiple-choice assessments, teachers are able to refine their lesson based on what the students understand. It brings the large class sizes back to a nearly one-to-one learning experience.

However, “Measuring Learning in STEM+ Classrooms” has experienced challenges, too. There was mixed student feedback early on. “The students love it when you put a tablet in their hand but the reality is when they sit in a class that’s using InkSurvey and all of a sudden they have to work a lot harder in that class,” explains Susan. It was also difficult to find teachers willing to change their curriculum to accommodate the mental agility required for this new learning process. According to Frank, it is important to stress why the technology is being implemented so that participants will understand its importance and hopefully be more perceptive to the change.

When asked for suggestions for future schools hoping to start a similar project, Frank recommends giving students the freedom to help in the project implementation. “I think the advice would be if you decide to do something to pursue a particular thing, make sure deep down you really believe it has potential- you have a vision of where you’re going with it,” says Frank.

Frank and his cohorts recently created a video explaining their project and how the InkSurvey software can be used in the educational setting. They posted it on YouTube and have received very positive feedback. The team is now in the process of making more videos that will help people in the beginning phase of implementing the technology. They are creating a single website, which will host a series of videos that capture key elements of the hands on technology training that was conducted on the Colorado School of Mines campus.

Technology

Through “Measuring Learning in STEM+ Classrooms Real-Time Formative Assessment at an Engineering University”, HP provided Colorado School of Mines with Elite Tablet PCs, which the students checked out to use InkSurvey in their classes. HP also provided the school with a server that administers and delivers the InkSurvey software worldwide. A Virtual Room was also created where Colorado School of Mines HP Project participants can interface with other project leaders and participants. It has proven onerous to connect with people abroad but has served as a great way to share project challenges and successes with other domestic HP Catalyst project participants and others interested in discussing the project.

Frank and his team administered multiple training sessions for teachers and students on the use of the technology. They also conduct periodic check-ins to ensure that everything is running smoothly.

MoPS Project
Mobile Grid Platform for STEM Subjects
(Social Learning and Knowledge Measurement)

National Research Irkutsk State Technical University
Russia

Summary

When students become the teachers themselves, everyone learns. That is what Irkutsk State Technical University in Irkutsk, Russia, and the Chinese University of Geosciences in Beijing expect will happen as they explore a new education platform they call MoPS that utilizes mobile devices and social networking techniques. The essence of the idea is that students themselves will generate problems and ideas, communicate them via their mobile devices where they will then be distributed among their social networks. Peers who receive the communication will be encouraged to provide a solution, which itself will be further discussed within the community. The result is students educating other students.

Students learning STEM subjects must be privy to a wide spectrum of problems in order to acquire the diverse problem-solving skills needed to be competitive in the job market. Often, access to these problems is limited. By allowing students to generate their own problems, they become active participants in their own education.

A novel mobile-based knowledge measurement model allows any member of the community to generate a new problem, and then send it automatically to a randomly selected section of their peers. If this problem is solved by a sufficient number of students, it can be sent beyond the boundaries of the class to more extended communities. Early indications are that the approach is highly motivating, and one reason is that the collaborative environment teaches students to set up learning objectives. The responses that materialize offer tangible and immediate proof that the objectives were fulfilled.

The Project in Action

HP Catalyst project leader Kirill Lebedev and his colleagues at National Research Irkutsk State Technical University are breaking ground in 21st Century student learning. This team has incorporated an interesting concept in their project- the use of social networks as a means of expanding learning. One of the most unique pieces to this project is the fact that it centers on a student-motivated, student-led educational movement. "Our idea is basically the students should generate questions for each other among their friends in classes. And our project aim is to simplify this process of questioning each other," explains Lebedev.

Lebedev and his team at National Research Irkutsk State Technical University developed an educational model based on peer-to-peer learning. In explaining the peer-to-peer learning model, Lebedev uses the example of asking your peers to respond to the question "What is two plus two?" he says, "If we got a lot of correct answers, for example, everybody says it's four, the problem is not interesting for everybody because it cannot give new knowledge." Equally so, if a question posed receives mostly incorrect responses, it is deemed too difficult for that level of learning. "We use this technique in real classes and students and teachers were very excited about this educational model."

The project team at National Research Irkutsk State Technical University only recently received the HP technology and is almost complete with the beta version of the platform for these online collaborative questioning techniques. Lebedev notes, "I think in a month or two we will have beta version of our software that can be used on the Internet."

When asked about the largest obstacles in the development of this project, Lebedev notes, "The problems we faced were mostly the technological approach problems. We suggest the use of peer-to-peer networks to manage peer-based questioning. And this technique is not well developed in computer science for such kind of software." Lebedev and his team mitigated these challenges by educating themselves on software development and implementation. "We set up our project and developed an educational model without a good view on how to implement software. And not all of our educational ideas [have been] implemented now because our misunderstanding of our ability to implement ideas and so forth." Future project leaders can save themselves a lot of backtracking by partnering with IT specialists already knowledgeable in the field, and by conducting ample research before starting the implementation part of the project.

Technology

Through the HP Catalyst project, National Research Irkutsk State Technical University received HP Elite Tablet PCs and servers. The server houses the online communication platform for students and teachers to access from their computers, and has been integral in testing the beta platform. Lebedev says, "As we get beta working fine we will use these tablets, these netbooks as a base for us to set up our MoPS education platform and MoPS software."

It is anticipated that little training will be needed for project participants to familiarize themselves with the HP technology. The online communication platform is designed in such a way that students and teachers will find it very accessible.

A Quality-Aware Evaluation System for STEM+ Education

Hong Kong University of Science and Technology
China

Summary

How does one measure the quality of a curriculum? Hong Kong University is committed to evaluating, understanding, and improving the quality of education, with the goals of modeling best practices in course design, teaching, and learning. The model they are applying provides teachers with real-time feedback and the opportunity to revise their curriculum to quickly adapt to emerging needs.

In addition to collecting assignment and exam scores, Hong Kong University will gather statistics on students' clicks on course materials and system query logs and ensure the accuracy of this information by comparing it to other data collection sources. They will also formally define red flags that indicate problems with course materials. The goal is a comprehensive system that will monitor and guide teachers and students through every phase of the teaching/learning cycle.

One thing that is clear to educators at Hong Kong University is that the rapid proliferation of the Internet and a broad array of software tools have triggered immense change in effective teaching approaches. That shift, coupled with the fact that the role of learning styles in STEM education has become much better understood means that making good decisions in the design of learning experiences is all the more important — and that is the driving force behind Hong Kong University's quality-aware system.

To establish a platform for evaluating course, teaching, and learning qualities, Hong Kong University will utilize the HP Multi-seat Desktop Lab and HP servers to store the organized, large-scale data. A query interface will make it easy for both teachers and students to use the system, provide insightful feedback, and collaborate on the development of the quality-awareness model.

The Project in Action

Project leader Lei Chen explains that his goal is to create a model that will improve teaching and learning by identifying the factors that affect a student's interaction with the material. To this end, Chen has established the HP Teaching Lab at Hong Kong University of Science and Technology. Inside the lab, students answer questionnaires and deliver feedback about the courses discussing their major difficulties. As a result, professors stay abreast of student reactions to their courses, and can redesign their lessons to make their lectures more effective.

Still in the first stage of the project, the lab is collecting data about the learning process. Lei Chen is concerned when he describes the development of the project. He reports that everything is set: there is a mountain of data, statistics have been calculated, but the investigation has hit a wall. "The data is there but we need to do the mining to find what the hidden process is. We notice statistics but it does not show what the reason is," he explains. So far he reports that he does not have the support to complete his objective. "The project is kind of half done because I need some innovation funds to hire some research associate to

really do the data mining to set up the whole model. I have the data now but we don't have the manpower. Otherwise I have to do it by myself. It's not possible."

Despite the obstacles to his project, Chen has big goals. He finds it remarkable that the UST is the only university in Hong Kong to receive support from the HP Catalyst Initiative, and he thinks that his model can be promoted to the other eight universities. He explains, "The reason is that the whole idea, the Catalyst Program, is that we try to improve the science and the technology teaching to the whole education institute, not only one or two. So I have a big goal to promote this program to the whole of Hong Kong, not just UST."

Working toward this goal, Chen connected with other members of the consortium who indicated interest in his model during the Catalyst Summit in India last year. Once his project is complete, Chen hopes that his conclusions will help improve the quality of teaching and learning at other institutions, such as Beijing University.

Technology

This HP Catalyst Initiative project received 42 laptops to equip the HP Teaching Lab at the UST where STEM courses take place. Chen says that since finding that some laptops have powerful graphics cards, he has been able to assign graphics courses to the lab. Students are also doing 3D modeling and 3D object display. As part of the project, students are using the machines to fill out questionnaires about the new technology so that Chen can find out more about the process of learning.

Real-Time Assessment of Standards-Based Declarative and Procedural Knowledge

Rancocas Valley Regional High School
New Jersey

Summary

At Rancocas Valley Regional High School in Mount Holly, New Jersey, teachers care deeply about producing students who not only know the material taught in their courses, but can apply it in ways that demonstrate mastery of 21st Century critical-thinking and problem-solving skills.

They are concerned that traditional means of assessing knowledge provide little immediate or relevant feedback to most students, and so they are investigating questions like these: How can practical real-world tasks be designed and administered that effectively integrate the use of technologies into classroom assessments? Which aspects of technologies improve and/or hinder student attainment of specific declarative knowledge and procedural skills? Does the immediate feedback provided to students through technologies improve student performance with respect to targeted standards and learning outcomes regardless of other intervening factors such as gender, socioeconomic status, or learning disabilities?

Teachers are currently completing the preparation of course maps that detail content-specific Big Ideas, Essential Questions and Enduring Understandings. This project will add to that work by developing new ways to evaluate the student's core content knowledge of biological and environmental sciences and algebra. Questions will not only demand students recall basic facts, but also employ higher-order thinking skills to interpret information contained in graphs, charts, and diagrams, and challenge students to generate original content; use models and simulations to explore concepts; collect and analyze real-time experimental data; and collaborate with other learners beyond the classroom setting to solve problems.

The Project in Action

According to project leader Ronald Maniglia, "Real-Time Assessment of Standards-Based Declarative and Procedural Knowledge" focuses on using the technology to increase student performance by providing immediate feedback on activities that they do in class. An increase in student performance is already evident. One math teacher reports preliminary results of a near 20-point difference between the control group and the target group using the HP technology. While science teachers have reported more mixed results in student assessments, teachers and students alike are enthusiastic about the use of technology in the classroom.

"It activates their learning, and it energizes the kids," reported Maniglia. This enthusiasm has fostered more opportunities for collaboration amongst teachers within the school. According to Maniglia, "There was a lot of collaboration. [For example], one teacher would create one online assessment and then she would share it with the rest of the teachers." Additionally, positive student and teacher feedback combined with outside interest in the project has sparked a partnership between RVRHS and the Colorado School of Mines, where similar student assessments are already established. The two schools are currently collecting and exchanging data to compare the changes in student performance as a result of technological assessments at both high school and college levels.

Rancocas Valley Regional High School math and science teachers who are participating in the HP Catalyst Initiative project noted that they were pleased with the new and dynamic additions to their lessons and will continue to use the HP technologies upon project completion. Teachers in other departments who were not included in this project have also expressed interest in the use of similar student assessments in future course curriculums, and there are plans for future cross-trainings between math and science and humanities departments regarding the use of technological assessments in the classroom.

While “Real-Time Assessment of Standards-Based Declarative and Procedural Knowledge” has had an overall positive impact on students and faculty at RVRHS, participants experienced a learning curve early on. Maniglia recommends maintaining concrete, yet realistic goals to account for the major technological transition. Additionally, it can be challenging to invoke such a drastic change in teachers’ curriculum design. It is also important to acknowledge qualitative feedback during project evaluation, as this may provide a clearer picture of how students are handling the new assessments. This proved particularly relevant in the case of special education students. “They become overwhelmed with the technology so that was an unusual finding which we did not expect,” said Maniglia.

Technology

Through the HP Catalyst Initiative, HP provided Rancocas Valley Regional High School with various technologies, including HP Elite Tablets, HP Mini Netbooks, HP Touch Pads, and math and science kits. Math and science teachers utilize these tools to create simulations for students, while students are assigned individual laptops for assessments, web searches, and surveys. The project focuses on using this technology to increase student performance by providing immediate feedback on activities that they do in class.

Using Machine Learning to Measure Student Learning

North-West University
South Africa

Summary

For students from backgrounds that were excluded from formal learning in the past — such as many from the historically disadvantaged communities of South Africa — the path to STEM+ excellence is steep. Conventional learning environments do not account for the strengths and weaknesses of such students. North-West University will quantify these differences in capabilities by measuring behaviors of students engaged in real-world learning tasks.

Electronic courseware will be instrumented to measure — and subsequently improve — the ways in which students utilize various resources in tutorial sessions. Methods from statistics and machine learning will be employed to gain an understanding of the relationships between student behaviors and the different performance measures. Clustering will be used to extract meaningful groups of student behaviors; classifiers will be designed and analyzed to determine student behaviors that predict successful learning, and outputs from these analyses will be used to suggest learning interventions.

The proposed work will extend current research of the Counseling Psychology department on the first year student experience in STEM learning. Because South African students come from many diverse backgrounds, this study will offer new insights on how the learning patterns of different students are conditioned by their earlier learning experiences.

The Project in Action

In an environment flooded with social and political changes, Etienne Barnard and his colleagues at North-West University have sought an interesting approach to analyzing and mediating the repercussions that the apartheid era has had on higher-level learning. “We are trying to understand the specific characteristics of our group of students,” says Barnard, “and understand how those changes are impacting the new generation of students that we see.” In the project “Using Machine Learning to Measure Student Learning”, instructors and project participants were able to track the students’ academic work at a very fine grain level. “The unique and exciting thing about this project is it was less focused on curriculum content and more focused on general principles,” reports Barnard.

The project consists of three phases: curriculum and software development, student activity measurement, and conclusion. “We’ve developed the tools that allow us to measure how students use these components and to analyze what the impact of their technology use is on their performance in various dimensions,” reports Barnard. He and his team are now analyzing data from the first cycle of student activity measurement. Upon completion of this step, they will begin collecting data from a new group of students and academic courses.

Early on, Barnard began collaborating with faculty and staff at Carnegie Mellon University. “[They] provided a lot of theoretical insights that have gone into the way in which we designed our tools and we’ve also actually received data from other consortium members to kind of put them through the same tools that we are developing for our students in order to

understand sort of what the capabilities of what these tools are for various other scenarios," says Barnard.

In the midst of this HP Catalyst project, North-West University is experiencing a significant transition. The school is expanding from solely an undergraduate program to include research and education at the graduate level, which may have augmented some of the challenges faced throughout the project. The IT infrastructure was initially incapable of supporting the modifications necessary to equip laboratories with the technologies used. The team experienced difficulties in the beginning phases of creating a system that properly integrated the new HP learning tools.

Additionally, the project required a dramatic change to the learning status quo, which required an acceptance to break from the conventional curriculum. Barnard suggests that future project leaders engaging in a similar project solicit administrative support early on to alleviate these types of challenges. Additionally, collaborations with other consortium members proved to be very useful.

Technology

HP provided North-West University with HP Elite Tablet PCs, laptop computers, workstations, and video conferencing software for use in the Catalyst Project "Using Machine Learning to Measure Student Learning." The HP Elite Tablet PCs were assigned to three professors, each teaching one of the courses involved in the project. Elite Tablet PCs gave instructors the ability to personalize their demonstrations and activities to meet the individual classes' needs, in turn allowing students to shape their learning process through discussion and questions.

During lab sessions, each student was designated a laptop computer for use in experimental investigations. At that point, Barnard and his team were able to measure how the students were using the education technology. The multiuser workstations were used in two computer labs for lab work as well. The new technology at North-West University has served a very positive, practical function by creating a more dynamic, interactive learning environment. "But then theoretically we're also hoping to develop some tools that will assist others to understand at a level of detail how education technology impacts the performance and the learning of the students," says Barnard.

The Multi-versity Consortium

Led by the Sloan Consortium

Blended On Line Collaboration For Global Engineering Education Excellence

Pontifical Catholic University of Rio de Janeiro
Brazil

Summary

Pontifical Catholic University of Rio de Janeiro (PUC-Rio) is rethinking effective teaching models for the Introduction to Engineering course. By balancing lectures and videoconference with hands-on projects, their goal is to adapt the contents of conceptual foundation classes in Engineering to better serve the needs of remote learners. The material covers all the vital components that comprise the life of an engineer — from the challenges and social responsibilities to the specifications and costs of a project to marketing and presentations.

