

Upside Down and Inside Out: Flip Your Classroom to Improve Student Learning



PHOTOGRAPH COURTESY OF JEN HEIGMA

Educators are notorious for jumping on passing fads and chasing the newest innovations, from the open classrooms of the 1970s to the one-laptop-per-student initiatives of the past decade. It's not surprising that when the next new thing—the flipped classroom—hit the hallways of America's schools, it was met with hesitation and skepticism from teachers, parents, and educational critics. The “flipped” part of the flipped classroom means that students watch or listen to lessons at home and do their “homework” in class. But is it just another fad or an instructional design worth keeping?

Pioneered just a few years ago by science teachers Jonathan Bergmann and Aaron Sams at Woodland Park High School in Colorado, USA, the flipped classroom now has a conference, several websites, and a professional learning network of more than 3,000 teachers (see Resources, page 17). Bergmann and Sams also have a book coming out in July called *Flip Your Classroom: Reach Every Student in Every Class Every Day* (see What's New, page 44, and read Bergmann's Point/Counterpoint response, page 6).

Some of the most enthusiastic advocates are the math teachers at Min-

nesota's Byron High School (BHS), which was the 2011 Intel winner for high school mathematics. Their story suggests that, at least for this dedicated group of educators, the flipped classroom is an educational innovation with legs, if not wings!

A Peek into a Flipped Classroom

Students from Troy Faulkner's Calculus I class shuffle into his classroom. Along with the usual hum of conversation, you can hear the melodic sounds of iPads, laptops, and smartphones being turned on as well as the clatter of furniture being shuffled around as students create informal clusters. Faulkner welcomes the students and talks about the day's task as he puts a couple of key problems on the electronic whiteboard to check for understanding on last night's video lesson. He gives the students time to work on the problems, then discusses the solutions with his students. After a lively exchange, the students get down to work at their own pace and in their own style.

Some choose to work in groups, while others prefer to sit alone on the floor or even out in the hall, plugging in their earbuds to block out everything and everyone around them. The expectation is that they all watched a

video of Faulkner teaching the lesson the night before and are ready to demonstrate their understanding using the day's problems. Some review the video lesson as they work, while others breeze through the problems at a fast pace, then move on to the next night's assigned video.

Faulkner moves from student to student, watching, listening, noting who needs help. If several students are stuck on a problem, he might work through more examples on the board at the front of the class. And, just to be sure, there are daily spot quizzes, often using clickers so the students and teacher get immediate results. The feedback allows for group discussion and peer instruction on the problems that many students are struggling with and helps Faulkner and his colleagues target—and revise in real time—instruction on concepts that students find difficult.

Left: Two students listen to their “homework” for their math class. Below: These photos and images from video—taken in Jonathan Bergmann and Aaron Sams' classroom—illustrate the projects and activities students have been doing since their teachers flipped the classroom.



students respond

Students were candid about what they liked:

I personally like that I can get through the lessons quicker than when we have ... class lecture. Then, when I do the homework in class, I can have help right away, which means I ask more questions.

—11th grade precalculus student

I liked this approach a lot because when we work on homework in the classroom, [the teacher is] here to help us. Otherwise, I would be lost at home and wouldn't be able to finish my homework because I would have no idea how to do it.

—11th grade precalculus student

I liked how I could rewind and pause the lectures in case I didn't understand something.

—12th grade calculus student

I liked the fact that I could get the more difficult problems in class and be able to ask questions about them.

—11th grade precalculus student

I like that we watched the concept at home, but then mastered the concept in class.

—10th grade Algebra II student

Some students were equally candid about what they didn't like:

Sometimes the video notes can become a little fast and hard to keep up with, but asking questions the next day helps [me] to understand.

—11th grade precalculus student

Why They Flipped

With the recession of 2009, the Byron School District, located in a small community near Rochester, Minnesota, USA, was driven by a pressing set of challenges that led to a serendipitous adoption of flipped teaching.

Superintendent Wendy Shannon explained that when it came time to get new textbooks because the current ones did not match new state math standards, her district just didn't have the money.

"We had a big problem," Shannon recalls. "With the district third from the bottom in state funding, two operating levy referendum issues that failed, and a bad economy, we'd already had to cut \$1.2 million from Byron's school budget. We literally had no money for new textbooks."

