The Flipped Classroom:

Empowering Students to Take Charge of Their Learning

For the first 19 years of his career in education, Jon Bergman–like most educators–rarely had the time to speak to more than a few students each day in his high school chemistry classes. His teaching model followed the conventions established generations ago: Standing at the front of his classroom, he delivered lectures to students who furiously scribbled notes. He presented homework each evening, which was briefly reviewed the next day in class before beginning a new lab. Students who quickly grasped the concepts Bergman presented did well enough on tests to pass his class; those who struggled or were reticent to ask for help did not.

But six years ago, Bergman and fellow educator Aaron Sams–then teaching in Woodland Park, Colorado–had an epiphany: Instead of relying on their lectures to cover the material, they began capturing their lessons on video. Given their school's rural, economically diverse population (with 20 percent lacking high-speed Internet access), the pair burned the videos onto DVDs that students could watch at home. In this way, students who were unable to understand the lessons the first time were able to review them as many times as needed to fully grasp the material–without worrying about holding back the class, or appearing slow.

By "flipping the classroom" in this fashion–having students review teacher-created video content outside the classroom, and reserving class periods for assignments they previously did at home–Bergman and Sams empowered their students to take charge of their own learning, at their own pace. As a result, students were able to complete 50 percent more labs during class time, and test scores increased dramatically. Bergman and Sams have since implemented the model at the Chicago high school where both now teach, with the same results.

Executive Summary

The teaching and learning model currently in use in virtually all corners of the globe had its beginnings in 18th-century Prussia. Developed for use in state institutions (which included prisons and mental hospitals as well as schools), the concept of a "sage on the stage" standing and delivering a lecture to a captive audience was intended to ensure complete control for the presenter. This model has remained the standard in pre-kindergarten through graduate educational institutions.

In the past decade, however, several innovative educators have questioned the efficacy of this approach. By flipping the classroom, they have found, students become engaged in unprecedented ways, learning becomes individualized, and it can be done at the appropriate pace for each student. Through the use of dynamic digital content that can be consumed outside the classroom, educators no longer bear the sole responsibility for imparting knowledge. Instead, students actively participate in the learning process, and classroom sessions become centers for effective interactions between teachers and students.

Recognizing this exciting new trend, Cisco brought together many of the country's most respected experts in education to share best practices learned from their own experiences with flipped classrooms. Connected via Cisco® TelePresence® System and WebEx® videoconferencing, the April 2012 Global Schools Executive Exchange (GSEE) attendees shared ideas, tips, and techniques for implementing a flipped teaching and learning model. In this paper, Cisco summarizes the key takeaways from the GSEE conference, and the results seen when teachers and students participate equally in the learning process.

Cisco Global Schools Executive Exchange Guest List: April 2012

Anoka-Hennepin ISD, MN

Durham Public Schools, NC

Gwinnett County Schools, GA

Katy ISD, TX

Lake County Schools, FL

Memphis City Schools, TN

Miami-Dade Public Schools, FL

Milpitas USD, CA

Orange County Schools, FL

Osceola County School District, FL

Oxford Community Schools, MI

Paradise Valley USD, AZ

Round Rock ISD, TX

St. Paul Public Schools, MN

Utica Community Schools, MI

Wake County Public Schools, NC

Walled Lake Consolidated School District, MI

Flipped Classroom Personalizes Learning

When students arrive in a classroom, they bring disparate backgrounds, experiences, learning preferences, and competencies. To present a universal curriculum does a disservice to students. Additionally, districts in more affluent areas typically have advantages with regard to their brick-and-mortar facilities, the salaries paid to attract high-caliber faculty members, the budget for leading-edge instructional technology purchases, parental and community engagement, and a host of other areas.

The key to ensuring equity in education is the effective use of technology, employed in a flipped classroom by a teacher who is actively encouraging the creation of course content. With this awareness, numerous districts in the United States–such as Mooresville Graded School District, Katy ISD, and Maine Public Schools–have committed to put devices into the hands of every student. The devices are varied, and include iPads, iPods, smartphones, and others. But the common denominator is their delivery of around-the-clock access to the Internet and engaging digital content that transforms learning.