Working in partnership with the Indo US Collaboration for Engineering Education (IUCEE) at UMass Lowell, the International Federation for Engineering Education Societies (IFEES), and the Student Platform for Engineering Education and Development (SPEED), PUC-Rio will create two virtual classrooms of 30 students each as a strategy to increase the technical knowledge of students in the first semester of the engineering curriculum.

The Virtual Rooms will provide the collaborative environment needed to engage the students in the innovative learning processes first piloted by the IUCEE. As one example from a lesson about the importance of reports in the real world of engineering, the teacher might distribute a variety of sample reports, all distinctly ranging in quality, along with related theoretical materials (slides, videos, etc). The students would then read and debate the reports in the virtual environments, eventually agreeing on the best report among them to use as their course standard.

The Project in Action

“Blended On Line Collaboration For Global Engineering Education Excellence” Project Investigator Marcelo Dreux believes this project’s greatest contribution to Pontifical Catholic University of Rio de Janeiro Engineering Department is its ability to motivate and uniquely prepare students for their intense years ahead in the engineering program. It also accommodates each student’s individual learning process, as students may complete lectures at their own speed. Dreux explains, “In the past we had to give ten lectures about the same subject for 700 students, so 10 classes of 70 students each. It was boring for us. So, we decided to put this material online. That way the students go there when they want at the speed they want.”

This new approach to the required introductory engineering courses will re-engage students in the field’s foundation. Regarding the dynamic of the classroom and ability to maximize

student interaction and activities, Dreux says, "I think it's really improved a lot. We will have more time to do the hands-on part of the project."

Early on in the project, Dreux and his team collaborated with SUNY Empire College in New York. Betty Lawrence, project leader of Empire State College in the Multi-versity Consortium, provided PUC-Rio with samples of her online project. These resources aided in the design and development of Dreux's engineering course modules. Dreux and his colleagues have successfully developed four modules and are in the process of uploading them to their online system. He hopes to create an additional three modules for the engineering course, and is eager to receive student feedback once the semester starts in March.

While enthusiasm for and interest in this project has remained constant, "Blended On Line Collaboration For Global Engineering Education Excellence" has experienced a few setbacks. Limited IT infrastructure and specialists have made it difficult to maintain momentum and scarce resources have forced project administrators to take on many roles within the project. Additionally, unforeseen issues regarding administrators' participation in the project have further created a dearth of time and resources.

Dreux offers advice to other HP Catalyst project leaders: "Don't be too ambitious. Start small and improve one step at a time." Dreux also suggests that future project leaders spend a lot of time and effort into planning each stage of the project, and that one should not assume that once all the material is obtained that everything else will fall into place.

Technology

Through this HP Catalyst project, Pontifical Catholic University of Rio de Janeiro was provided HP Elite Tablet PCs and HP software. The "Blended On Line Collaboration For Global Engineering Education Excellence" team created a computer lab where students may access all online modules locally. This has been critical, as many university students do not have computers at home. When asked if the HP technology has been central to the success of this project, Dreux replies, "Definitely. Without it, it would be really difficult to do."

Empowering STEM Faculty for the 21st Century

Empire State College in collaboration with
St. Petersburg State Polytechnical University
New York State, USA, and Russia

Summary

The number of online courses is briskly multiplying; how will we prepare teachers who are unfamiliar with the supporting technology to face the demand? Empire State College in Saratoga Springs, New York, and St. Petersburg State Polytechnical University in St. Petersburg, Russia, have decided to meet that challenge, and have set out to help their STEM faculty become better online teachers. They plan to work with Pacific Crest, a faculty-training provider, to develop a special curriculum for 40 faculty members from both institutions and deliver it via jointly sponsored "Teaching Institutes."

Faculty, via HP Elite Tablet PCs or Mobile Workstations, will access the online sessions. In each Teaching Institute, faculty members will be encouraged to work collaboratively, using problem-solving methodologies to improve their online teaching skills. Participants will work together to answer questions about how to engage with students online about the scientific method; which strategies are effective with online learners who lack confidence/abilities in quantitative skills; and how online students can be most accurately assessed for their deep understanding of STEM subjects.

A key component of the Teaching Institute is a focus on continuous improvement. Faculty members will engage in frequent assessments of their strengths, any areas for improvement, and then probe for insights on how to improve their own pedagogical skills and self-efficacy. With teachers acquiring progressive distance learning skills, the two partners hope to develop a variety of new online courses that combine rich sets of skills from multiple STEM areas.

The Project in Action

In a world where education is increasingly digitized HP Catalyst project leader Betty Lawrence has taken on the task of enabling faculty to reach their potential as remote teachers. By partnering with St. Petersburg State Polytechnical University, Lawrence and her colleagues at Empire State College have the unique opportunity to assess remote learning on a global scale, and share professional development strategies across cultural boundaries.

Lawrence and her colleagues at Empire State College have accomplished a lot in their project. Lawrence explains, "One of our primary goals was to hire someone who has a lot of expertise in faculty development in the STEM area to do a workshop both with our faculty and go to Russia and do a similar workshop in St. Petersburg. Those workshops did happen and we have good notes from the interaction the faculty had during that workshop." The "Teaching the 21st Century Student" project team also facilitated two faculty development webinars. Last February the group conducted a webinar titled "Empowering STEM Faculty in a Learner Centered Environment" and they recently organized another webinar on ePortfolios.

As the project progresses, Lawrence and her fellow project administrators are discovering a great deal in the realm of online teaching. "We're finding that actually portfolios hold a lot of potential for meeting the goals we had established. So our next stage really is to investigate

further how to use ePortfolios with STEM students. And helping faculty to use that kind of environment to encourage STEM learners." These discoveries can potentially shape the future of online collaborative learning.

Empire State College has also succeeded in maintaining a wide range of global collaborations. Lawrence explains, "I had a number of conversations with a Multi-versity partner in Africa about mathematics. Also I facilitated another webinar with him and with our Multi-versity partner in China. So we were able to work together and do a webinar about international efforts in STEM." Lawrence also shared online course materials with faculty at the Multi-versity Consortium member Pontifical Catholic University of Rio de Janeiro in Brazil. These materials aided in developing an online introductory course for engineering students at Pontifical Catholic University.

One of the greatest challenges that arose for Lawrence and her colleagues was distributing the HP technology to their counterparts in Russia. Strict government regulations around equipment with radio frequency capability made it nearly impossible for St. Petersburg State Polytechnical University to receive the necessary technology to participate in video conferencing with Empire State College. This challenge was met with persistence, flexibility and patience on behalf of both partners, and will hopefully be resolved soon. Luckily, St. Petersburg State Polytechnical University has some digital communication technology and the two schools are maintaining contact through these means.

Another obstacle within the partnership has also made collaboration difficult. Lawrence says, "We haven't really had the commonality that would have made our interactions more effective." Empire State College is a liberal arts college while St. Petersburg State Polytechnical University works primarily in the engineering and graphic design area. "Their interest even in terms of their disciplines was different than ours," remarks Lawrence. To help mitigate these differences, Lawrence advises that project participants be given clear expectations from the beginning. She believes it is difficult, but not impossible to collaborate remotely. She says, "Thinking of creative ways to keep the attention of participants, which is always a challenge when you have people that are in distributed environments."

Technology

HP provided Empire State College with laptops, a printer, a server, and various software programs. Empire State College faculty are using laptops to work on a range of projects from exploring ePortfolios to improving online math discussions. "Some other faculty in the college, one of whom was part of our project, got a federal grant for doing an assisted science project and that will include doing a math block of data that people are collecting from wherever they happen to be living, and again they'll be using their laptops to connect with the math block," says Lawrence. Faculty members use the printer for project-related handouts. The server and software programs enable video conferencing for online courses and for collaboration between professors.

Lawrence and her team at Empire State College agree that the technology was a great motivator in developing interest in the project and recruiting volunteers. Lawrence notes, "We actually got more people to volunteer for the project than we had computers. So the technology really helped us there."

Game Design and Technology for STEM+ Learning Collaborative
An Online Multi-University Learning Network for Teaching, Sharing, and
Engaging 21st Century Faculty and Learners through Game Creation

National University
California, USA

Summary

National University in La Jolla, California, hopes to better connect complex course content to the core elements of STEM+ subjects by making game design an integral approach to teaching in ten courses spanning five STEM+ disciplines. The essential assumption behind the project is that the nature of game design methodology requires a detailed understanding of the systems and relationships within a design and the related rules and procedures, in addition to the characters and challenges that players will focus on within the game. These all work to provide an engaging framework for STEM+ concepts.

In an earlier phase of the project, funded by an HP Leadership Grant, students actively engaged in the process of game creation and demonstrated a deep understanding of key STEM principles and a variety of critical workplace skills.

In this phase of the work, National University's Applied Systems & Interoperability Research Lab will build the Game Design and Technology Learning Collaborative, a sandbox that will allow multiple institutions to train teachers and students to implement game design methodologies, and thus effectively put what was previously learned into practice. The ultimate goal is to link real-world engineering experiences with video game design teaching methodology to provide learners virtual apprenticeships.

The Project in Action

There are three objectives that guide this HP Catalyst Initiative project according to the project leader, Dr. Shekar Viswanathan. First, students will be building games in order to learn complex concepts in STEM courses. When completed, the focus will move to the second objective, which is integrating the games into a network so that they can be shared among STEM faculty members. "And number three, of course, our ultimate goal is to make the learning process of STEM easier, particularly for at risk students," Viswanathan says. He believes that this new methodology will attract and retain more future engineers, scientists, technologists, and mathematicians.

Initially, training was necessary for every team member because even though every participant was an expert in his/her discipline, some had little to no experience when it came to developing games. Now, besides the faculty, students are also given background on game development at the beginning of their courses. In these training sessions, students learn the basics and have access to tools needed for game development. "Then we help them as they go along, in terms of providing guidance," says Viswanathan. "So it's still student built games."

To illustrate his concept, Viswanathan describes a game that he created involving a pizza parlor in which the objective is to meet the conditions necessary to maximize revenue while

minimizing quality problems and keeping customers happy with affordable prices and minor problems. "These are the kind of things we have done to emphasize, in this case, the role of games in learning a typical topic," he says.

Although a curriculum loaded with games may sound exciting, Viswanathan says that not all students welcome the idea. In addition to learning complex subject matter, students are expected to learn the methodology of game development. "As a result, it's very difficult within the time frame for people to do all this extra work to implement these things," he says. Viswanathan also finds that today's students are not always ready to change the paradigm; many are expecting to learn STEM topics in a traditional teaching method. "In other words, they expect the teachers to go in front of the board, write down things and teach them how to do certain things, etc.," he explains. "But learners here are using what we call problem-based learning concepts, so the actual scientific topics of what they're supposed to learn will be reemphasized." He says that the class always begins divided with some students enthusiastic and others apprehensive, but his typical example game succeeds in winning over the majority.

At this point, Viswanathan and his six-member team have developed a number of games, and are now concentrating on expanding the network that they have built to facilitate the exchange of projects. Viswanathan is already working with contacts in South Africa among others. For now, he is sharing information with members within the multi-varsity consortium as well as companies and universities outside the network.

The next step for Viswanathan and his team is to determine to what extent does problem-based learning helps students to retain information. He is very interested in assessing the impact of learning. "It's very complex, and that's what we're debating at the moment and trying to come up with a process."

Technology

This project has received HP Elite Tablet PCs and servers. The HP server is currently home to all of the games that have been developed, and the intention is to share the material among the faculty and within partner institutions.

All of the team members are using HP technology to develop games within their disciplines, and the students are building games using Elite Tablet PCs in the classroom. Viswanathan says that the technology is helpful because it gives the teacher direct access to his/her students' learning. "It's almost like an instant learning tool," he adds. For students, this is especially effective when learning complex topics that are difficult to teach. "It's much easier to do a particular math problem if you have a Tablet PC where you can write down and later review the steps that were taken to arrive at the solution."

He also has observed that HP technology is more user-friendly than typical PCs, and this is what has made the task of developing games for the tablet most efficient.

Implementing Virtual Laboratories for STEM+ Education

Fisk University
Tennessee, USA

Summary

Fisk University, in partnership with other Multi-versity institutions, is building a virtual science lab that students can use anytime, and from anywhere they have Internet. The lab will support four STEM disciplines: chemistry, computer science, mathematics, and biology. In the first phase of the project, Fisk University will build the online lab for an introductory general chemistry course that reinforces concepts from lectures with hands-on training. The ultimate goal of the project is to drive students' interest in STEM education by leveraging technology with unconventional learning opportunities, while also reducing lab equipment costs.

Participating students will use HP Elite Tablet PCs to run chemistry experiments and collect results online in real-time. Once the general chemistry virtual lab gains momentum, the plan is to scale it to the other three subject areas, beginning with a theoretical computer class that will require robust visualization tools.

The Project in Action

Lei Qian, the project leader for the HP Catalyst project "Implementing Virtual Laboratories for STEM+ Education" at Fisk University, is working to impact student learning in the areas of biology, computer science, mathematics, and chemistry. "In biology, chemistry, and mathematics," he says, "our goal is to implement online or blended course or lab in classroom and promote online learning. In computer science we promote a virtual lab."

Given Fisk University's relatively small student population and access to fewer resources, Qian emphasizes the importance of collaboration in working toward achieving project goals. He notes that participation in the HP Catalyst project has "given us the opportunity to collaborate with many members in the consortium ...during the project we [met] so many members [who] are doing interesting stuff that will help us." Last semester, HP sponsored the project team to attend a conference in Orlando where they made some initial contacts and learned about several new technologies and education methods, which have helped them in the development of their new educational model.

So far, the project team has built a mathematics lab where they have installed several software packages designed to enhance student learning, including MyMathLab, Classroom Presenter, and Mathematica. Using Classroom Presenter, students have been able to interact with faculty and obtain real-time feedback from their instructors on their notes and homework assignments. Mathematica software, on the other hand, has aided student learning by giving them an intuitive sense of mathematics concepts.

The project team is interested in comparing student performance in classrooms with such technology and in those without it. Initially, they have observed a high passing rate among students utilizing the technologies in the mathematics lab. In developing a chemistry lab, the team utilized HP funds to purchase MyChemLab software. Being commercial software, it has been relatively easy for the team to get it up and running.

For computer science, the team is currently working toward developing mobile applications, which will function primarily in Android systems. One impediment to more rapid progress on that front is the small size of Fisk University both in student numbers and in resources. For example, in a typical computer science class there are four or five students, which makes it difficult to have impact on a larger scale. Thus the project heads have made initial contact with potential collaborators in hopes of pooling resources and expanding their reach. In fact, Qian would advise future project leaders in a similar situation to begin looking for potential collaborators early in project development, ideally just after receiving funding.

Technology

As part of their participation in the HP Catalyst project, HP provided Fisk University with 66 HP Elite Tablet PCs, a server, and three printers. Students in the mathematics and chemistry labs use forty laptops to help them make diagrams, take notes, and prepare presentations. In order to expand the impact of the project and increase faculty productivity, the faculty was given the remaining computers. Because many faculty members at the university do not have access to grant funding, they have benefited immensely from the equipment provided. Moreover, they are providing the team with feedback on how the Elite Tablet PCs are helping them teach and conduct research.

The project participants received some private training in the use of the HP technology. Their first attempt at conducting a small workshop did not pan out, but they plan to conduct one in the next semester.

Providing and Evaluating Authentic On-Line Science Laboratory Experiences

Thompson Rivers University
British Columbia, Canada

Summary

Small rural post-secondary institutions too often do not have access to modern scientific instrumentation due to limitations in funding and infrastructure. Unfortunately, this places students at a major disadvantage when it comes to gaining science and technology literacy. Thompson Rivers University will alleviate the issue by building on the existing work of the British Columbia-Integrated Laboratory Network (BC-ILN). Through this project, the BC-ILN will provide geographically isolated students with access to cyber-enabled instrumentation in a virtual chemistry lab setting.

In order to make the project successful, Thompson Rivers University will be continuously assessing the user experience of their virtual laboratories and adjusting the design to meet the needs of remote users. Students will run online experiments and view the performance of the remote lab equipment in real time.

Pre- and post-lab surveys will be distributed so that Thompson Rivers University can evaluate the effectiveness of the user interface. The ultimate aim is to develop lab exercises for distance users, along with materials for the professional development of faculty that will help the project scale. The outcomes will be disseminated to other institutions as a means of improving province-wide distance education, and engaging more marginalized students in STEM learning.

The Project in Action

Bruno Cinel and Sharon Brewer are co-principal investigators of this HP Catalyst Initiative project to bring technology to science courses in rural areas of British Columbia. "These locations are two year colleges that wouldn't have access to some of this advanced scientific instrumentation, and also into the high schools, to the chemistry 11 and chemistry 12 classes," Cinel says.