Shannon encouraged math educators to think outside the box. But they actually proposed something that went one step further: thinking beyond the book! They suggested getting rid of textbooks altogether and creating their own math curriculum. BHS Principal Michael Duffy gave the math teachers the green light. They were committed to a textbook-free curriculum by the start of the 2010–11 school year, and the clock was ticking!

Starting in January 2010, the math team met before school every Monday. They used their professional learning community (PLC) time to wrestle with the new math standards, review student test data indicating areas of special challenge, and preview resources gathered from the web. They applied to a local foundation, the Byron Fund for Excellence in Education, and landed a \$5,000 grant that provided small stipends to teachers who worked over the summer of 2010 and paid for Kuta, a software tool for creating worksheets and tests.

Jen Hegna, the school's director of information and learning technology, helped the teachers create a Moodle

site for each course. It soon became clear that they'd have to create their own video lessons rather than relying on prepackaged web courses or lessons. Once the district agreed to unblock YouTube, they embedded the video lessons in each course site.

A New Way of Teaching

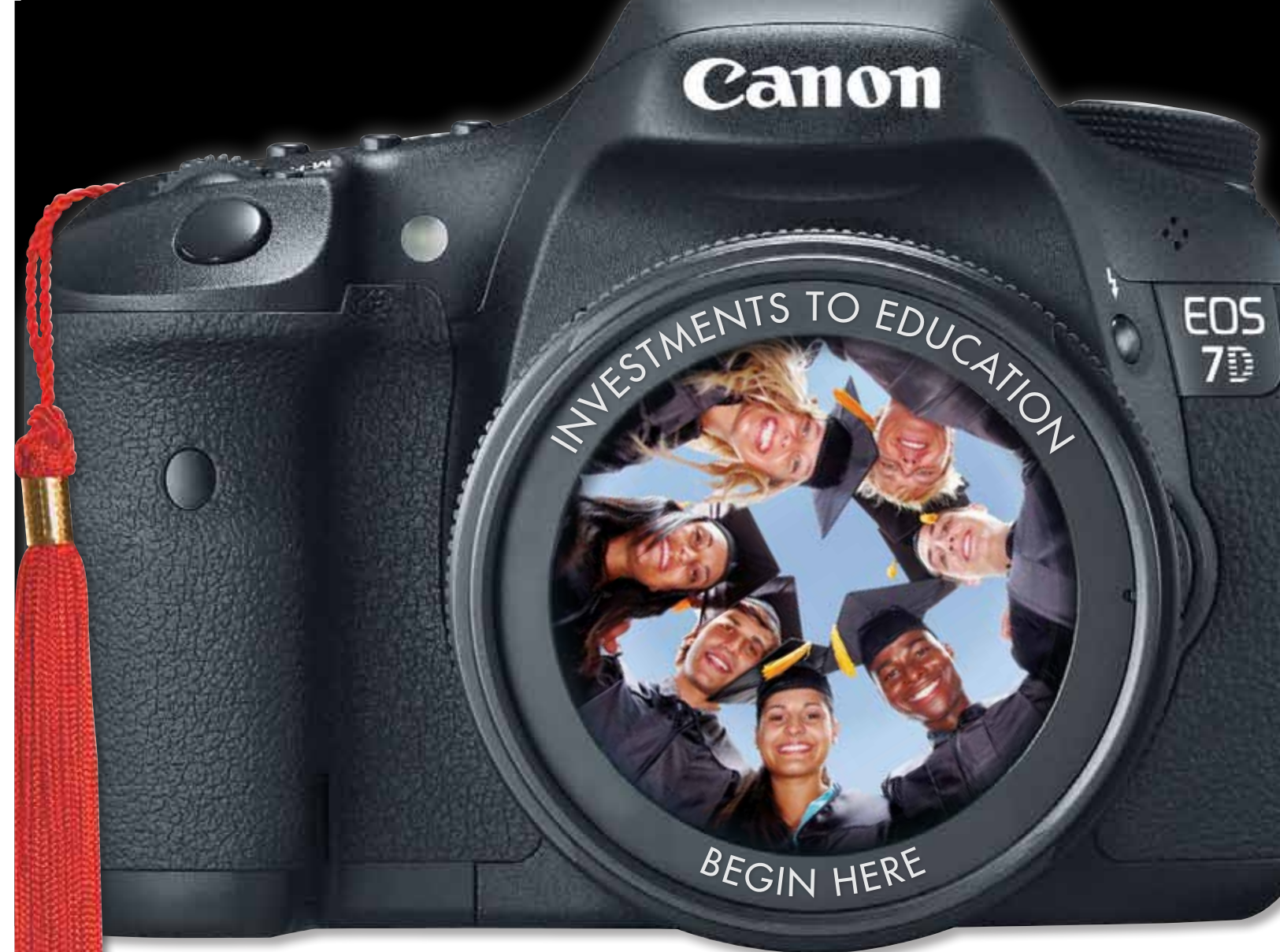
Throughout that first year, the teachers struggled to stay a few video lessons ahead. They were all learning together, continuing to meet in their PLC, reviewing test data, and adjusting and tinkering with the Moodle lessons, resources, and videos.