In Katy ISD, administrators have supported teaching, learning, and assessments through the distribution of 2500 "mobile learning devices," referred to as MLDs. Katy ISD Chief Information Officer Lenny Schad noted that his district now sees more than 30,000 connections to its wireless network throughout the day, because students use other devices in addition to those distributed by their schools. In this way, learning continues beyond the walls of the classroom and beyond normal school hours.

"Our mobile learning strategy affords us the opportunity to leverage the personal investments that parents have made in mobile devices, and change our funding strategy to address equity districtwide," said Schad. "That's the power of mobile learning."

Added Steve Hoffman, assistant director of innovation and technology in the St. Paul Public Schools, "The first question I always hear is 'how does technology impact learning?' We need to flip that question, and say 'what learning do you want to impact with technology?' Technology by itself isn't going to help students learn. But we can change the learning environment with technology."

Benefits of Digital Learning in the Flipped Classroom

- Learning can continue outside the classroom.
- Classroom experiences are more engaging.
- Learning adapts to the needs of the learners.
- Learners are turned into creators.
- Students are connected with experts.
- Learning is personalized.

Student Need Influences New Classroom Model

Along with his colleague Sams, Bergman is a pioneer in using "vodcasts" (teacher-created videos) that students can view outside class time, so that classrooms can be flipped. Bergman and Sams also maintain The Flipped Class Network (http://vodcasting.ning.com), a social network for educators interested in the flipped classroom, which currently has more than 4000 members coast to coast. Drawing upon their experiences with the flipped model, Bergman and Sams have authored a book entitled *Flip Your Classroom: Reach Every Student in Every Class Every Day*, published by the International Society for Technology in Education (ISTE).

When Bergman noticed his chemistry students' frustration six years ago, he realized that recording his lessons and publishing them online would offer a way for students to consume and review the content at their own pace, in the more relaxed environment of their homes. "I haven't given a lecture since," Bergman noted. "Now my students watch the videos, and then if they need help they can get it while we're together in class."

Capturing the lessons in vodcasts offers the opportunity to make them far more compelling than the traditional lecture format. For example, Bergman recorded a lesson about the chemistry of diamonds while standing in front of the Hope Diamond in the Smithsonian Institution National Museum of Natural History. For a lesson about the geology of the Andes, Bergman captured footage of the mountain range during a trip to Peru.

Cisco Infrastructure Supports Flipped Classroom

Today, the capture component of many lecture-vision solutions is often achieved by recording live video streams or conferences using the videoconferencing endpoint in both unplanned and scheduled modes. But there are several other required components in the education-vision workflow, including editing, publishing, archiving, retrieval, viewing, distribution, and display. A solution that encompasses the whole workflow surrounding captured video is critical.

Only Cisco offers a suite of solutions with diverse and robust end-to-end components that form the entire set of building blocks in the education-capture workflow. In educational environments, it's important to maintain access policy as well as contain security threats. As with any network, as the traffic that rides over it grows, modularity and scalability are critical. Cisco builds solutions for students and educators with their unique needs in mind.

Cisco understands the creation, management, publishing, and distribution components of video technology, and has solutions that can be modularly assembled in an integrated network to implement an education-vision solution within any campus environment. Additionally, the fundamental components that offer lecture capture also provide two-way or multipoint videoconferencing, which an educational institution can use to facilitate remote learning, alternative courses, and professional development. This increases the flexibility of learning modalities: Learning can be passive, active, or interactive, as well as on-demand.

Ideally supporting the flipped classroom, Cisco Lecture Vision offers the ability to capture video on any device (iPhone, iPad, video camera, WebEx session, Cisco TelePresence System) and then edit, publish, archive, retrieve, view, distribute, and display those videos. Students and teachers can view videos in a social media environment and carry on a dialogue about the lecture, start a chat session, or launch a virtual web conference. Cisco Lecture Vision addresses all these requirements, while:

- Providing students with access to additional courses and educational content
- Enabling searching across all video content and resources campuswide
- Offering an alternative learning method for students who have a range of learning styles
- Attracting talent—both students and teachers
- Aiding in professional development
- Allowing class time to focus on discussion, demonstration, and experiential work
- Enabling access on any device for those who are unable to attend class
- Promoting greater opportunities to include guest lecturers

Changing the Role of Teachers

In the flipped classroom, the notion of teacher as sage on the stage is profoundly altered; instead, the educator truly becomes the guide by your side. "Class is no longer a dissemination of knowledge; it's a conversation with students. It allows for more hands-on, inquiry- and problem-based time with kids, and tutorials for those who are stuck," Bergman said.