HP Workstations and Elite Tablet PCs essentially transport the laboratory at Thompson Rivers University to any classroom, giving students the instruments they need to answer scientific questions. "The students would actually be doing the research on real samples in real time," says Cinel. "It's basically almost like a virtual field trip where they're not two feet away from the instrument, but we want to make that experience as if they were."

Late arrival of the equipment forced their timeline forwards. Since the spring academic year has already started, they can't implement their plan in the university courses. "We lost that window, and now we have taken that time to sort of readjust our milestones and our deliverables so we can get something done this semester," Cinel says. Consequently, the focus for this semester has shifted to high school students, which the investigators seem enthusiastic about. "We are putting a very positive spin on it, because it did allow us some time to really adjust things," points out Brewer.

Cinel and Brewer look forward to collaborating with other institutions down the road like Northwestern University and Fisk University. When considering the Multi-versity consortium, Cinel explains that their project feels undeveloped in comparison to the other members, which is why he wants to begin implementation and start delivering before diving into any solid partnerships. "At the same time," he adds, "we're entertaining the whole idea of collaborating and seeing what we can offer to other Multi-versity members and how maybe we can get something from them or be involved in their projects." Learning about other projects through websites, webinars and discussions reminds the project leaders about the great potential for collaboration, but they are wary about straying too far from their objective. Cinel and Brewer agree that their intention is to answer their original research questions and avoid getting sidetracked.

One minor frustration for Cinel is understanding how the numerous contacts surrounding the HP Catalyst Initiative fit into the bigger picture. He mentions HP, the Sloan Consortium, ISTE, and the New Media Consortium among some of these groups as involved in the interesting flow of information.

"If you had some sort of organizational chart of who is involved in what, I think that would be very beneficial to someone new who is joining," he says. An additional benefit of this information might keep new members in the know about what these groups are doing. He explains, "It would be neat to have all these materials or all these different projects accessible or a new member pointed to those so we could begin investigating what others are doing right from the start."

To someone in charge of a similar project, Cinel and Brewer recommend forming a strong relationship within the faculty as well the institution's IT department since the logistics of incorporating the equipment is involved. "You really need to have a bit of a team behind you because there is so much that is going on in terms of the equipment that arrives, getting it inventoried, making sure it's appropriate for the institution," Brewer explains. He also thinks it is important to reach out and find existing models that could inform your project.

Technology

This HP Catalyst Initiative project has received 17 laptops, 38 Elite Tablet PCs, and seven printers. The IT department at Thompson Rivers University provided space on their server. Freeware software has been installed on all laptops and Elite Tablet PCs. The team has designated a set of Elite Tablet PCs and laptops that they take to high schools that allow students to conduct experiments with joint analysis.

Brewer explains, "We have a network camera they can connect to from the Elite Tablet PCs. Again, they can zoom in on a certain part of an instrument. Training was necessary to familiarize the high school teachers with the equipment and the software. Tasks such as logging in, connecting to the server, and controlling the camera are demonstrated to the teachers and students in person. For farther locations, they ship the equipment and then guide them through setup on Skype. They also provide PowerPoint presentations among other tutorials that help users learn to use the equipment well. Cinel says, "The whole idea is to make the user experience very easy, user friendly and learner centered."

Remote Access to Scientific Instrumentation and Online Labs for STEM Education: *Building Laboratory Parity throughout the Curriculum*

Western Washington University
Washington State, USA

Summary

The quality of STEM education is often dependent on access to laboratory instruments and other critical learning tools. Western Washington University, in Bellingham, Washington, has equipment that neighboring Whatcom Community College and Squalicum High School do not, yet all three schools offer a similar college credit course that looks at water quality. The “Building Laboratory Parity” project will bridge this educational divide in Bellingham by building upon Western’s open source, web-based Integrated Laboratory Network (ILN) — an online laboratory with remote instruments. The goal is for students who have limited or no contact with professional lab equipment to gain those critical experiences through the ILN’s virtual laboratory.

While Western utilizes special equipment in its version of the course to obtain real-world results, Whatcom and Squalicum up to now have had to rely purely on traditional means. With the ILN, all three schools will be able to collaborate so that all their students can participate in the analysis of relevant real world data. The project will initially focus on an experiment where students at Whatcom and Squalicum will prepare lab samples, deliver those samples to Western, and, in turn, Western will load the samples into robotic samplers that allow students to remotely control the instruments and analyze the results using Elite Tablet PCs.

As the project progresses, science teachers will be able to receive certification for specialized online lab instruction which itself will be offered online. Western is currently working with a variety of institutions to develop a Remote Educational Consortium (REALC) to design, disseminate, and evaluate all the practices associated with using online labs, with the hopes that it will encourage replication of the approach in other communities, or even as a way to bring these resources to schools on the other side of the globe.

The Project in Action

For the past seven years Western Washington University has strived to build infrastructure that enables students and faculty at different institutions to remotely access scientific equipment. Through HP Catalyst project “Building Laboratory Parity throughout the Curriculum”, project leader Erin Macri and her associates are expanding upon this mission. “We’re now trying to branch out to underserved communities, such as community colleges and some high schools, and provide those students with some more experience that students at a four year university would,” says Macri.

Students from these underfunded schools often end up at Western Washington University, where the specialized laboratory equipment can overwhelm them. This project is unique in that it gives the students confidence and preparedness to succeed once they do enter a four-year institution like Western.

The first year of this project's lifespan was devoted to planning and configuring the website and providing access to the online scientific equipment. The team also succeeded in uploading course material to the website. Well into the second year of using the HP-provided technology in the classroom, faculty at Whatcom Community College and Squalicum High School are pleased with the addition of specialized scientific equipment in the curriculum.

Macri notes, "We have some of the tablets out in some community college classrooms right now as well as one advanced placement chemistry classroom in the high school. And we're right on track with our goals as far as getting instructors to use the equipment and remotely connect to our instruments."

Connecting to Western Washington University instruments has proven monumental to Whatcom Community College students' interaction with course material. In one experiment, students connected to High Performance Liquid Chromatography to study food dyes that the students themselves had extracted from candies in class. Students also collected water from different sources and measured magnesium and calcium levels in their samples. "There's a sense of ownership when the students see their own sample in auto sampler," Macri explains. "The higher level thinking offers the students to be able to actually manipulate and work with real data rather than looking at a picture in a textbook."

Macri and her team have achieved a great deal in their project, but they have overcome obstacles as well. The largest challenge for this group was providing instructors with the professional development needed to integrate computers in the classroom. "It's like handing someone a jet plane and saying, 'here, drive it.' There's some background you really need to provide the instructors that are participating," Macri says.

She and her colleagues also struggled in finding a way to integrate Western instrumentation into labs that already existed. In handling both of these obstacles, Macri advises future project leaders to maintain a strong relationship with instructors. "Take it one step at a time and really know the people, be there for the people that are participating in your study and listen to their needs. You won't have a successful project in getting people to use your application unless they feel comfortable with it and they're getting the support from the people they're participating with," Macri notes.

Technology

Through this HP Catalyst project, HP provided Western Washington University with Elite Tablet PCs, printers and a server. The Elite Tablet PCs were set up as virtual laboratories with a quick launch application that made remote instrumentation access possible. The administrative team also uploaded chemistry software onto the tablets. These Elite Tablets PCs were then distributed to the community college and high school, where students remotely accessed the HP server that housed the curriculum materials and information about the project. The two HP-provided printers were also distributed to the two schools for students to print their experiment data as needed.

Research and Promotion of Online Collaborative Learning Education

Renmin University of China
China

Summary

Today, both online learning and in-class lectures pose challenges and limitations in leading students to a deep comprehension of IT education and its real world applications. Renmin University of China in Beijing is exploring how combining these two different forms of learning within a single hybrid course will impact the IT knowledge and critical problem-solving skills of their students. Teachers will use class time to convey the key, basic points of the curriculum, and send the students online to explore further details and to engage in more in-depth study time with classmates.

The researchers are purposely testing the methodology with students who presumably have the least amount of hands-on classroom experience with technology. The course "Database Technology and Application," designed for the humanities students, was chosen as the first application of the approach, in hopes that such a strategy will provide the greatest insight into the effectiveness of the idea.

On average, about 300 humanities students take this course per semester, and each time it is offered, two challenges emerge. First, humanities majors exhibit very different levels in computer basic knowledge and skills; secondly, they come with very disparate expectations about what they will learn. The online platform is designed to help students address these challenges, by encouraging interaction and communication between them.

The Project in Action

HP Catalyst project leader Xiaoyong Du and his colleagues at Renmin University of China have taken on the challenge of analyzing 21st Century student learning with blended online and in-class discussions. Du acknowledges a cultural characteristic of Chinese students, which may be accommodated with this teaching approach. He says, "For Chinese students, it's difficult for them to ask questions in front of a professor. So we hope they can ask some questions on the Internet."

This HP Catalyst project is fairly far along in its life cycle. Du and his team at Renmin University of China developed an online communication platform for students to submit questions and engage in class discussions. This online communication tool was integrated in Du's Introduction to Database System course for undergraduates majoring in Computer Science. The "Research and Promotion of Online Collaborative Learning Education" project team has since extended this online communication platform to more courses, including humanities courses. Du says, "We also updated our system to a new one with more functionality and more stability to support the more than 400 students who use it."

Du and his colleagues have also collected data on students' response to the new communication platform. This data has been valuable in learning how students can maximize online collaborative learning. Du notes, "Some students told us if they can use a mobile device for them, they can ask a question at any time, that's better." He goes on to say, "Most all of them say compared with traditional education ways, online collaborative learning is

more interesting to them. But some results are negative. For example, compared with face-to-face discussion, they say online collaborative learning is not so effective." This feedback gives project administrators a better idea of students' needs and how to accommodate student's learning preferences.

The project team will continue to use online collaborative learning in a range of courses and plan to extend this tool beyond the standard full-time undergraduate class. Du remarks, "Next semester we will try to do further experiments for all the students who are studying in my school and who are part-time students." This will produce different results from the first few courses in which the online collaboration platform was implemented, as students in these part-time courses usually work full-time. "So there's no choice for them to discuss problems and some questions face-to-face. So they have to use our platform for discussion," says Du.

The main obstacle this group has experienced in its project has been largely technical. "It's still a challenge for our technical team to maintain or upload upgrades to their [IT] systems," says Du. As the online collaborative learning platform tool is extended to more courses, the IT system must be upgraded to accommodate more students. It is best to insure strong IT support and competent technical specialists before embarking on such a project.

Technology

Through this HP Catalyst project, Renmin University of China received HP laptops and an HP server. The server houses the online communication platform, which students connect to with the laptops. "We encourage them to ask and answer questions outside of class time. At that time some of us use laptop computers," says Du. Teachers use the laptops as well to respond to students' questions and encourage class discussions.

According to Du and his colleagues, the students and teachers did not require any training in the use of the HP technology. Most project participants are very tech savvy and the technology is used for fairly basic purposes. The online collaborative learning platform was very intuitive and project participants found it easy to use without any additional training.

Science Lab Server Farms Project

Northwestern University
Illinois, USA

Summary

Northwestern University in Evanston, Illinois, is working to provide economically challenged public schools access to professional, high-caliber science laboratory equipment — virtually. The approach is proven; Northwestern's Remote Online Lab Network hosts authentic laboratory experiences. Using the virtual tools, students can learn the same skills they would in a physical lab, but bypass all the logistical limitations. A fall 2009 pilot showed a 15% overall gain between pre- and post-test scores among schools using the virtual instruments.

The network operates as an international collaborative of universities sharing instrumentation with high schools to create a virtual broadly distributed science lab. The remote labs allow students anywhere in the world to seek out resources that they need and explore their questions with authentic data and then share those results globally. Limitations of space, funding and equipment are no longer impediments to rural or low-income students and teachers seeking to access sophisticated modern STEM+ laboratory experiences.

As they conduct their experiments online, students watch the science equipment in action through a live video feed, and are involved in every aspect of the experiment from start to finish, setting up the purpose, the variables, and the number of runs. When their experiment is complete, they are able to view multiple graphs of the data results, and export their objectives and conclusions into a PDF report. Because students are not in the traditional group setting of a lab, there is no pressure on them if they do not get it right the first time. They can actively learn from their mistakes and try out their own creative methods.

The Project in Action

Kemi Jona of Northwestern University serves as project leader for this HP Catalyst project. He recalls the beginning phases of the project, when he and his colleagues "realized that many classrooms, particularly those in urban and rural areas do not have the technology infrastructure needed to actually provide these resources to students." Since its inception, "Science Lab Server Farms" has had an immensely positive impact on its participants. Jona notes, "There's been sort of this explosion of creativity and new ideas that teachers have had just because they know they have access to these tools ...the teachers have thought above and beyond the curricular resources we provided to create their own."

In its second year, this HP Catalyst project has already enabled ten teachers and nearly 1,000 K-12 students at its seven partner schools to broaden their access to STEM learning resources both at school and at home. Jona and his counterparts have developed an HP Elite Tablet PC loaner program, which allows teachers and students access to implementing the STEM learning opportunities in their classrooms. Through this program, teachers request a classroom set of HP Elite Tablet PCs, wireless Internet access, and other equipment they need to implement other STEM learning opportunities in their classes.

Through this project, Jona has cultivated fruitful partnerships between Northwestern University and other organizations. Within the consortium, Northwestern University has

collaborated with a team at Western Washington University. The latter university is doing similar remote lab work, but mostly at the community college level. Northwestern University's main collaborator outside of the consortium has been University of Queensland in Australia, which provides laboratory equipment for student use. The remote labs give students experience with a range of fundamental scientific practices and enable them to collect a range of data from phenomena like radioactivity. These experiments would not be possible otherwise, as measuring it in the classroom would be too dangerous. Jona and his colleagues are also building relationships with Western Interstate Commission for Higher Ed, which is also launching a shared lab effort.

The main challenge that the project team has encountered has been that teacher response to integrating the technology into their classrooms has been so enthusiastic that the demand has outweighed the supply. Teachers are requesting more online labs and are currently on a waiting list for more HP Elite Tablet PCs to be loaned to them.

Technology

HP provided this Catalyst Project with 50 HP Elite Tablet PCs and 25 Probe Kits. They are all used as part of the loaner program where teachers submit applications requesting either the HP Elite Tablet PCs only or the Elite Tablet PCs and the probes for a specific period of time during the school year when they would like to implement it into their curriculum.

Project participants have received training in the use of the HP technology at professional workshops. Last summer, five middle and high school teachers spent two days learning how to use the HP Elite Tablets, probes, and remote lab software, and how to conduct different probe activities. The participants committed to spending the next month preparing an activity integrating what they learned into their curriculum, and subsequently sharing their ideas on the project website.

The New Learner Consortium

Led by the Agastya International Foundation

BLADE

Building Learning As a Distributed Experience

Sheffield City Council, Children & Young People Service
United Kingdom

Summary

Today more than ever, jobs require a combination of skills across multiple subjects and the ability to collaborate in multi-disciplinary teams. BLADE is focused on fulfilling the demand for students to have a meaningful experience across the “design-to-delivery” product lifecycle, using IT as the glue to bring together scientific, technical, creative design and communication skills. BLADE builds upon the UK city of Sheffield’s aim to create a broader range of opportunities for skills development which serve the City’s key growth industries — engineering, manufacturing, health care technologies and creative and digital industries.

By creating a virtual collaborative environment that supplements classroom studies, BLADE brings together students who have elected to study different specialties with the hopes of cross-fertilizing projects and skills. Working together, students will become accustomed to the diverse population and skill sets within workplaces. BLADE also aims to determine what kind of impact the informal learning within a virtual environment might have on the formal learning of a classroom — and whether the online participation can help build collaboration and team working skills.

To demonstrate working practices that harness a diverse range of knowledge and expertise BLADE will also develop master classes to provide a better understanding of how scientific engineering and design data can be leveraged through advanced computations, real-time data feeds, and visualization tools.

The Project in Action

The HP Catalyst project “BLADE” is unique in its aim to combine a collaborative approach to education while incorporating an element of sustainability to the learning community. Project leader Emma Beal explains, “We’re trying to build a repository of reusable learning resources that we generate through the activities we do for learners, teachers, and visiting professionals.”

Thus far, the project has had a great effect on the student community. When asked about students’ response to the project, Beal notes, “Their feedback’s been really positive and we engage professional employers in the collaborative as well. The students really enjoy knowing they’re working on a real life challenge and the teachers are enthusiastic about the innovative this delivery allows. “Both parties have taken a lot out of the collaborative work and have seen the benefits of the interdisciplinary project working, which has been a great benefit for the project as it is our aspiration to imbed this style of working more broadly across our curriculum,” Beal reports.