Classroom management was another challenge, says 20-year veteran teacher Rob Warneke: "Kids need to be trained and guided to stay on task, work collaboratively, solve their own problems, be disciplined," he says. "This is harder than making everyone be quiet during a lecture. Thinking and learning can be quite noisy!"

Jen Green, who teaches math and English, describes it this way: "It was an incredible amount of work, but it was the right work for the right reason: We were doing it for the kids. With the first student I could see the videos were helping, I knew it was all worth it."

Working collaboratively on development of the curriculum, common assessments, and guided notes fostered a bond among the teachers and stimulated their professional growth. They created a library of all the BHS teacher course videos and allowed students to watch any teacher's videos. Most prefer to watch their own teacher, but some like to watch a different teacher's video lesson for review or to see a new angle for understanding a difficult concept. It gives the kids great freedom, and the teachers are benefiting from "flipped professional development" as they learn new approaches for their own teaching when viewing each other's videos.

Faulkner expects that some videos will be reused from year to year, while others will be re-recorded.



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parents respond

A recent survey of parents suggests an overall favorable reaction to the new methodology too:

The flipped classroom seems to be a much better use of the teacher's time. It also is less frustrating for the student when they need extra help as the teacher is available during class time ending the necessity of going in before/after school to get needed help.

—Parent of a 12th grade calculus student

Prior to the flipped classroom, we had to pay for a math tutor. Now our son is feeling more confident and hasn't needed the tutor because he is able to get his questions answered on a daily basis.

—Parent of 10th grade geometry student

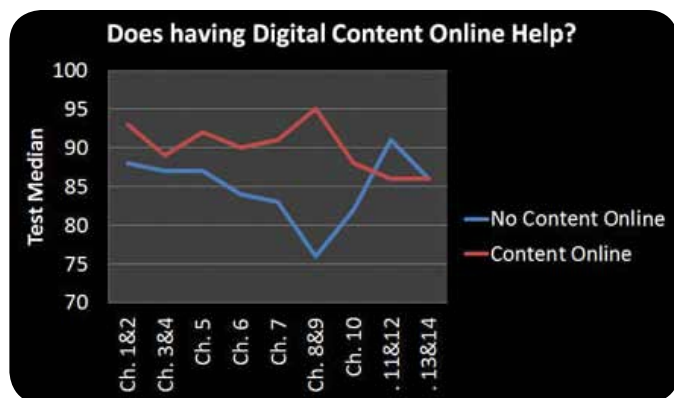
The flipped classroom approach is a great idea for a hands-on subject, like math. We believe it better utilizes the students' and teachers' classroom time. Thank you for taking the extra time to record the teaching lessons!