The other primary advantage of the flipped classroom is that teachers have the opportunity to connect with every student, during each class session. Such interactions can be one-on-one or in small groups. In both modes, Bergman and Sams make complete circuits of their classrooms and communicate with every student daily to assess their progress, identify any gaps in learning, and provide any needed remediation.

Said Bergman: "Everything changes in the flipped classroom. The videos always create spontaneous Q&A, so we talk about those first. Then we have 75 minutes for guided independent lab activities." What also changes in the flipped classroom, as previously observed, is the notion that teachers "own" all the knowledge. Instead, teachers and students participate equally in sharing knowledge and creating and owning content. While this prospect may be unsettling to educators more comfortable with the traditional teaching and learning model, Bergman believes that the most effective classrooms of tomorrow will be flipped classrooms. "Control-freaks need not apply," Bergman advised. "Teachers need to be comfortable with a small amount of chaos, because they're giving the learning over to their students. The flipped classroom allows all students to be much more self-directed."

Cisco Technologies Support the Flipped Classroom

Cisco Lecture Vision: Helps educators create, manage, and share educational content with their students, anywhere, at any time, on any device, including PCs, smartphones, and tablets. Features integration with Cisco Pulse,® a video product that allows users to easily find videos based on what's spoken and who's speaking. Cisco Lecture Vision includes:

- Cisco Digital Media Suite: This solution provides a content manager and video portal application that allows users to post video, tag content, provide feedback, and access libraries of media material.
- Cisco Show and Share®: Allows teachers to easily manage videos they've created, and share them with students in a secure environment. Also allows videos to be shared with other teachers, so flipped classrooms can become flipped schools. The social features of Cisco Show and Share empower students to embed questions in videos for peer response and comment, giving teachers deeper insights into student comprehension and enhancing the ability to differentiate instruction.
- Cisco Media Experience Engine (MXE): Video Pulse Analytics (included in MXE) provides automatic speaker recognition and keyword tagging, so students can "search" within a video at any given moment and find specific content to support their individual learning needs.

Cisco TelePresence solutions: TelePresence Content Server allows teachers to easily record their lectures with a single click.

Cisco WebEx solution: Allows teachers to record lectures with integrated video and slides and make them available for playback in Show and Share.

Workflow Function Technology Components:

Input
- Input device: Any video camera used as a capture device (leveraging a Cisco encoder).
- Cisco TelePresence codec: Provides all the power required to transform your workspace into a high-definition (HD) video media-collaboration room, and is designed for any standard HD integration project.

Record
- Cisco TelePresence Content Server: Allows for recording, streaming, and simple editing before publishing to the Cisco Show and Share application.

Media Processing,including Pulse
- Cisco Media Experience Engine (MXE): Enables any type of video to be transcoded, enhanced, and shared on any other device (live or on-demand) or application. In addition, the MXE can:
- Add branding elements, such as graphics overlays, watermarks, video trailers, bumpers, and more.
- Automatically tag the video with spoken words and identify speakers, so that media can be easily navigated and consumed. Cisco MXE also allows content to be bookmarked for easy sharing among teams.

Publish
- Cisco Show and Share application: Provides a webcasting and video sharing solution that allows for simple archiving and retrieval of stored video assets throughout a school system or campus

Distribute
- Cisco Content Delivery Network (CDN): Provides a system of media servers that enable the on-demand playing of videos, including streaming content, with consistency throughout the campus
- Cisco medianet: Offers a Cisco architectural playbook and best practices for a video-ready network infrastructure—a critical foundation to introducing video traffic over a converged network

Display
- Cisco Digital Signs: Provides network-based digital signage that displays video or live streaming media to any digital media player endpoint
- Cisco TelePresence System: Creates a live, face-to-face communication experience that empowers students and teachers to collaborate in real time with individuals from different schools and communities
- Desktop and/or mobile devices: Cisco provides the capability to display content on any PC, Mac, or mobile device
- If using an interactive whiteboard: Sync will keep video and annotated contents in proper format during the session, as well as for the recording capture, for proper playback

Learning Extends to Families

The benefits of the flipped classroom extend beyond the student population. When students have access to digital content, it can be viewed, shared, and discussed by their family members, reinforcing lessons for students (and involving parents and siblings in the information-sharing process).