This HP Catalyst project is broken up into two parts. "The first stage was developing an interdisciplinary project that requires students from engineering, ICT and creative media disciplines to collaborate both face to face and virtually to work on meeting a real delivery challenge," says Beal. The team at Sheffield City Council, Children & Young People Service has successfully run two groups through the first stage of the project and is now entering the second stage, where they aim to develop online collaborative skills.

Project participants experienced significant technical difficulties in the first year of the project but persistence paid off as they have now worked through the technological transition and have distributed all HP math and science kits. Students are using the HP learning resources in the classroom, and Beal and her team will collect student and teacher feedback in March.

Throughout the project, Beal and her colleagues have made interesting discoveries about how learning institutions in different locations prefer to collaborate simultaneously on projects. "What we found is our schools prefer to work independently on their individual elements of their project, coming back together physically, rather than virtually, which they find difficult," Beal explains.

Beal suggests that anyone looking to launch a similar project begin by getting as many people on board as soon as possible. With full support across all disciplines involved, it is much easier to ensure clarity of project purpose and goals. Emma notes, "One of the benefits we've seen in the second half of the first year was the teachers working together and actually finding new opportunities, putting in place new bits of project that we hadn't thought of initially. And that came from professionals working together at a much more of an operational level. And so we would definitely say get your teaching professionals working together on the ground. Find a way of freeing up their time and resources to do that."

Technology

Through this HP Catalyst project, Sheffield City Council, Children & Young People Service received laptops and related equipment, which teachers implemented in their classrooms and students routinely check out to continue working on projects at home. According to project administrators and teachers, the laptops have been very helpful as they insure that groups have access to IT throughout the entire delivery of projects. They have also encouraged students to explore the use technology in their particular fields such as engineering or math in nontraditional fashions. HP also provided a Virtual Room and science and math kits, which include advanced calculators and probes.

While limited tech training was needed for this project, the Sheffield City Council team did include a professional development workshop on the use of the math and science kits. Professor Chris Olley, HP Educator for Math and Science Kits from Kings College London, conducted a hands-on training session. Project participants were also provided resources to encourage exploration and suggest unique methods for incorporating the technology in the classroom.

Eve (Eco-Virtual Environment) Project ***Creating a Sustainable Virtual World of Learning***

City Academy Norwich
United Kingdom

Summary

City Academy Norwich recently and radically overhauled their curriculum in favor of embracing enquiry-based learning and more student-centered learning approaches. In what they're calling the "EVE Project," students are leveraging 3D technology to design and create their own virtual worlds. These new worlds will become hubs for active STEM learning with an emphasis on environmental themes.

Working in teams assigned to different virtual environments, students at City Academy Norwich will develop a sustainable energy source within their environment and compete to design the most energy-efficient space, drawing on all the resources embedded in the environment to sustain it. Web-based assessments will provide participants with feedback on their work.

During this project, the Academy, which serves large numbers of students from economically deprived backgrounds, will receive extensive support from an internationally renowned university, a large college, local government agencies and educational training hubs. These institutions will provide support, including education advice, ICT guidance, and environmental expertise.

The Project in Action

Nigel Youngman, project leader for the "Eco-Virtual Environment Project", sums up the team's objectives for the students, saying "in short, the students design and make decisions and explore issues about the environment, and the environment itself becomes a virtual learning space." As part of their participation in this HP Catalyst project to develop sustainable energy sources within their virtual environments, Youngman envisions the students at City Academy Norwich becoming well versed in STEM learning areas because of its central role in the activities. "Throughout the year students will spend four weeks doing seven hours of STEM," he says, "So STEM has gone from being something that one enjoys doing on curriculum to being an integral part of the curriculum."

One aspect of this project that is particularly important is the idea of student ownership and creativity. As designers of energy-efficient spaces and sustainable energy sources, the students will not only participate in hands-on learning, but will experience the sense of ownership over their work similar to that of working as professionals and leaders. Youngman sees the importance of this point, emphasizing, "I'm sure there are people that can very quickly and easily create something far more beautiful than what we have done. My question would be, do the students own it?"

So far, the project team has managed two successful trial simulations as the IT teams are building the virtual worlds. Right now, Youngman and his colleagues are working to bring the simulation into the virtual world. In addition, they have already developed the curriculum, which came from collaborating and exploring new ideas with the staff. The project team is

currently drawing from the local education and industrial community to support them in using digital technology to engage and excite the students. One of their collaborators is the University of East Anglia, which is actively working with them in developing the project. In addition, they are looking toward collaborating with Opito, a national organization interested in educating young people about the energy industry.

Some issues the project team has encountered will partly shape its next steps. First, they are concerned about developing a protected open SIM environment for student use. Consequently, the virtual environment is currently only accessible within the intranet for students starting their development, and the team has access only from outside. Another challenge has been learning how exactly to create an open SIM environment where they can bring simulation into the virtual world, a problem they are actively working to solve. Finally, the team has struggled to find students to work with them, an issue which touches back to the security concern. With their aim of creating more islands for more people, and offering the learning spaces to students at other schools, the team must ensure that they design an environment in which students can enter securely.

Technology

HP provided this Catalyst Project with a full classroom set of laptops and of touch pads. These tools have thus far been instrumental in the designing phase of the project. In addition, the use of these technologies has inspired creative and innovative thinking about the project. For example, Youngman thinks that the "future next step is incorporating the notion of touch screen technology in this project." Training in the use of the hardware and software is built into the curriculum for students. As the staff begins using the equipment more, a need may arise for their training.

Get Invested
Case Studies in Innovation
Computer History Museum
California, USA

Summary

Researchers at the Computer History Museum (CHM) in Mountain View, California operate on the premise that students become more engaged in learning when it impacts their life and their immediate surroundings. In its current work with high school students, the CHM is focused on bringing global challenges into vocational programs and more traditional classroom settings to drive more interest in STEM education while instilling advanced technological skills in students that might otherwise be marginalized.

Working in parallel, students from diverse cultures in California and Mexico will collaborate in teams to identify a global problem or need, and envision a technology-based, creative solution or product that will address it, using the museum's considerable resources. Students in the program will learn to craft written proposals and oral presentations so they can compete for "funding" from teachers and CHM educators role-playing as venture capitalists.

The project will challenge students to formulate the right questions, apply new skills to solve problems, take responsible risks, and interact in a multimedia, graphics-based environment. HP laptops and Elite Tablet PCs will provide a platform for students to collaborate and develop these solutions. CHM plans to distribute pre- and post-project surveys to students, aimed at measuring their STEM+ learning and computational thinking. Students will also reflect on their work by sharing reports through a social learning network.

The Project in Action

Through their project "Get Invested: Case Studies in Innovation," project leader Lauren Silver and her colleagues at the Computer History Museum have partnered a local California high school with a high school in Monterrey, Mexico. This HP Catalyst project team selected these two schools to implement a unique program that applies STEM subjects to real world issues. "This program is a model for us not only in terms of our collaboration with schools but just in the way we can reach and learn about and begin to serve more effectively the needs of a wide range of educational and academic communities locally and worldwide," says Silver.

Silver and her colleagues collaborated with teachers from the two high schools to develop a new curriculum that would incorporate this project. The curriculum was implemented in the current academic year, and students have been busy working on their project ideas. "The teams are collaborating to develop innovative solutions, technology-based innovative solutions for global social problems or even local community based social problems that the kids themselves have identified," Silver remarks.

"Motivation and self-confidence and concepts of themselves as potential contributors to the world in a positive way are all very, very important to this project," notes Silver. Examples of student-generated projects include a mobile application that connects cyclists with cycle-friendly businesses in the area. "The drug-related violence in Monterrey really affected students," explains Silver. In hopes of alleviating innocent bystander deaths, Mexican high

school students designed a GPS-based mobile application that would notify mobile users of high crime communities in the area so that people may avoid dangerous neighborhoods. Another group of students developed a proposal for a chip to be installed in handguns that identifies the handgun handler. This chip would prevent the gun from firing in the event that the handler does not match the identity of the person who is licensed to carry the gun.

The students will soon begin preliminary project presentations. According to Silver, they will then develop “a final formal proposal that each of the teams is going to deliver and then ultimately a pitch for hypothetical venture capitalist funding to real venture capitalists.” This is scheduled to occur in March, followed by student evaluations that will conclude at the end of the academic year in June. “And at the same time we’re going to start to assess what needs to be done in regards for the second year of implementation, an evaluation on the grant, which will begin next August,” says Silver.

“One thing to know is the education program in our museum is extremely new,” Silver notes. The museum was re-launched in the past year and this HP Catalyst project marks the beginning of a robust future for the education department. Silver says, “So right now there’s a lot of potential for us to use this project as a springboard to start further collaborations between the museums and other providers for similar populations and similar types of STEM projects, locally for us certainly.”

In launching this type of project, Silver believes it is important to keep project sustainability in mind, “not to create a program that is so dependent on your own resources that the schools can’t implement it on their own.” Project administrators must also keep a good balance between clear goals and flexibility in achieving them.

Technology

Through “Get Invested,” the Computer History Museum was provided HP Elite Tablet PCs, Mobile Workstations, servers, a Virtual Room, and laser jet printers. The Elite Tablet PCs and printers have been crucial for student project development and presentations. Open source software was uploaded onto the laptops and Elite Tablet PCs for student use. The team experienced technical difficulties with the Virtual Room and were unable to utilize it as much as planned.

Silver scheduled an on-site training for the students in the use of the HP technology. An HP representative came from Palo Alto to demonstrate how to use different programs on the Elite Tablet PCs, which prepared students for project presentations. The students have been really enthusiastic about the use of technology in the classroom. Silver remarks, “They took to it instantly, which is great.” Regarding the HP technology, Silver notes, “It’s been really important to us to have in particular the Elite Tablet PCs available to them because they have a hard time getting access to technology even though they have a technology program in their vocational training.”

Global Innovation in Science and Technology (GIST)
Institute for Teaching Through Technology & Innovative Practices
Longwood University
Virginia, USA

Summary

Longwood University in Farmville, Virginia understands that global collaboration in education is a powerful tool for developing high-level communication skills and inventive thinking among STEM students. The “Global Innovation in Science and Technology Project (GIST)” will bring around 2,000 economically challenged students from three rural school divisions in Virginia together with peers in Ghana and India to work on projects in small teams.

In GIST’s initial year, the goal is for selected teachers and students of rural school divisions to develop online tutorials on how to use Alice, Scratch, and Kodu that will become resources for all the schools in the collaboration. The projects will involve probes, games, and simulations that support an inquiry-based teaching model and incorporate a blend of the teachers’ technological, pedagogical, and content knowledge.

“Elgg,” a social networking engine, will allow teachers to interact and collaborate around the online learning modules. Key outcomes are for students to become creators and problem solvers. The overarching outcome, however, is that participating students will achieve a better understanding of global problems and how to work together across borders to identify potential solutions.

The Project in Action

“GIST” project leader Manorama Talaiver, of Longwood University, has seen the project reach its preliminary goals by first giving teachers instruction in using programs such as Scratch, and observing the different ways they integrated it into the content of their curriculum. Talaiver says, “we have completed the “GIST” component of all the objectives of training the teachers with Scratch, providing the online learning resources for Scratch, Alice, and Kodu so the teachers can have the next application and be on their own. So that’s where the sustainability is because we provided all the resources online and it’s all in one place as a video tutorial... If any teacher in the world is interested they’ll be able to pick up the online learning resource and go with it.”

With those pieces in place, Talaiver can focus on the next phase of the “GIST” project, using insights gained from the first year to target specific challenges, and areas of need toward achieving the ultimate goal of “helping the kids to become creative thinkers, designers, communicators, problem solvers because that’s where global problem solving comes [and] can happen using these tools.”

One component of the “GIST” project, which Talaiver will focus on next, will be involving girls in engineering design. In their first attempt, they found that their pilot kits did not incorporate sufficiently interesting ideas or materials to engage the participating middle school girls. Based on an interest in robotics among many of the girls, they plan to incorporate some robotics activities in the future, and currently Talaiver is working with a

specialist to put together a kit for each girl in hopes of teaching them about engineering aspects, including designing, controlling, and computer science.

Another current direction in the project involves collaboration with the Agastya International Foundation and with the University of Fort Hare in Alice, South Africa. As part of the innovation grant, they want to replicate what they have learned and bring their training to teachers in other countries such as South Africa. With the help of HP funding, they plan to provide training in specific areas, including technology integration across all contents, introducing technology tools to be used in instruction, and inquiry based learning in math and science.

Between herself and the staff worldwide, one of the challenges Talaiver is encountering is building a professional learning community online. As opposed to having everyone communicate via Elgg, she has found that some use email, others Google Chat, Skype, or telephone, an impediment to having one location where exchanges and interactions can be stored and studied later.

Going forward, Talaiver hopes that more and more teachers will correspond via Elgg. In addition, she plans to use Moodle, an open source package for a learning management system. That way, they will be able to add both students and teachers and hopefully promote more interaction. Finally, Talaiver found that most teachers and students thus far have chosen to use Scratch in their classrooms, likely because it was the first software they learned. Yet at conferences and training in the future, the "GIST" project team plans to teach all three source applications (Scratch, Kodu, and Alice) so that the teachers can learn about all of them and choose which is best suited for their teaching needs.

Technology

As part of their HP Catalyst project, "GIST" was provided HP Probe Kits, Mini Notebooks, Elite Tablet PCs, science kits, a server, and software. In addition, they received virtual workstations for each school in Virginia for use by teachers and students in creating their projects. Transporting the workstations into Ghana and India presented too much of an obstacle. Each teacher received three Mini Notebooks with all of the software to be used in the classrooms with students. In addition, HP Elite Tablet PCs were used to provide professional development to teachers.

Talaiver notes that teachers have expressed a great deal of excitement about the potential teaching benefits of the Elite Tablet PCs. In the future they hope to have "a classroom set of tablets so they can work not only with gifted learners and average learners, but also kids with special needs like kids with autism." Talaiver provided training to teachers in Ghana and India about using probes in inquiry-based science learning, as well as using Scratch in the classroom, using HP Mini-Notebooks.

Project Ringtones

The India Council for Integral Education (ICIE)
India

Summary

Project Ringtones, conducted by the India Council for Integral Education (ICIE), is providing rural and urban students with severe economic and linguistic challenges with technology and educational expertise sufficient to create student-centered, project-based learning environments. The projects students are creating software and educational content relevant to major national education priorities that include a \$35 device called an e-slate and national 3G access that will allow them to connect anytime and anywhere.

The ICIE is working with a rural village school in Tamil Nadu and an urban slum school in Mumbai to help students develop this software for themselves and their communities. The project will provide a marginalized group of students with the opportunity to develop basic skills and knowledge that underlie the STEM disciplines. Middle and upper class schools in India are famous for their STEM-rich curriculum and successful STEM-related expertise; however, this kind of education does not often extend past the more privileged classes to the children in poverty. This project will provide a window into how to extend the wealth of STEM+ knowledge and experience so that all children in India have access to strong STEM educational experiences.

First, using HP Servers, Virtual Rooms, and Elite Tablet PCs, ICIE will provide at-risk schools with the technology and educational expertise needed to create student-centered, project-based learning environments — virtual environments where the students can more easily develop STEM skills. The results of this project will better inform models for future grassroots, culturally appropriate technology integration in developing nations.

The Project in Action

David Morris is the project leader of this HP Catalyst project, and when he describes the difficulties that come with planting a technological project in an impoverished community, it brings to mind an old adage. “When you try to insert yourself into that, people can easily misunderstand what it is you’re trying to do and think, ‘Okay, these folks have computers, therefore they have money, so actually my problem is I need money,’” Morris says. “Actually, no you don’t need fish; you need to learn how to fish.” To put it another way, it is not enough to make technology accessible to an underserved community; you must teach technology that will sustain innovation within a community. Morris says that support from the HP Catalyst Initiative has enabled them to do that.

When the Indian government announced that it would subsidize the manufacture of millions of simple tablets, or e-slates, ICIE saw the abundance of technology as what Morris calls “the wave of the future in education in India,” and switched their focus from cellphone based applications to the newly offered and well promoted tablet. Of their progress, he said, “Through the grant and having the latest HP equipment, we jumped ahead 10 to 18 months and can go right to working on the concept and also to give a very positive image.”