—Parent of 9th grade geometry student

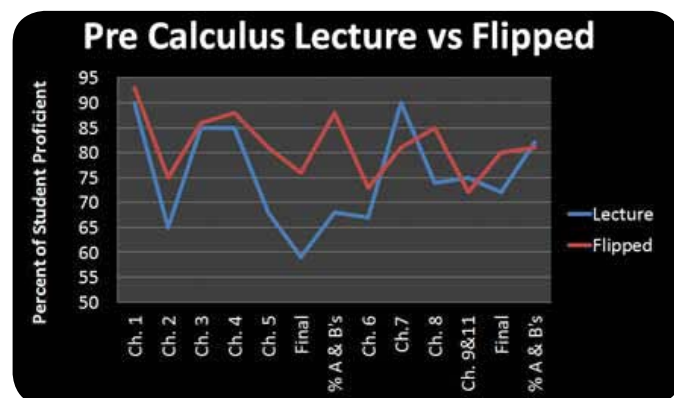
Documented Success

Separating the effects of the new digital curriculum from the flipped teaching technique can be difficult. Nonetheless, teachers are collecting detailed data on student achievement, and the results are promising. Early data suggest significant increases in student learning and achievement when flipping compared to baseline data on the same courses taught in the traditional classroom lecture mode, using the same assessments.

The graph above shows that calculus proficiencies are up an average of 9.8%. Proficiency refers to the number



Studies showed that including digital content (videos, notes, homework, homework solutions, and extra links to help students visualize mathematics) online improved academic performance.



This graph compares the proficiency levels of students who experienced the flipped classroom compared to those who participated in a traditional lecture format (chapter 2 is omitted because it was taught only with lecture).

of students who score 80% or above on unit assessments. Meanwhile, pre-calculus proficiencies increased an average of 6.1%.

In Accelerated Algebra II, there was a 5.1% increase in median test scores after including digital content (videos, notes, homework, homework solutions, and extra links to help students visualize mathematics) online. Other courses, such as Algebra I and geometry, have posted similar gains in student scores.

Student math scores on standardized external exams also have risen dramatically. In 2006, Byron's high school math mastery level was 29.9% on the Minnesota Comprehensive Assessment (MCA). In 2010, its mastery rate had risen to 65.6% as a result of data analysis and curriculum alignment with state standards. In response to a desire to continually improve, the department implemented digital content and the flipped classroom in 2010–11, and this change resulted in

73.8% mastery on the MCAs in 2011. Byron has insisted on a solid high-level math education for all students, as shown by the fact that at the end of the 2011–12 school year, 94.7% of Byron's seniors completed four or more credits of math.

Student and Parent Reaction

After every course, teachers surveyed students about the flipped classroom experience. When asked what they liked (besides having one less book to lug home each night!), the student comments were candid (see "Students Respond," page 14).

Parents were also generally happy with the results (see "Parents Respond"). However, as with any new practice, not all reactions are going to be positive. Many parents had a hard time adjusting because the change was different from the way they were schooled. One common concern was the demand this approach can make on a family's home computer, especial-

ly if there is more than one student in a household assigned to watch videos for homework. Students with no internet connection can get the lessons on a jump drive or CD.

Flipping Forward

BHS is already seeing a ripple effect. Other departments and grade levels are creating their own versions and applications of flipped classrooms. The social studies department is building digital curriculum, and language arts teachers are using e-portfolios.

With class time freed up from lectures, teachers are developing open-ended, cross-curricular projects that actively engage students and bring real-life relevance to their math skills. And, because of eighth grade teacher Jeremy Baumbach's involvement in the math curriculum redesign, some middle school students are already experiencing flipped classes.

BHS educators are the first to admit that one size does *not* fit all, with flipped teaching or any instructional approach. What is common, however, is their shared commitment to student learning and their belief that today's educators must guide students to use technology in ways they will embrace for future learning.

An email to Faulkner from recent BHS grad Timothy Salazar validates this approach:

The online lectures were extraordinarily helpful, even in my post-secondary schooling. ... The YouTube videos served as excellent review sessions for my college calculus classes. They present a very visual medium that I feel complements traditional class lectures well, especially since they are accessible from virtually anywhere, so long as I have access to the internet.

For BHS, flipping is no fad. It is a way to ensure students have 24/7 access to extraordinary teaching!

Resources

Byron High School Math Department website: <http://tinyurl.com/bhsmath>
 Flippedteaching: <http://Flippedteaching.com>
 Kuta: www.kutasoftware.com
 The Flipped Class Network: <http://vodcasting.com/video/video/listForContributor?screenName=1vd2muf3elntt>
 Vodcasting and the Flipped Classroom: <http://flippedclassroom.com>



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“We can't be upset with teachers who are hesitant in using unfamiliar technology if we do not participate ourselves. How can school leaders better model the expectations that they have for staff members and students?”

—Patrick Larkin, Principal

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