Bergman related that in a past parent-teacher conference, one father stated that he was a fan of Bergman's quantum mechanics vodcasts, which his child had viewed throughout the semester. In another instance, a mother asked her son when he would have new math videos to watch. "She said she had never learned math herself, and wanted to learn beside her son," Bergman reported. "We hear so many comments from parents who tell us 'finally, someone cares about my kids actually learning; not just moving on and hoping they'll get it.'"

Vodcast Guidelines

- Keep videos short and concise.
- A video should be roughly half the length of a classroom lecture; ideally no more than 20 minutes in length.
- Capture lectures in conversation format, with one speaker as the expert, and the other a "novice" posing questions.

Classrooms Flipped Successfully in Arizona

The GSEE conference included real-world flipped classroom success stories from Paradise Valley Unified School District (USD) in Arizona. Sandy Harness, a physics teacher at Horizon High School, described her use of an iPad to create five-minute videos for her district's website. That led to the creation of a flipped classroom, in which all her course materials are now delivered online.

Using a stylus and a free application called ShowMe, Harness can include any desired digital content in her videos. When the videos are complete, she uploads them to the cloud; later they can be accessed via any browser. She noted that she can now create instant tutorials for students needing extra assistance.

"A student can email me saying he or she is having a problem, and I can quickly create a ShowMe presentation and embed it in the online course. I've noticed that the amount of work and the quality of work that I'm seeing from my online class has improved dramatically. Also, the number of students using the videos has increased, while my lecture-time has significantly decreased," Harness said.

Hybrid Model Yields Success

Carola Mantana, another Paradise Valley USD educator, has created a hybrid flipped class at Explorer Middle School. Her new classroom model was borne of her frequent need to repeat lessons for students who had been absent, or who struggled to grasp curriculum content. She, too, realized that it would be a more efficient use of her time to videotape her lessons and publish them online for her students' viewing at home.

Using GoogleDocs, Mantana now maintains a website where she posts a calendar with each day's lessons. During class, students (who work in small groups) open the calendar on their iPads and view any notes and videos posted there. Then they complete the assigned exercise. Those who need more practice can review the digital content, while those who successfully master the material are free to move ahead to the next lesson. Additionally, Mantana has an instant view of students' progress through their assignments.

"My students are much more engaged, and it works really well. Last year our test-scores increased by five points," Mantana said. "I want my kids to be engaged in class, not reading and taking notes. Now they can watch the videos as many times as they need…and if they need assistance at home, their parents can help them, too."

GSEE Roundtable

Educators across the United States are already implementing fully flipped classrooms, as well as hybrid models. Here are a few of the highlights:
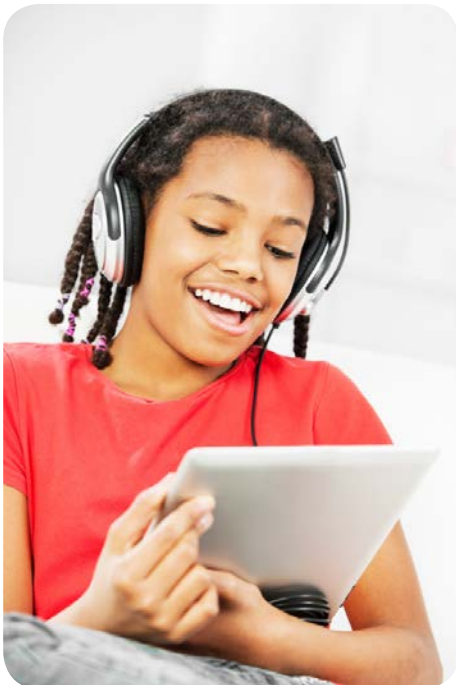
- Paradise Valley USD is partnering with the University of Wisconsin-Madison to modify the latter's hybrid blended learning environment, and present a class in Mandarin Chinese to all five high schools in the district. One teacher visits each of the schools one day per week, supplementing her curriculum with videos posted online. Also, one of the high schools is evaluating the feasibility of transitioning from textbooks to exclusively digital content.