The support from HP also put Morris in touch with other project leaders who have experience in mobile-device based curriculum. He described his conversations with Adele Botha at the Meraka Institute as very helpful. "She had a lot of practical knowledge about practices — how to keep interest up, length from towers, how you put in repeaters, things that are just very useful for us and what will be useful for us in the future with the tablets."

Morris feels confident about the timeline. "We have proof in the concept. That is, we have demonstrated it takes about four months to take somebody from zero to object-oriented to being interested in C++. That's pretty standard." Now in the second stage of the project, students have become familiar enough with the tablets and open source applications that they can now begin to learn C++. For the third and final stage of his project, Morris foresees that after one year of C++ training, students will be able to create their own software. He hopes they will be able to form small companies, perfect the applications, and market them in a model similar to iTunes, which could generate income.

The ICIE's major challenge was in the initial implementation of a technology-based project into a rural village or an urban slum setting, which Morris describes as very complex ecosystems. Knowing full well that a smooth transition into the community was essential to carrying out his goals, Morris called on community organizations that already existed, and put himself into the context of their relationship with the people. To others that are looking to start similar projects in rural or slum environments, he stresses the importance of contacting NGOs, organizers, and caseworkers and seeing these entities as key to promoting the idea.

He also advises others to consider storing their equipment in a multipurpose building, with the idea that it has the potential to be a community center. Using the ICIE's concept of the Ringtone Hut as the model, he explains these buildings are centers of learning which are usually staffed 12 hours a day. "Even adults can come and actually learn a little bit of programming if they're interested. When kids get out of school, and on the weekend, they can come to the Hut and hang out and also work on their projects." Apart from the Ringtone Huts in Mumbai and Tamil Nadu, the ICIE plans to establish 100 ringtone sites around India with a franchise-type model that will allow an individual to invest in their own community.

Technology

For "Project Ringtones," HP provided the ICIE with the technology they requested: HP Elite Tablet PCs, a server to link the tablets and desk units, and printers. This equipment is stored in a building called a Ringtone Hut, which also doubles as a learning center in both Mumbai and Tamil Nadu. In the Ringtone Huts, students familiarize themselves with the HP Elite Tablet PCs and the desktop units, then with simple open source tablet based applications, which will lead up to their training in C++. The printers are mainly used to bring home projects to children's parents.

These learning centers have also hosted volunteer educators who work with local staff to bring computer training to villages outside of Pondcherry with HP mobile devices in tow.

Promoting Interest Through the Use of Digital Literacy & 3D Gaming

St. Thomas Aquinas College
New York, USA

Summary

Games offer students the opportunity to develop strategies to achieve a desired outcome and to learn important skills as they pursue the goals embedded in the game. St. Thomas Aquinas College is developing new models for games that emphasize science literacy, computational thinking, exploratory learning, and industry collaboration. The 3D, third-person games will be tested by marginalized high school students in the East Ramapo Central School District.

Researchers at St. Thomas Aquinas are evaluating how and where games most effectively improve STEM learning. They are identifying methodologies for connecting and applying STEM skills within gaming experiences to solve specific real-world problems. The gaming models developed in the project, as well as the game itself, will be adapted in response to the students' experiences.

Gaming industry partners are contributing to the games' content and mechanics, while mentoring the participating students as they navigate the game. During weekly project-based workshops, students are paired one-on-one with their mentors to learn elements of graphic design and other artistic content that contribute to game development.

The Project in Action

After some initial bumps with distribution and set-up of machines in pilot high schools, the project "Promoting Interest Through the Use of Digital Literacy & 3D Gaming" has transitioned into its development phase. Robert Vermilyer, the Principal Investigator for the project, and his colleagues, have enlisted the collaboration of both high school and college-aged interns and research assistants in creating an engaging and educational STEM game. They have been open to new directions and ideas in the design process, incorporating features such as "students creating [original] background music for the game using the machines. That's something we hadn't originally anticipated doing but we decided that it would be another way of getting students involved... And exposing those students who normally might not be involved in a science project in a science project."

According to Vermilyer, such student involvement has been integral to their success thus far in the game development, and he would advise anyone who might plan to launch a similar project to follow their example. Moreover, students who participate in the design process are presented with a unique learning opportunity. Vermilyer observes, "just being involved in the creation of a project motivates students and starts them thinking about science and all sorts of things they wouldn't have normally thought about."

As the project team continues with the game design, they are working with high school teachers to identify areas of need and STEM topics of interest, which can be translated into game content. After they have gathered this information from the teachers, the team will collaborate with their industry partners, InterGen Inc. of Columbus, OH and Lawler Environmental Group of Nyak, NY, to find examples of how the concepts, theories, and ideas

play out in real life experiences and actual industry activities. Though the project team encountered obstacles at the outset in finding both time and ability of the staff at the high schools to configure and set up the equipment, they hope that with further training provided, the deployment of the game will be a smoother process.

Technology

For the “Promoting Interest Through the Use of Digital Literacy & 3D Gaming” project, the equipment provided by HP included workstations, Elite Tablet PCs, and printers. The Elite Tablet PCs are for use primarily by the students, with one for the teacher. The project team has been using the workstations in the game development phase. Specifically, they are being used to run several software packages, which have been key to the game creation. These include a graphics package called Maya, a game engine called Unity 3D, and Sibelius, a program that enables students to create original background music for the game. Vermilyers considers such technology “absolutely crucial to the success of the project. We wouldn’t be where we were now if it wasn’t for that.”

At the outset of the project, they received some training with set-up and installation of the equipment. Looking forward to the launch of the game, the project team anticipates receiving training for the high schools about how to use the laptops and integrate the game into the science curriculum.

Reaching the World, Mapping the Mind
Global STEM+ Collaborations Between College Study-Abroad Students, At-Risk Youth, Pre-Service Educators and Career Teachers

Reach the World
New York, USA

Summary

How do we help the 'new learner' develop the knowledge, attitudes, values and thinking skills needed for responsible citizenship in a complex, culturally diverse and rapidly changing world? By introducing them to global mentors who can demonstrate actionable pathways to college and career readiness. Reach the World (RTW) cultivates relationships between young students and volunteer world travelers through an innovative program of online journalism and face-to-face interactions. In this project, RTW focuses on fostering collaboration between marginalized secondary students and global mentors, and between pre-service teachers and in-service teachers using the power of peer to peer mentoring to shape curriculum and give project-based learning a real-world context in partnership with the Rafael Hernandez Dual Language School in the Bronx.

For each semester-long volunteer/classroom match, the volunteers will focus on either STEM+ or social studies themes, producing rich-media research content for the RTW website, participate in at least three videoconferences with their students, and exchange frequent project-based email communication. To further this relationship, every RTW classroom participates in the GeoGames curriculum, which ensures that students develop the core world geography skills that support deep engagement with global geographic issues. Students will utilize HP Elite Tablet PCs to digitally complete mapping exercises.

To support RTW's efforts at a teaching level, pre-service teachers from local colleges and universities are also matched up with classrooms, where they work with teams of three to four teachers, providing important technology support and training to the in-service teachers as they integrate RTW into their curriculums. By personalizing both the teaching and learning experiences, RTW strives to create model global citizens who understand how to wield the power of true collaboration to solve socially-pressing problems.

The Project in Action

Reach the World's HP Catalyst project has helped transform math and science education at The Rafael Hernandez Dual Language School. RTW Executive Director and Founder, Heather Halstead, notes, "Our goal for HP was to form successful and robust relationships between STEM, the mentors who are studying abroad in countries around the world, and classrooms and to really push forward in each case. "

This new approach to teaching STEM subjects has truly broadened students' perspective on the world. "The global lens the students are looking through right now is really inspiring them to think beyond the traditional professions that they may see in their community along with this opportunity to study abroad, being introduced via the traveler connection. I think they're starting to really think about their professional opportunities in a broader scale as well," says project leader Tonia Lovejoy.

RTW is currently working with a handful of 6th and 7th grade classrooms to advance meaningful STEM-based learning via science, technology or math projects over the course of each semester. The project evoked such great enthusiasm for math and science that students expressed a need for new extra-curricular activities never before offered at The Rafael Hernandez Dual Language School. Thus, Halstead and Lovejoy initiated the afterschool club GeoTech. Once a week GeoTech Club students stay afterschool to explore the HP-provided technology and research computer resources. Each student has a specific role within the club.

“For example we have a web designer. We have someone who is working with video. We have someone who is into gaming and researching new resources that can be shared, academic researches, educational sites that can be shared in the different subjects,” Lovejoy explains. With the time constraints innate to the New York City public school system, this afterschool club allows students and teachers to maximize classroom-learning activities and get the most out of the HP technology.

Reach the World has also partnered with the Rafael Hernandez Dual Language School with Agastya School in India in a global science fair project. The collaboration will bring hands-on science, mobile learning labs, in the Bronx halfway across the world to students in rural India. The Rafael Hernandez Dual Language School students will use HP Probe Kits to gather real-time data in the US and share it with their Agastya counterpart students, who will do the same in India. Students will then be able to make comparisons and presentations about the two different environments. The pilot project is due to launch in the spring and if successful will provide a model for implementation in other sites that Reach the World works with in the US. “It’s been a neat experience for us to come together across a very wide cultural and geographical divide, and find we have the same problems, which is our young children are not getting science education, which would provide the basis for them to go on to more advanced learning in their life,” notes Halstead.

Technology

Through their project, Reach the World and The Rafael Hernandez Dual Language School received HP Elite Tablet PCs, Probe Kits, and printers, along various computer lab equipment. With these tools, students experience a one-to-one experience with their teacher and partner traveler. The pen tool allows students to write directly on the tablet, which transcribes handwriting into text. This feature has been critical for students who have less access to technology and have limited typing experience.

Halstead and Lovejoy organized two very successful technological trainings that exposed teachers to HP Elite Tablet PC functions and encouraged them to develop technology goals for incorporating the tablets in the classrooms. “Our challenge with the teachers has been really to convince them that this is a resource that is there to improve the teaching methodology, to improve student engagement and really make the teaching process more modern and fun,” says Tonia. The two suggest that anyone looking to launch a similar project be sure to delegate ample time to getting the school or organization tech-ready, and consider the logistical pieces of the project such as efficiently transporting and charging the technology so that all students have equal access to it.

STEM+ Innovations for Under-Represented, Rural Based Science Schools

University of Fort Hare
South Africa

Summary

Arguably, the most effective way to better the lives of economically challenged communities is through education. The University of Fort Hare, in Alice, South Africa, supports rural-based and underrepresented schools that lean heavily on traditional, often outdated teaching methods. The university is home to the FOSST Discovery Centre, a robust resource for science and technology activities including experiments, assembling electronic kits from scratch, and introductions to high school computer literacy.

To identify students particularly suited to pursue careers in science, the University of Fort Hare will select 30 disadvantaged schools in its service area in which to run HP STEM+ hands-on competitions/quizzes and will then select the best 60 students to attend a camp for a week during school vacation at the University of Fort Hare FOSST Discovery Centre. To compete, students must embark on computer-aided projects that involve robotics, aeronautic engineering, physics, mathematics, and more. Winners at the HP STEM+ Camp will further their technical skills by engaging in activities that utilize multimedia software and interactive exhibits.

“Dashboard monitoring” will be employed to measure the success of each initiative, and research papers will track and convey program progress. The project includes the development of a multimedia center that will connect the 30 participating schools and act as a sandbox for science and mathematics education innovation.

The Project in Action

The University of Fort Hare, home of the FOSST Discovery Centre, has reached out to 30 schools in rural communities in an effort to create a new technological foundation for STEM+ students. “Our model is enhancing teaching and learning using technology,” says Phumezo Kwinana, the leader of this HP Catalyst Initiative project. With support from HP as the impetus, this project is bringing underrepresented rural high schools into the modern age. “When we started the project, we were using the old system, the chalkboard system. But when we received the HP computers, we’re able now to let them work in groups and interact on the Internet,” Kwinana says.

The integration of the HP technology depends on how the school is designated. The project has leased two Elite Tablet PCs to four high schools, which have been deemed outstanding in their performance by the South African government. In exchange, the schools will compile reports on the students’ progress and allow their classes to be observed.

Additionally, there are ten focus schools, which already have science and mathematics tracks for students. In these schools, students are given career-based aptitude tests to better prepare them for their technology-related studies at the university. These students, along with those from the other 20 schools, are offered supplementary classes every Saturday thanks to additional funding by the Department of Transport in South Africa. In these courses, students have the opportunity to use educational software, which helps them problem solve

and conduct experiments in the lab. Besides their Saturday classes, students from these high schools are also invited to compete in national science weeks with projects of their own design. This preliminary experience with technology should prepare students for the foundation program offered by the University of Fort Hare that will further familiarize them with STEM+ computer-based technologies.

The project has come a long way. In schools located in rural settings, it is often a challenge to maintain an adequate network connection. Only this year has the situation improved. "We could not even get to Skype in our university. I had to travel about 120 kilometers to get into Skype, so you can really imagine the situation we were working under," Kwinana says. The recent improvement to the network as well as to the curriculum has already hastened students' progress. "There's been a hike, a vast improvement in as far as their performance is concerned in science and mathematics," he says.

Comparing the pre-computer and post-computer pass rates from the 30 schools proves that the effect of the integrated technology is overwhelmingly positive. Regarding the data collected from the Saturday classes, Kwinana explains, "The results in 2009, the percentage of the pass rate was about 50. And when we started in 2010 using the computers, the performance picked up to 93, and last year it was 97%."

As the project progresses, Kwinana admits that he is still learning from his colleagues when it comes to integrating technology into the STEM+ curriculum, and he is on the receiving end of good advice and training. Collaborations with the New Learner Consortium and the Agastya India Foundation have helped support the transition from chalkboards to computers for the project. Kwinana is excited about the upcoming HP Summit, which he thinks will allow him to interact more with his colleagues, as well as a week of enhanced computer training, which will be provided by Longwood University and will take place in April 2012.

For launching similar projects, Kwinana advises that the project leader prepare the institution as much as possible before the equipment arrives. In his case, the equipment arrived before he could concentrate his full attention on the project. "Work with the colleagues within the university. Have this idea bought by the team and the university so they can be smooth operations." Fundraising is also essential to an efficient transition. "You can get this equipment only to find out you don't have other things to make use of them. I would advise that person to be strong in fundraising also."

Technology

"STEM+ Innovations for Under-Represented, Rural Based Science Schools" received HP Elite Tablet PCs, printers and accessories. In addition, HP provided the access points for their network connection. The project is also awaiting the arrival of HP Calculators.

Educational software has been installed on all of the Elite Tablet PCs, eight of which have been loaned to four of the highest performing schools in the region. The project has installed Edukite, Learning Channel, Thinkwell, and TRAC software on the PCs. Over one hundred learners attend the Saturday classes, which means that all of the activities are performed in groups because there are not enough computers for individual use. HP has also equipped the university's mobile lab, which is brought routinely to different rural schools.

Virtual Laboratory for Engineering and Applied Sciences Education (EASE)

Western Michigan University
Michigan, USA

Summary

Learning isn't just about mastering a new concept, but more importantly, being able to apply that concept in a personally relevant and creative way. Western Michigan University in Kalamazoo, Michigan is using a virtual laboratory to build a learning model that fosters the student progression from comprehension to application to self-motivated exploration.

Because physical laboratory equipment and resources are expensive, undergraduate engineering classes often do not have vital lab components tied to them. In this project, two hundred sophomore-level engineering students will engage in prearranged experiments in a 3D virtual laboratory. Using HP Elite Tablet PCs, every student will be able to change the design and modify the virtual lab space in ways that mimic the same process of visualizing, evaluating, and interacting with actual lab objects and equipment.

Among the benefits of the work is that students enrolled in distance learning, students with disabilities, and students who generally do not feel comfortable using potentially hazardous equipment can more easily gain authentic experience via the virtual laboratory.

The Project in Action

Pnina Ari-Gur is the project leader behind the development of the virtual laboratory at Western Michigan University. Aware that the virtual lab may serve as an introduction to a career in the sciences, the team has developed only the most important experiments. "What we do is we choose specific experiments in the materials science laboratory that we feel are the best to start with," she says. Unsurprisingly, preparing an experiment for the virtual realm is no simple task. First the team must conduct the actual experiment and collect data while capturing it on film. Using the film, they then develop the 3D simulation of the equipment. "Then for the modeling, we use virtual reality to make the parts actually move and respond to commands," Ari-Gur explains.

The novelty and innovation of the virtual science lab is attracting a new generation of future STEM+ students. Ari-Gur and her team have shown off their new virtual territory during demonstrations at the local museum, Kalamazoo Valley Museum. "That museum actually serves about 200 miles around," she points out. They have also arranged demonstrations in middle schools and high schools, and have invited high school students to their campus. After they see the presentation, Ari-Gur says many students leave excited about science. "We got comments that they were very satisfied with the virtual lab. It gives them some idea about engineering."

The main difficulty encountered by the team is rooted in the long hours needed to implement and develop the models. Fortunately, the team utilized the university's best resource: human potential. "The way we got around it is we trained students who have some background in 3D modeling, and we trained them in virtual reality," Ari-Gur remarks.

Besides this initial challenge, Ari-Gur describes the progress of the project as a learning experience. "Some of the techniques we developed over time," she says. "For example, a complete, detailed videotaping of the actual experiment, we did not do at the beginning. Now we see this is beneficial to do." The teams also had to consider the perspective of the students who were adjusting from the real lab to its virtual counterpart. "We learned on the fly how to make it more appealing to students," she says. Seeing students' feedback as crucial to a better design, the team asked them to complete evaluative assessments every semester about the virtual experiments.

Educational institutions around the world are showing considerable interest in the project's virtual brainchild, and Ari-Gur and her team are happy to share their findings. "We provide it free of charge for any institution," she says. "We provide it free, happily." She admits that her project's situation was favorable because they found the resources to develop the models they provide, but other institutions may not be as fortunate. "Human resources is a major issue here, because people that have the expertise with virtual reality are in so much demand that it's really hard to find them and have them work on the project." She advises that project leaders working in the same situations should be conscious of their capabilities, and that they have students who can take on some of the work.

Technology

"Virtual Laboratory for Engineering and Applied Sciences Education" received HP Elite Tablet PCs, a PC and monitor, a projection unit, and calculators.

The team uses the HP PC and monitor to develop the 3D models and virtual reality, while the students mainly use the Elite Tablet PCs to do the simulations of the lab experiments. When conducting demonstrations with younger audiences, the projector unit and the calculators come into play.

Pedagogy 3.0 Consortium

Led by Futurelab

Capacity Building of STEM Teachers for Effective Delivery of STEM+ Disciplines for the 21st Century Learner

University of Nigeria, Nsukka
Nigeria

Summary

The University of Nigeria, Nsukka believes that students perceive STEM subjects to be too abstract to fully comprehend, and teachers have a difficult time finding ways to make them more engaging. As such, the problem with STEM education is connected with the method of delivery where content is separated from pedagogy. In this project, the university will explore various pedagogies to establish the best methods for teaching STEM disciplines to students.

To facilitate hands-on training for teachers and students, the university will set up technology-driven classrooms with HP technology. This infrastructure will support them as they evaluate the following: What is the level of collaboration between pedagogy and content experts in the university? What online course materials are likely to bridge the education gaps between cultures? What online facilities are likely to promote sharing of research results? After evaluating the outcomes, they will develop online courses, websites, virtual libraries, and tutorials to help train teachers and students on STEM subjects. Teachers and students will collaborate on assignments using videoconferencing tools, chat rooms, and listservs.

The Project in Action

Project Investigator Uchenna Nzewi and her colleagues at University of Nigeria, Nsukka have recently embarked on the groundbreaking HP Catalyst project "Capacity Building of STEM Teachers for Effective Delivery of STEM+ Disciplines for the 21st Century Learner." University staff, faculty, and students are excited about this project, which they hope will cultivate a more dynamic STEM education experience. "What we are doing is to build the capacity of teachers so they can use the technology to teach science, technology and mathematics," explains Nzewi.

While they are still in the early stages of the project, Nzewi and her team at the University of Nigeria have managed to achieve a great deal. "We designed some questionnaires to find out the entry level of teachers, how much they can use the ICT facilities," remarks Nzewi. With the data collected from these questionnaires, the group developed a baseline from which to begin technology trainings. In these hands-on trainings participants have learned computer power functions, mouse control, typing, Internet navigation, and email use. Nzewi notes, "Some people have never, ever used a computer all their life. Most of them have created email addresses to send emails and they respond."

Nzewi refers to the original questionnaires when she states, "Part of our outcomes was to see how excited the students are about science and technology." When asked about students'

response to incorporating technology in the classroom, Nzewi responds, "They are very excited. We have received tremendous reviews."

The course is scheduled to start in mid-February and teachers and students alike are enthusiastic about implementing their newly acquired computer skills in the classroom. They are also eager to collaborate globally with their peers, and expand their educational experience.

While the "Capacity Building of STEM Teachers for Effective Delivery of STEM+ Disciplines for the 21st Century Learner" has maintained a great start to the project, Nzewi and her team have experienced one significant setback early on. According to Nzewi, "The major obstacle we had was the political situation in the country." Political unrest in Nigeria affected everyone, as universities closed and students were not able to attend their classes or meet for computer trainings. Nzewi also struggled with project participation as well. She began by recruiting volunteers, but wishes she had made this project mandatory for students. It is best to build strong working relationships with professors, administration and students before engaging in such a project. "Talk with the faculty and get all the students to move along with you," Nzewi states.

Technology

Through HP Catalyst project "Capacity Building of STEM Teachers for Effective Delivery of STEM+ Disciplines for the 21st Century Learner," Nzewi and her team at the University of Nigeria, Nsukka received HP laptops, printers, and servers. Science and math professors will use the laptops in the classroom for interactive STEM-related activities. They will also upload lectures for students to access outside the classroom.

Each student participating in the project will be assigned a laptop to use outside of the classroom to access course resources online. The servers will be used to upload the online lab sessions and store them for student access throughout the entire semester.

Most members of this HP Catalyst project team are highly computer literate and are working to administer the technical training portion of the project. "Within the university we also have an ICT unit and we are working with them. So what we do is we invite them to come and teach the people the basic competency skills," explains Nzewi.

She and her team have encountered a wide range of computer literacy in the project participant group. Nzewi notes, "We have isolated those that caught on faster than the others to use them as the main group, while we are trying to build the capacity of the others, because eventually the idea is that anybody who is a STEM teacher has to be able to use the computer."

Computer Supported Collaborative Science Initiative

California State University Northridge
California, USA

Summary

California State University Northridge (CSUN) believes that middle school science students can learn more when teachers use a student-centered, collaborative approach with the support of technology. The "Computer Supported Collaborative Science Initiative" (CSCS Initiative) is an ongoing effort to help science teachers in high-need Los Angeles area schools engage students in authentic research experiences through the use of cloud based computing tools. The grass-roots effort targets teachers directly by inviting them to participate in "Google boot camps" that teach them how to use online tools to gather data, collaborate on the analysis of this data, as well as assess knowledge gain.

As the second-largest teacher-training institute in California, CSUN is responsible for credentialing a high percentage of teachers serving this high-poverty district. With four mobile computer labs, the CSCS Initiative will be able to support teachers whose classrooms do not have sufficient equipment to conduct the activities, as well as conduct boot camp activities at CSUN and pre-service teacher training during the year.

The Project in Action

"Computer Supported Collaborative Science (CSCS) Initiative" project leader Brian Foley is working closely with four faculty members from the College of Education and six faculty members from the College of Math and Science at California State University Northridge. They are working together to incorporate technology in the classroom at the secondary education level. When describing the CSCS team, Foley notes, "It's a very democratic group." Perhaps it is this cohesive quality that prompts the great success of this inspiring and innovative HP Catalyst project.

This HP Catalyst project team is using cloud computing to create a multi-user forum where teachers can upload weekly assignments for students. Cloud computing also promotes a more collaborative work environment for students. "You can get a lot quicker feedback on the work you're doing. And you can also be writing collaborative reports and sharing those with other students on all sorts of things," Foley remarks.

This project also utilizes cloud computing to alleviate the time restraints present in the traditional science classroom. "One of the things about being a science teacher is you've got this lab set up and you're collecting data and the bell's going to ring and you're going to sort of lose everything," says Foley. With cloud computing students can pick up where they left off in the previous class and do not have to worry about losing work.

Thus far, the CSCS team has conducted extensive teacher trainings on the use of cloud computing and implementing technology in the curriculum. "We actually had the teachers teach their lessons during the summer workshop. We took advantage of the fact we have a summer school on campus and we borrowed some of the classes and had some of the teachers actually go in and try out these new lessons they've been creating," Foley explains. The teachers are in their second semester of using cloud computing in the science courses.

When the course concludes, Brian and his counterparts will collect data from each participating school and analyze the effectiveness of cloud computing in the classroom.

Foley and his project team have experienced two challenges in their HP Catalyst project. Initially, teachers did not utilize the technology in the classroom as frequently as intended. The time lag between teacher trainings in the summer and the start of the fall semester made it difficult for the newly acquired knowledge to remain fresh, and for teachers to maintain momentum and excitement for its use in the classroom. This HP Catalyst project team amended this by meeting with teachers more frequently and developing more interactive professional development workshops throughout the semester.

The team also encountered technical problems in their project. In some schools, science teachers did not have computers in the classrooms and computer labs were needed for assignments. Relocating 30-40 students to a computer lab is often disruptive and detracts from regular classroom experiments. Appropriate laptop distribution to the schools helped alleviate this stress. Additionally, some schools' bandwidth did not support Google, which slowed down the project's timeline. Foley recently discovered a solution to this problem and notes, "We're really optimistic that we're going to get some much better data in the spring than we had in the fall."

According to Foley, part of what has made CSCS so successful is its simplicity. The instructional approach can be applied to almost any curriculum and environment. He explains, "There will be unexpected challenges in the classrooms and you don't want to take on too much." Foley suggests that any future project leader implementing a similar project start small.

Technology

Through their HP Catalyst project, "Computer Supported Collaborative Science Initiative," Foley and his counterparts at California State University Northridge were provided with HP Netbooks and tablets. The HP Elite Tablet PCs are primarily used for teacher professional development workshops. Teachers have been exploring the software uploaded on the tablets and developing activities in the course curriculum to include technology in their lessons. Middle school students utilize the Netbooks in their science classes. This project has been implemented in larger urban schools with classes of 40+ students. Students work in groups, sharing a laptop for their lab experiments.

Design Corps

Learning Games Network, in partnership with
P20 Innovation Lab, University of Kentucky, and the
Student Technology Leadership Program, Kentucky Department of Education
Kentucky, USA

Summary

How many students would prefer to be making a difference in the world right now if they could? Based on the results of an extraordinary partnership between the Learning Games Network in Cambridge, Massachusetts, the P20 Innovation Lab at the University of Kentucky, and the Student Technology Leadership Program of Kentucky Department of Education, it appears a great many would. Called the “Design Corps,” the partnership is based on a participatory national program that inspires teachers and students to excel in new methods of exploring STEM concepts by creating challenge-based learning projects — immersing teachers and students in a collaborative process that requires the adoption of new ‘roles’ of teacher facilitated, student-driven inquiry and design.

“Design Corps” currently engages 6,000+ students and teachers. Students delve deeper into the course content as they apply their newly acquired knowledge in designing a playful learning experience. They are more motivated — even empowered — because they are realizing their own creative visions and, in turn, are making more concrete connections between what they learn and how that knowledge can be applied. Partnering with the State of Kentucky, “Design Corps” will be embedded into their statewide Student Technology Leadership Program, which supports teachers and students in conducting technology and project-based learning.

Researchers at the University of Kentucky’s P20 Innovation Lab will study the effectiveness of this approach and pedagogy. The P20 Innovation Lab will assemble team of 25 teacher-researchers known as the “Kentucky Game-Changers,” who will serve as the on-the-ground catalysts and action researchers for this project. Together they will study the impact of this approach and how it relates to existing statewide efforts to refine and scale pre-service and in-service teacher training on new STEM pedagogical approaches.

The Project in Action

The Boston-based non-profit organization, Learning Games Network, is revolutionizing traditional approaches to education. HP Catalyst project leader Jennifer Groff states, “We see design work and design thinking in a critical channel for children developing understanding in a certain content area.” Groff sees her team’s project “Design Corps” as “one way to encourage collaboration between teachers and students to explore topics. And often to demonstrate ability in learning rather than say a research paper at the end of the project.”

According to Groff, the first-year goal for the “Design Corps” project was to “create a beta or prototype of our in design process to pilot with schools in Kentucky that have a statewide technology program that works with students at the high school level interested in applying their abilities and knowledge into some technology area.” By working in conjunction with the Kentucky Department of Education, the team achieved this mission. The learning games course included a STEM project competition. “We brought the winners of the competition to

MIT for a week to be participants in our summer game design camp," says Groff.

Learning Games Network Executive Director Alex Chisholm provides interesting anecdotal evidence of the effect the "Design Corps" program is having on student learning. According to Groff, Chisholm notes that, "Students who have grown through the game design program with us have designed better, and were stronger, more robust, and rich as far as content and content knowledge, compared those students who didn't go through our program."

Through this HP Catalyst project, the team also created a tangible toolkit in hopes of achieving more scalable results in the project's second year. Groff explains, "Working with Cablevision, we beefed it up quite a bit and improved the curriculum, improved our resources and materials and created polished videos that a company teaches a lesson for the steps through the game design process to support teachers at their own pace if they want to use the materials." "Design Corps" is halfway into its second year and Groff and her colleagues are eager to assess if the addition of this new tool will provide more data to collect at the end of the course.

According to Groff the largest obstacle in the project has been the limited budget. This was especially difficult for collaborative work. Limited resources made it difficult for Learning Games Network staff to meet with University of Kentucky partners, which created a strained relationship early on. This jeopardized the evaluation portion of their project. "It's very much about relationships," says Groff. The most fruitful collaborations for Learning Games Network have been with organizations with which there were strong ties before the project began.

The limited budget also made it difficult to transition the prototype to a permanent online learning resource. Groff explains, "Ultimately we're so happy with the product but there were definitely hurdles in creating, coming from the webinar version to the productized version was challenging but we realize for this to really impact kids beyond this two year Catalyst grant it's got to be made into a product that can be scaled because what we had joined on the Catalyst program to do could not be scaled."

Technology

Through this HP Catalyst project, Learning Games Network was provided with HP laptops, a server, and a color printer. Groff and her colleagues distributed the laptops to participating learning sites across Kentucky. Students use these laptops to access the Learning Games Network toolkit and work on their individual projects in the classroom. All digital material for this project is loaded to the HP-provided server at the Learning Games Network office in Boston. The "Design Corps" team uses the printer for all project-related documents that are distributed to partner organizations and the participating Kentucky schools.

E-Scapes: Towards STEM+, in Theory and in Practice

Graduate School of Education, University of Bristol
United Kingdom

Summary

With distance learning becoming the education method of choice for millions of students worldwide, the University of Bristol consortium seeks to transform traditional teaching methods into a model focused on collaboration. Ultimately, sixty graduate scientists at the university will receive e-scapes training to be the classroom practitioners and curriculum managers of the future, with each of them encouraged to develop innovative teaching strategies to employ within their own schools. The graduate students will work with their professors to build a new generation of materials called "e-scapes." As they create, the students will be encouraged to think like experimental scientists, researchers, authors, and filmmakers, instantly sharing their ideas with teammates, other schools, and the members of the consortium.

The project includes a consortium of leaders in their fields that represent a mix of secondary and tertiary education institutions. These include a software provider, localized media expertise, a filmmaker, innovative local practitioners, local schools in Bristol and the South West, as well as local (and national) providers of continuing professional development for schools. These practitioners will interact with students around their own research and the work of the students. The teachers in this mix will model new behaviors as well, shaping the experience as research facilitators, debate moderators, media consultants, ICT trainers, and more.

The Project in Action

Dr. Neil Ingram is the lead researcher for "E-Scapes," the HP Catalyst Initiative project which aims to train future teachers to effectively incorporate new media technologies into their curriculum. Ingram hopes the new teachers will develop strategies to facilitate their students' interaction with computers. He says, "They can create experiences for their students in which the students themselves use this technology to learn about science. The whole thing has got a STEM based agenda."

Because the grant funding and equipment arrived with little notice, Ingram says that they spent the first year planning and organizing. Yet the progress of the project seems to be on track. "The first year of the project was intended to be a pilot study in which we allowed the students to work with their schools to make films or animations or work with data logging equipment," Ingram says. He adds that then tracked the students' progress and the outcomes while noting the different challenges that came up. Collecting this feedback allowed Ingram to create protocols that will streamline the training process.

During the second year of the project, students will receive standard teacher training along with their "E-Scapes" training in digital media technology. Ingram explains, "In the next few months, a number of them will be doing some kind of multimedia episodes, which they will monitor and they will write about as part of their curriculum for the training course." Not yet accustomed to the work intensive and complicated projects, students should be able to refer to the materials Ingram and his team developed at the close of the first year, which organize

the tasks by particular deadlines. In addition to this project, Ingram adds that they plan to write a manual that will describe this process, which he hopes will be helpful to other institutions that are working on similar projects.