- The Anoka-Hennepin district has deployed six Cisco TelePresence Systems, supporting each of its high schools as well as its administrative offices. The TelePresence systems have enabled the district to continue to offer (from a single location to all schools) courses that would otherwise be cut due to budgetary constraints. Additionally, TelePresence allows the district to partner with other educational institutions to present curricula not available within the area.

- St. Paul Public Schools have a centralized portal supporting collaboration spaces for each class. Using almost any device, students can log in, view digital content, and engage in conversations with their teachers. This model ensures equity of access for all users, because it does not require application deployment on any devices, as is the case with traditional computer labs.

- Oxford Community Schools has created a virtual academy that is "open" 24 hours a day, offering classes to U.S.-based and international students. Teachers in Michigan will be teaching students in China in real time via streaming video. Also, the district will soon offer Mandarin language classes to 2200 students, the largest such program in the state of Michigan.

- In a middle school in Round Rock ISD, teachers in two classes have flipped their classrooms. Now the fifth- and sixth-grade teachers take turns videotaping each other's math and science classes, and then post the content online. Thanks to the success of the initiative, teachers in the high school are investigating their own flipped classrooms.

- Wake County Public Schools has more than 50 flipped classrooms. One of their critical success factors has been the inclusion of teachers as leaders during professional development sessions. These innovative educators discuss and demonstrate their video-capturing techniques, which has greatly speeded adoption among their peers.

- Within the next two years, Milpitas USD will demolish a few of the walls in several schools, and then assemble students according to mastery and comprehension of various subjects.

Summary

Whether the classrooms to be flipped exist in elementary schools or universities, the goals are the same: to extend the learning day, engage and empower students to take charge of their learning, and facilitate better and more frequent communications between students and teachers. In all instances, in every school, the process of flipping a classroom and infusing it with technology must never overshadow the priority of transforming education.

"It's about changing instruction; that has to be the goal," said Darlene Rankin, director of instructional technology at Katy ISD. "Then with everything you do, whether it's flipping a classroom or launching a Bring Your Own Device initiative, your technology will support that. And once there's a common understanding among all your teachers, you will move on to acceptance."

Additional Resources

- Connect to Compete (http://www.connect2compete.org) National nonprofit uniting community, foundation, and business leaders to create technology programs that improve lives. Offers high-speed Internet access for $9.95 monthly to families of students who qualify for free or reduced-price lunches; also makes desktop and laptop computers available to qualifying families for $150.

- EducationSuperHighway.org (http://www.educationsuperhighway.org) Nonprofit building a central database of the broadband infrastructure at every K–12 school, developing solutions to assist schools in deploying broadband infrastructure that is more than 100 MB, and conducting advocacy activities to influence the policies and spending needed to speed the construction of the Education Super Highway.

- MyData Download (http://www.ed.gov/edblogs/technology/data-interoperability) Joint project between the Office of Educational Technology (OET) and the White House Office of Science and Technology Policy (OSTP). Encourages schools and software vendors who hold student data to allow students to download their own data to create personal learning profiles they can keep with them throughout their learning career. Focuses on making educational data available to parents and students in formats that can be used to maintain a personal learning profile and customize learning experiences.

- National Education Technology Plan (http://www.ed.gov/technology/netp-2010) Calls for applying advanced technologies to our education system to improve student learning, accelerate and scale up the adoption of effective practices, and use data and information for continuous improvement. Presents five goals addressing the five essential components of learning powered by technology: learning, assessment, teaching, infrastructure, and productivity.

- Jon Bergman's Blog (http://flipped-learning.com) At this site, Bergman (a teacher, educational coach, and writer) offers a wealth of resources for educators interested in flipping their classrooms.