Now in the second year, Ingram believes "E-Scapes" may have reached the point where he can begin to focus on collaborations. He has already connected with Ben Williamson from the University of Exeter, but their discussion is limited to the theoretical issues of the pedagogy that comes with using digital technology in the classroom. "We're trying to find what pedagogy 3.0 might look like in an era of mobile technology and semantic web and the free availability of many tools like Google sites and so on," Ingram explains. "We're using a theoretical model based on a sociologist called Bernstein, which allows us to make predictions about what might happen." He says that they are working on publishing their research very soon. Beyond his connection with the University of Exeter, Ingram says he is looking to collaborate with people in Africa.

Looking beyond the theoretical realm, Ingram relates his enthusiasm for being involved in such innovative and practical work. "Our students themselves are finding that having some competency in this area is making them more employable with schools," he says. He hopes the theoretical development that supports ICT in education will reinforce its practical benefits for students.

Technology

"E-Scapes" received a number of laptops which are loaned to students so they can work on their own, while a portion of the laptops are taken to schools for student-use in classrooms.

Ingram says that he's worked with several different partners that have contributed to the project in different ways. Adobe, for one, has equipped their machines with their programs, which give students access to industry standard media software. Without the HP equipment, it would be impossible to run this sort of software, Ingram says.

He's also been working with people associated with Science.TV who teach students about data logging equipment in schools, remote center, and probes. Additionally, professionals from film production companies like the Bristol Film Academy work with students on filmmaking techniques such as stop-motion. "One of the exciting developments of that is that we've been trying to get the student to use their own mobile phone as stop motion film cameras," Ingram says.

Future Learning Environments

Fraunhofer IAO Institute for Industrial Engineering
Germany

Summary

The Fraunhofer IAO Institute for Industrial Engineering (the Institute) in Stuttgart, Germany, is exploring the premise that science can help in the pursuit of the most universally effective learning environment. The Institute aims to discover the best balance of learning models, room and ambiance design patterns, communication facilities, technology, and media, not only for its unique curriculum, but for any learning enterprise. To do so, they will build a network of research partners and user organizations, with an initial concentration on the interplay and interdependence of real and virtual learning environments.

Generally, teachers and those that influence them tend to stay in the realm of their specific discipline. The learning environment they know is the learning environment they were trained in. In an era in which we are all always connected, the essential question is which aspects of those old models do we need to keep, and which need to make way for new approaches?

The “Future Learning Environments” project will study the relationships between all the variables in a typical learning environment, and investigate how the right mixture of e-learning, mobile learning, group learning, just-in-time learning, and workplace-based-learning could impact the level of knowledge comprehension. The research findings will then be used to inform practical guidelines for creating innovative, learner-centered environments — especially those that are sustainable and adaptable.

The Project in Action

Anna Hoberg is the project leader responsible for “Future Learning Environments” at the Fraunhofer IAO Institute for Industrial Engineering. With partial funding from the government, the Institute has been working toward its goal of creating varied learning environments and offering innovative techniques to engineering students for the past three years. “The main idea is to form learners in their own organizations and in their environments to support learning with very collaborative approaches,” Hoberg explains.

One of these collaborative approaches was born out a concept that transformed over time. According to Hoberg, the original idea was to make learners responsible for their own learning by having them create their own content. In other words, the curriculum of certain courses would rely solely on user-generated content. But there were difficulties in this approach. Hoberg explains, “We realized pretty soon that it is not that easy to motivate them for this approach.” Rather than throwing out the idea, Hoberg and her team saw the interaction take a shape that would allow students to learn from each other. “In the end, there were quite a lot of Word documents and PowerPoint presentations that could be connected,” she says. “They were really valuable for the course itself.”

Of meeting her objectives, Hoberg points out that it is difficult to say due to the general nature of the project proposal. Even though there are not specific tasks or milestones, Hoberg considers the project successful. “We have the overall project that’s been finished and we set

up the concept of organized learning and brought it into practice," she explains. To illustrate, she mentions a two-year science course that has just ended at the Institute. All of the students in those classes received good scores on their final exam, which is issued by the government.

Looking ahead, Hoberg sees the project branching outside of the academic realm. "We are always looking for how to use the results of learning research topics in business contexts," she says. The organizational and collaborative concepts they are developing in the Institute would prove useful to businesses, Hoberg believes. "Enterprises, in our opinion, need structured approaches for future challenges like demographic changes or contexts like that."

Technology

The Fraunhofer IAO Institute for Industrial Engineering received 40 HP netbooks, 10 Touch Netbooks accompanied by 10 monitors and docking stations, as well as two printers and one HP server.

The HP technology has been essential to building the infrastructure of The Blended Learning, Training and Development Center in the vocational training site in the school. Trainers can work with the netbooks and monitors in order to do and prepare for their online courses.

Additionally, using the HP netbooks, Hoberg has developed a new learning scenario that focuses on mobile learning and mobile infrastructure for groups of students that meet intermittently.

Kingston Primary School Internship

Kingston Primary School
Australia

Summary

In rural Australia, the demands placed on teachers are far more related to culture and how well it is understood than those facing teachers in suburban schools — how students learn often reflects the community where they live. Kingston Primary School is planning to provide new teachers with specialized training for rural school settings that includes a yearlong internship, followed by pairing with a mentor teacher for two years in Western Australia, a state that is home to many marginalized and geographically isolated communities.

The school, in partnership with Edith Cowan University, has developed what they refer to as a Professional Learning Model to facilitate this training. The model involves the use of Virtual Rooms, supported by HP technology, to link the pre-service teachers with other interns in their program as well as facilitating fast, high-quality assistance from a group of mentors. The pre-service teachers will use HP Elite Tablet PCs to prepare lesson plans and demonstrate their knowledge acquisition in real-time.

The Project in Action

Principal Alan Kidd and Deputy Principal Tanya Uren are leading the “Kingston Primary School Internship Project” at this unique Australian school. Kingston Primary School is the only institution in Australia that administers a pre-service training program for primary education teachers preparing to work in the remote and rural schools in Western Australia. “Where the HP Project fits in is that we’re also using technology to continue to provide support and professional development to be taken in remote areas of Western Australia,” says Uren, project leader.

Since the beginning of this HP Catalyst project, Kingston Primary School staff trained and graduated nearly 30 student-teachers and remain in contact with them as they work in the field. They have also maintained a fruitful collaborative relationship with Murdoch University and gained another project partner, Edith Cowen University. Uren and Kidd note that the extensive collaborative opportunities made possible by this HP Catalyst project will continue to greatly benefit their school. “It’s opened so many doors to what we can do in our primary school knowing that 99% of other consortium groups are actually universities, not primary schools,” Kidd explains.

Uren and her colleagues hope to improve the education curriculum at the primary school as well. According to Uren, this will be accomplished by “improving mathematic teaching through the use of HP tablet technology and at the moment the area of need that we’ve identified is probably geometry focus and maybe statistics and data.”

While Uren and her team at Kingston Primary School have succeeded in the administrative pieces to their project, they have experienced significant technological setbacks. As a government school, Kingston Primary School is bound to strict government policies on the use of technology. “We have standard operating systems and any computer and technical equipment we put on the department network is supposed to be sourced from a select list,”

explains Uren. Unfortunately, the HP equipment was not on this list.

However, with a great deal of determination, creativity, and additional funding from the school budget, Kidd and Uren have succeeded in upgrading the network to accommodate the HP equipment, and the HP tablets will soon be incorporated in the students' geometry lessons.

Kidd and Uren note that administrative support from the Australian government's Department of Education and local universities is crucial to their project's success. Uren states that any organization interested in initiating a similar project "would need to have very strong and innovative leadership but also good connections to local universities that provide a teacher training service. And those universities need to be willing to be flexible in their approaches just to make it work."

Technology

Through the "Kingston Primary School Internship" project, HP provided Kingston Primary School with HP Elite Tablet PCs, Netbooks, hard drives, Virtual Rooms, and a printer. The HP Elite Tablet PCs and Netbooks will soon be used in the classroom during lessons dealing with transformation of shapes and understanding angles.

Uren notes, "We're hoping the flat Notebook surface and the tablet surface will allow greater collaboration between students, will allow teachers to assess what the students are doing and enable students to achieve a greater understanding because they're not spending hours and hours drawing shapes and redrawing them ...We're also hoping that the interactivity of the tablet will again achieve deeper understanding in those difficult areas."

Using Technology to Support Teacher and Student Conceptual Learning in Mathematics and Science

Kenyatta University
Kenya

Summary

In Kenya, it is a fact that very few teachers have significant IT skills. There is also no concrete link between how pre-service education impacts a teacher's post-graduation professional development. Kenyatta University, located outside Nairobi, Kenya, wants to address both of those challenges. They plan to work with colleagues from the Departments of Chemistry, Mathematics, Physics, and Biological Sciences at Kenyatta University and mathematics and science education colleagues from Syracuse University, California State University–Fullerton, and California State University-San Marcos.

The project will reach 300 pre-service mathematics and science teachers and eight in-service high school teachers in an exploration of ways to more effectively develop mathematical and scientific curriculum. All participants will attend workshops to learn how to use Elite Tablet PCs, prepare and share classroom tasks with each other, and collaborate on techniques to incorporate technology in the scientific inquiry and problem-solving process. The primary purpose of the training will be to employ the technology as a means of fostering more comprehensive understanding in students.

Kenyatta University is home to 3,200 students enrolled in education programs to become secondary math and science teachers. The project will further relationships between Kenyatta University and school-based sites. Equipped with HP Mobile Calculating Lab Probes and HP Graphing Calculators, they aim to provide their pre-service teachers with the skill set necessary to instruct future students utilizing 21st century technology.

The Project in Action

HP Catalyst project leader Marguerite Miheso-O'Connor speaks with great passion as she discusses how her project will enable Kenyan educators to reach their full potential and better prepare students for the future. She notes, "We came up with this project because in the way that math and science is being taught here at the secondary school level does not focus on conceptual understanding." Miheso-O'Connor and her team at Kenyatta University have set out to meet this need by incorporating emerging technologies in the classroom.

The HP Catalyst project "Using Technology to Support Teacher and Student Conceptual Learning in Mathematics and Science" came to Kenyatta University at the right time. The recent influx of computer technology in the country has sparked immense interest in projects that support the use of technology in non-conventional ways. As demand for participation in this project currently out-weighs resources, Miheso-O'Connor and her team are struggling to keep up with current volunteer interest. "We're very happy about this because we didn't know we would reach that point. We're very happy and grateful to HP for giving us the opportunity to support each other in learning about technology. We also learned quite a lot," says Miheso-O'Connor.

The team organized and facilitated two faculty development workshops focused on computer literacy and the use of computers in the classroom. While equipment is limited, professors have been very enthusiastic about this newly acquired knowledge and have incorporated it in their lessons. Miheso-O'Connor and her colleagues at Kenyatta University have also conducted IT workshops for teachers at the secondary level. Miheso-O'Connor says, "Together with the teachers [we] have also visited IT centers where integration of technology at school level is being supported at [the] government level. And the teachers have picked up now, they're more confident with using technology and accessing material on the Internet and also involving students in the kind of research work after they have made their presentations. And we are very happy with their progress."

Miheso-O'Connor and her team will soon receive HP Probe Kits, at which point they will continue faculty development. "We hope to hold workshops with both the pre-service and the teachers and lecturers in the university so they're able to use this at [the] classroom level," Miheso-O'Connor says, "[With] the support of Syracuse and California State Universities' experience we should be able to have both the lecturers and teachers engaged in using this type of technology at a very high level."

The project team experienced a few challenges in their project. There were not enough facilities to accommodate all project participants. Additionally, because the pre-service teachers are spread all over the country it is difficult to evaluate their use of technology in the classroom once they begin teaching. Lack of infrastructure has proven difficult as well. Some pre-service teachers are sent to schools that do not have electricity. In these situations it is difficult to maintain group cohesion and motivation to stay abreast on emerging technologies that may affect teachers when they do one day have access to these materials.

Miheso-O'Connor comments on a final difficulty in the project, "The other challenge we have with the pre-service is fear of technology but that is being overcome. At the beginning they didn't have sufficient confidence to try [it] out. And so that is the attitude we have focused on. At least 90% of them are now ready and they're on their own. They're more independent." Through all the obstacles, the most important thing to keep in mind is strong support for the project participants.

In offering advice to potential future project investigators, Miheso-O'Connor suggests, "Think about other technology other than the computer if they are in the same environment like the one we're dealing with. Focus more on how students can still access this without going to a computer lab like using mobile technology, which is catching up very fast. That is the way to go, mobile technology."

Technology

Through their HP Catalyst project, Kenyatta University received HP computers, Elite Tablets PCs, and Probe Kits with calculators. Under the guidance of instructors and facilitators, workshop trainees use this technology to learn basic computer competency. They build upon this foundation to cultivate a more specialized knowledge that will allow them to use computers in STEM-related courses.

STEM-preneur Consortium

Led by Tsinghua University

Business Cradle for Technical Students

Saratov State Technical University
Russia

Summary

In Russia, students who are studying technical subjects often do not have sufficient opportunities to gain practical business knowledge, a problem that the Russian government recently highlighted, along with the necessity to increase the number of student-driven small businesses at technical universities. Saratov State Technical University (SSTU) plans to accomplish this at their institution by developing a set of nine online courses designed to develop business skills among such students, and ultimately to encourage them to open their own businesses.

Among the online courses being developed in the “Business Cradle” are basics of e-commerce, project management, and marketing. In these courses, Bachelors and Masters students majoring in subjects such as robotics and civil engineering will work with each other to generate new business ideas and consult with each other in teams while launching small companies. Web portals, made possible with HP hardware, will support this collaboration and online learning, and facilitate social networking among the young entrepreneurs.

By blending online learning with team building, SSTU hopes to prove that the methodology of mixed business training can and should be adopted by other universities and social services. They plan to assess the success of their project by measuring the number of students who successfully complete the program and tracking them to see whether they are able to sustain the businesses they started or gain employment at other companies.

The Project in Action

Project Investigator Olga Dolinina and her counterparts are pioneers in their field at Saratov State Technical University, where they have identified a need for entrepreneurship skills in their business students. Dolinina explains, “It’s very hard to start their own business after graduating and especially we don’t have a very stable economic situation. So it’s very difficult to find a good job in a company.” This is why Dolinina and her team have embarked on the HP Catalyst project “Business Cradle for Technical Students”. Dolinina notes, “This project is devoted to the development of entrepreneurship skills of students and graduates of technical universities.”

Olga and her colleagues have completed the first stage of the project, which was devoted to developing the course curriculum and creating the teaching material. The course was designed to include subjects such as financial management, marketing, staff management, modern computer technologies, and e-commerce.

"We just got the HP equipment and now we're trying to understand how we'll use them in the project. This is the process of implementation of the software," says Dolinina. The group installed and tested the Virtual Room equipment to ensure remote learning will be possible once the course begins in February. Teachers will then be able to cultivate practical entrepreneurship skills in their students. Dolinina remarks, "We will try to help them develop their business plans, to develop their business ideas. And during the project we'll try to develop at least ten business teams, which will start their small business companies."

Over the course of the project, Dolinina and her HP Catalyst project team have maintained strong ties with St. Petersburg State University of Information Technologies, Mechanics and Optics. According to Dolinina, they also created relationships with other HP Catalyst project leaders, "especially with people from Nigeria and from France who have the project on the New Pedagogy in business education." "Business Cradle for Technical Students" is still in its early stages but the group is eager to continue collaborations and share information as the project unfolds.

The team at Saratov State Technical University has also established a dynamic body of local partners that will play an active role in the project's development. "We already have agreements with several companies through our region-business companies, who are ready to be volunteers in the project and to work with our students in the business cradle." Dolinina has created seven links with different local companies and universities.

Technology

Through the HP Catalyst project "Business Cradle for Technical Students", HP provided Saratov State Technical University with laptops and mobile devices. The business cradle curriculum was designed to incorporate technology as much as possible to accustom students to conducting business in the modern world. Dolinina explains, "The students come to the classes and they will use all the mobile gadgets because we have special courses in mobile technologies. We are going to teach students how to use electronic business, in their business world. Also we will teach them how to use the different web technologies for building the web-oriented applications as well."

Dolinina and her team also received Virtual Rooms, which are connected to an HP server. "These Virtual Rooms in the HP labs will be used during the educational process. We'll go into put most of the information through the webinars for our students so they can combine the lecture in the classes with the education through webinars," says Dolinina. The Virtual Rooms are vital to the success of the project, as four of the five lessons will be taught via these webinars.

Business Math at Conestoga College

Conestoga College Institute for Technology and Advanced Learning
Ontario, Canada

Summary

Conestoga College believes that the use of information technology in the math classroom enables students to develop ideas, solve problems, and understand the commonalities among different concepts. The Conestoga College Institute for Technology and Advanced Learning is offering a program that strengthens math competency by creating an engaging and collaborative environment focused on helping students to relate their learning experience to real business applications. A Business Math Lab, which includes 45 HP Elite Tablets, an interactive white board and use of online learning tools, videos, and collaborative software will serve as the cornerstone of the project in the Faculty of Business at Conestoga College.

Classroom activities will involve interaction with business and financial services professionals through the school's partnerships with local businesses. In the second phase of the project, a mini-lab consisting of ten HP Elite Tablet PCs will be used in Conestoga's Centre for Entrepreneurship to provide workshops in budgeting and business planning for students wanting to start their own businesses. Conestoga is also exploring using tablets to support tutoring in math of struggling students that are in multiple campuses. In addition, up to 10 business math courses will be introduced into the project. Introduction of the entrepreneurial component will provide a meaningful context for learning math. Conestoga plans to share their findings with a national alliance of ten leading research-intensive institutes of technology.

The Project in Action

According to project leader Lisa Koster, the idea for HP Catalyst project "Business Math at Conestoga College" began a few years back at the "This is IT" Conference (now called "Advancing Learning Conference). It was there that Koster was introduced to Carol Carruthers and her HP Tablet Computing project at Seneca College in Toronto. "The idea came from using it in her technology math class where she had students similar to ours; those that tended to have a harder time with math and were weaker in math," explains Koster.

"We're hoping to use technology and a variety of different means to improve their base skills in math so when they continue on they'll be more successful," says Koster, "We're also trying to connect mathematical concepts to entrepreneurship and the business world and have entrepreneurs come in and talk to us about how they use math. This way, the students can see there is a relevance to what they're learning."

Koster and her team received the HP Elite Tablet PCs late in the Fall 2011 Semester, and implemented them in business math classes. While it is early in the project's life cycle, Koster is already seeing the positive impact the Elite Tablet PCs are having in the classroom. "The same lesson done the traditional way took maybe two thirds of the time because the students that really needed to be listening weren't," Koster says. "With the tablets in front of them when they are working on a question, they are more involved. For the questions the students are having problems with, they have been putting their hands up and asking for help. This is

not something they have done in the past.”

Due to the late arrival of the HP Elite Tablet PCs, this HP Catalyst project team is a little behind in tracking concrete data to evaluate pass rates in the course but, “We’re hoping the 30% fail rate will drop down dramatically,” Koster says. The group is eager to complete this winter semester, which will provide data on student HP tablet use throughout an entire course.

Once the semester ends, Koster and her colleagues will collect and analyze data, and draw conclusions about what this means for use of technology in classroom to improve the pass rate of students. The school will also soon open a satellite campus and the HP Catalyst project team is exploring how they can expand their project to encompass this. “We’re looking at maybe having one teacher in one campus teaching two classrooms in two different cities. So there might be some opportunity to consult with other Catalyst members,” Koster remarks.

The greatest challenge Conestoga College has faced in this project is assuring that all technology is in working order for all students to use. Each student receives his or her own Elite Tablet PC when they come to class. With so many students utilizing the technology, the project administrators have developed a system to ensure responsible use. Lisa explains, “They’re given a specific inventory number. And when they come into class and take their computer, they have to check it out when they open it up. They know to check it out because if there’s anything wrong with it, it goes back to the previous person that used it. I think the procedure part of it just keeps them honest.”

Koster offers advice to other project leaders. “Make sure you have full support from your IT and your facilities. When you start bringing these computers in, like in our case, it’s a very different environment.” She also suggests that project leaders meticulously plan each phase of the project, always taking logistical needs into account. A project team should acknowledge everything from teacher training to classroom set up before embarking on the material part of the project.

Technology

Conestoga College received HP Elite Tablet PCs, multiple printers, and a server. Students and teachers use the Elite Tablet PCs throughout the business math lectures and the printers are provided for students who wish to obtain a hard copy of their notes after class. Koster and her team used HP funds to purchase DyKnow, a collaborative software program that is connected to the HP-provided server. With this software, everything the teacher displays on his or her Elite Tablet PCs automatically appears on the students’ Elite Tablet PCs. The students are then able to write their personal notes directly on to their individualized copy of the lecture.

“It works beautifully with the tablets,” notes Koster. The DyKnow software also works as a quick evaluation of students’ understanding of the lesson. Teachers can request student feedback much like a stoplight. Koster explains, “If you see a lot of people choosing red, which means ‘stop.’ you know you have to go back. Yellow means they’re on the edge, and not quite understanding, and green means yes, no problem, let’s move on. It’s really a great indicator as well. It allows students to say I don’t get it without actually putting up their hand.”

No significant training for the students was needed for the basic use of the HP Elite Tablet PCs. Students and teachers dove straight into using the hardware in the lectures. The technology really seems to engage students in the lesson. Koster remarks, "I had a student put it perfectly, and I love this analogy: he said 'with the tablet in front of me, I can't help but pay attention.'"

Design Thinking
Pedagogy in the IDEA School
EMLYON Business School
France

Summary

EMLYON Business School, known for their entrepreneurial expertise, has partnered with Ecole Centrale of Lyon, a renowned engineering school, to develop new learning approaches that blend together engineering and management. They will integrate these pedagogies into a new business-engineering hybrid institution they are launching with the Ying-Yang Alliance, called the IDEA School (Innovation, Design, Entrepreneurship, and Art).

The IDEA School will foster a higher education science and business culture that produces future manager-engineers. As part of their coursework, students will generate innovative business projects. Group work and collaborative workshops will ensure that each project and prototype reflects diverse perspectives. The students will take courses that incorporate serious games to promote more active learning. Their classrooms will be equipped with HP Elite Tablet PCs, interactive whiteboards, and other multimedia solutions.

The teaching approaches EMLYON will deploy derive from a method called “design thinking,” which uses creative solutions to resolve new problems. Unlike analytical thinking, it is an iterative process based on the building up of ideas. EMLYON will develop new approaches to implement design thinking into the IDEA School curriculum by employing 30-40 faculty members at EMLYON and Ecole Centrale of Lyon to experiment with and evaluate different techniques. They will share their outcomes through a network of educators partnered with the IDEA School to incite similar teaching and learning methods.

The Project in Action

Thierry Picq is the project leader of “Design Thinking Pedagogy in the IDEA School,” an initiative that creates a partnership between one of the top engineering schools in France with EMLYON Business School. The two institutions will cooperate together on the IDEA School, a place where students can form potentially innovative relationships. “The overall idea is to have engineering students and business students working in teams on projects for innovation and launching new businesses, new ideas and new products,” Picq explains.

After receiving the HP Catalyst Initiative grant, Picq established a space with 10 rooms that could serve as a jumping off point. “It’s a small sandbox for a bigger project,” he says. Presently Picq and his team are in the process of making his learning lab usable. “We want to have these rooms equipped so we can test and experiment new methodologies and new learning processes using technology in the building,” Picq explains.

Within the new facility, Picq can invite companies to test their software and devices in a classroom setting. He says, “The overall idea is that we want to test their solutions, their products that are not yet on the market, or used in the education sector.” Picq hopes that evaluations at the learning lab will generate student feedback that companies need in order to design products in the education sector.

Picq admits that one challenge comes with the scrutiny surrounding the project. "It's a political issue because this is a highly visible and political project here in Lyon," he says. The engineering school is public and EMLYON is private, but both institutions are considered top by the French educated elite, which is important background for a project leader who needs huge support to join the two schools. Picq speaks from a business point-of-view about what it will take to make the project successful. "How do you get people committed and involved in this new project within two schools, but also at the regional level with industry, with political people, with all the stakeholders?" Picq said. "The first and most important issue is money and resources."

At the time of the interview, Picq had met the other members of the consortium two weeks earlier. Since then, he has not had much time to develop connections, but he is hopeful about learning more from his colleagues. "I discovered a couple of very interesting projects for me," he says.

Technology

The IDEA school received around 20 HP Elite Tablet PCs and a small portable PC. Currently, Picq is overseeing experiments of how students use the tablets in class like the handwriting feature, for instance. They are looking at students' ability to comment directly on their slides during presentations. He and his colleagues are interested to see how this type of technology will change interaction between students.

Developing STEM-preneur through Engineering Innovation Projects

Texas A&M University - Kingsville
Texas, USA

Summary

Freshman year of college is a critical time in students' academic lives. The first university courses they take can either strengthen their connection to a discipline or diminish it. Texas A&M University–Kingsville (TAMU–Kingsville) plans to increase retention among engineering majors by weaving hands-on projects into their introductory curriculum. In preparation for this initiative, university faculty are developing learning modules and designing projects with the help and guidance of their partner institution — Del Mar College — that launched its own successful HP Catalyst project in 2010.

The goal of this project is to alleviate the growing issue of engineering students leaving their major within their first two years. The university has long been established as a leader in producing Hispanic engineers, and they aim to build on that by exposing their engineering majors to more real-life engineering experiences that will give them a multi-faceted view of all the types of careers engineers can pursue. Using HP technology, students will be working on projects for industry and municipal entities at the Javelina Innovation Center.

TAMU–Kingsville's project will enrich ongoing collaborations between TAMU-Kingsville and Del Mar College, including TAMUK STEP, a program that offers students more personalized experiences in smaller classes, along with one-on-one assistance. Formative and summative assessment will be used to measure the success of development, implementation, and dissemination of outcomes. Plans are to extend this project to high school students in special summer camps, as a way of increasing the number of students in the pipeline.

The Project in Action

Kai Jin and Stephan Nix are project leaders and share that title with two other colleagues within the College of Engineering at Texas A&M University in Kingsville. According to Jin, the project is divided into two parts. First, they will incorporate HP technology into freshman level engineering courses and pioneer a new curriculum. Jin says that they are working on developing hands-on projects for freshman students, which will mingle engineering with business concepts. These innovative activities will attract engineering students to the College of Engineering and keep them there, Jin hopes.

The other part of the initiative focuses on transforming the Javelina Innovation Lab into a hub where student engineers can get paid to develop ideas and solutions by the industry. Nix, the dean of the College of Engineering, says that although the project has just started, there are students that are currently working under contracts. "Right now we have one team that's doing a self-generated entrepreneurial project in environmental engineering. And we have another team that will be hired shortly by the city engineer here in Kingsville to work on some road construction projects," he says.

Partnered with Del Mar College, they have developed the new curriculum, they will introduce it to the other school, a community college in Corpus Christi just forty miles from Kingsville. "Del Mar just got a new mechanical engineering program," she says. "So they have the exact

same courses we have, the graphic and programming courses.” She adds that the PIs have also been communicating with the Tsinghua University in Beijing about developing an innovation lab, and she is excited about fortifying the collaboration at the upcoming Beijing Summit.

Presently located in the College of Engineering, Nix says the Javelina Innovation Lab will end up moving to a more conspicuous location. He says, “Eventually that lab will move to a location in downtown Kingsville and is part of an effort to revitalize downtown Kingsville.” A building has been donated to the school, but according to Nix, it is more or less uninhabitable at the present time, which is an issue that requires major fundraising to resolve. Nix says, “The building requires about \$300,000 to make it workable, \$100,000 to make it legally habitable, and another \$200,000 to renovate the interior.” The team acknowledges that they are still in the early stages of their project, and that they are excited about submitting a proposal for the HP and ICT Leadership grant that could provide more support.

Technology

This project received 10 HP Elite Tablet PCs, 28 workstation computers, 25 HP Notebooks, and four printers. HP has also given the school access to two Virtual Rooms, which are used for student projects and allow the PIs to conduct teleconferences with their partner institution, Del Mar College.

The Elite Tablet PCs are considered by the PIs as good tools for innovation within the classroom and are used by engineering faculty to design interactive activities. The Javelina Innovation Lab is equipped with the workstation computers that can run commercial software and allow students to model with ease. The PIs have found that the HP Notebooks are perfect for students to carry on field trips and record data. To illustrate what kind of data, Nix describes the roadway project that his students are working on with the City of Kingsville: “They have to go out into the field and do some surveying, traffic counts and so on.”

STEM, Social Entrepreneurship and Glocaledge

Learning Links Foundation
India

Summary

In many cases, solving pressing global issues begins with local action. The Learning Links Foundation is working to empower young students from rural India who are studying scientific and technical subjects that can help improve community living conditions. Their project aims to equip youth with the entrepreneurial skills needed to design innovative business plans to tackle socio-economic challenges. The Learning Links Foundation, in partnership with the Akshaya Centre, has chosen the state of Kerala to implement this initiative and special STEM curriculum because of its high literacy levels and the large number of educated youth.

During the first phase of the project, technical students ages 17-25 will work with researchers, faculty members, and other subject matter experts to investigate real-life issues. They will then leverage their STEM knowledge to develop products, and service and delivery models to alleviate those issues. The students' research and business ideas will provide proofs of concept for new rural start-ups and micro ventures. HP equipment will provide the technical infrastructure required.

Participants will be encouraged to approach government agencies and entrepreneurship development programs to fund their solutions. Having already impacted 85,000 students through their curriculum and trained over 1,200 Akshaya entrepreneurs, the Learning Links Foundation intends to create a sustainable, active STEM education model that will scale across education systems in India.

The Project in Action

As the Vice President of the Learning Link Foundation, project leader Nuriya Ansari is in charge of "STEM, Social Entrepreneurship and Glocaledge" (SSG), the initiative to combine local knowledge and social entrepreneurship in an effort to transform STEM learners into innovators in India. Glocaledge, the novel concept behind this project, plays a key role in this endeavor, and it is what Ansari describes as STEM-related local knowledge such as local medicines and local ways of working.

In essence, the idea is that when exposed to the best global practices, which are rooted in technology, students should be able to apply Glocaledge to solve problems in their communities and market working solutions. The project addresses two types of potential innovators. "What is important to understand is that the learner profiles in both models are totally different and therefore our approach is completely different in both," he says.

The outreach model includes students who are not engaged in the traditional school system; these students are between the ages of 17 and 25, and come from low-income backgrounds. STEM learners from this category will be concerned with the more practical side of their education, which emphasizes their vocational skills. "They should be able to walk away with the confidence that they'll be able to use the skills they have learned to their advantage to get jobs or start small ventures," Ansari explains. Currently in action, Ansari says "The outreach

model is well on its track, and we hope to start training the actual Akshya Centre owners by the end of this month.”

The other model addresses students in grades 8 thru 12. In contrast, “Here the stress is on knowledge acquisition, exploration, reinforcement and innovations,” says Ansari. Students from this group benefit from the added opportunities the project provides of investigating further into STEM concepts, and learning how to apply them to solve problems. A well-thought out solution has the potential to be profitable. Though still in its early stages, Ansari is encouraged by the positive reactions they’ve received from the public schools they have approached about adopting the model. Moreover, both models have already been tested with education researchers.

As India is an immensely diverse country, the most immediate challenge was designing an overarching idea that could adapt to a variety of cultures. “The approach had to be contextualized and that was our biggest challenge,” Ansari explains. “How to contextualize it and yet keeping the principles of a strong, innovative STEM environment.” Ansari also thinks the project could have been more efficient if the team had originally proposed two models instead of one, so they could have saved the six months the team spent addressing the separate in-school and out-of-school learning environments.

Among other challenges, the team has also found that teaching young people ingenuity and how to innovate is a formidable task in itself. Training people to come up with creative solutions is molding their way of thinking. “It’s actually, look at the environment around you and say, ‘Okay, that is a problem. That is something I can fix.’ Or ‘Hey, there’s a great concept of science that applies to something like that bottle outside my school or a bad sewage line in my village,’” Ansari says.

Despite their obstacles, Ansari is confident about the model, and he sees any geographical region as a good candidate for the project. He looks forward to discussing the concept and collaborating with other consortium members during the upcoming Beijing Summit. For others looking to create similar initiatives, he emphasizes that the most important step of the project takes place before anything happens. “Research, research, research, that’s what my advice would be,” he says. The preparation necessary to start the SSG model entailed many interviews, meetings, and a case study collection before the team could design an effective model.

Technology

HP provided the SSG project with an HP Elite Tablet PC, HP Mini Notebooks, the HP Mobile Workstation, two servers, a printer, and access to the HP Virtual Room.

Much of this technology is currently incorporated into the infrastructure of the out-school headquarters — the Akshya Centre. The center is home to the STEM Innovative Lab, which has all of the technology needed for the curriculum employed by SSG for the outreach learners. Ansari also adds that the HP grant provides the support for literacy services and other types of training, development and networking.