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Inside the Flipped Classroom

- By Kathleen Fulton
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Students at Byron High School (MN) are participating in a "flipped" classroom approach that is transforming education at their school.

By 5:01 p.m. on a Tuesday afternoon, Byron High School (MN) math teacher Troy Faulkner has already received five e-mails from his students: "Where's tomorrow's video lesson? We are waiting!" With their laptops, tablets, or smartphones--whatever is convenient--Faulkner's students are waiting to log on to Moodle <http://moodle.com> and watch a YouTube <http://youtube.com> video of him solving quadratic equations. In the classroom the next day, Faulkner will work with students as they demonstrate how well they understand the concepts laid out in the lecture the night before.

Welcome to a "flipped classroom" at Byron High School--where the lectures are homework, and problem solving with the teacher is class time.

A Cinderella Story

According to Superintendent Wendy Shannon, nobody in the Byron Public Schools <http://bears.byron.k12.mn.us> district set out to flip their classrooms, but necessity became the mother of invention. The district, in suburban Rochester, was due for a math textbook revision. Teachers already knew the old math texts were poor matches for the state's new math standards, and that a curriculum update was needed. But they faced a huge problem.

"With two failed operating levy referendum issues and a bad economy, we'd already had to cut $1.2 million from Byron's school budget," Shannon says. "We literally had no money for new textbooks."

The teachers came up with a radical idea: They'd create their own math curriculum. Byron High Principal Michael Duffy questioned each teacher privately to make sure they really were up for such an ambitious task. Satisfied that they were, he gave them his blessing.

All Byron High School teachers have participated in professional learning communities since 2008, with each department meeting for at least an hour each week, so the math department already was comfortable working as a team. So, starting in January 2010, the math team got together every Monday at 6:45 a.m., tearing apart the math curriculum and rebuilding it from scratch.

Middle school math teacher Jeremy Baumbach, who taught an advanced math class to eighth graders, joined the team to assure that his students would have a seamless transition into their high school coursework. The pressure was on: They'd committed to a textbook-free high school math curriculum by the time school started in fall 2010.

DIY Curriculum Formation

Initially, the teachers thought they could simply pull material from the web, linking to online lessons they found from other math teachers around the country. But it soon became clear that this wasn't going to give them what they needed.

According to Faulkner, "We looked at the state standards and areas where there were cracks in our kids' mathematical foundations. Take rational equations. Students should have them down pat by the time they are juniors, but this was something that lots of kids stumbled on in tests. Why not introduce the concept earlier, starting in algebra, again in more depth in geometry, and on through upper-level math classes? It just made sense."

Shannon gave the teachers her full support. In the spring of 2010, the team applied for and won a $5,000 grant from the local Byron Fund for Excellence in Education. It provided small stipends for teachers to continue to work together in the summer and paid for the purchase of Kuta, a software program that supports a common framework for generating worksheets.

Unable to afford an expensive course management system, they turned to Moodle, a free online learning management system. The district's director of information and learning technology, Jennifer Hegna, helped the teachers create a Moodle course for each class, embedding lessons, homework, quizzes, and answer sheets in each course site.

They soon realized they would need to record videos of their individual lectures so that parents and students would have a resource to use when they were at home. At that point, however, they weren't sure of how to do it.

The math team continued to meet once a week through the summer, and spent many more hours working on their own. "There I was sitting in my cabin at the lake," Baumbach says. "While everyone else was out waterskiing, I was doing worksheets and trying to find internet access in the boondocks!"

Unblocking YouTube

Hegna describes an important breakthrough the group had: "Formerly, the district blocked YouTube from student use. Once we got permission to unblock it, this made all the difference. We could store recorded videos for free. YouTube is available on almost all student personal learning devices. Teachers create their own YouTube channels and embed--not link--the videos into Moodle. This eliminates distractions and helps kids stay focused on the content."

When the 2010 school year started up, the math team was ready--but just barely. Throughout the first year they kept trying new things, struggling to stay a few lessons ahead of the students. As the teachers get more comfortable with the technology and their new approach, the tinkering continues.

Darren Nelson, who teaches Basic Algebra, Algebra II/Trig, and Senior Math, describes some of the benefits he's seen: "This saves an amazing amount of time. We can demonstrate a math concept in a 10-minute video that normally we'd spend a whole period on in class. Students work at their own pace and, if they finish the problems in class, they move on to the next lesson."

In class, Nelson is always on the move, watching as students do the problems, working with those who have trouble, encouraging students to help each other, offering praise. "I can work with them right when they need help," he goes on, "rather than have them get stuck at home with no support." He believes this approach gives him greater insight into how each student is learning, and more flexibility in his teaching.

Do teachers find it awkward to "perform" on video? Some found it unnerving at first, but most soon became comfortable with using an interactive whiteboard just as they would in class. Faulkner laughs, "It's okay because students see just our hands [working problems on the whiteboard] and hear our voices on the videos."

Even if a course is taught by several teachers, it is built around the same curriculum. So, typically more than one teacher can make a video on the same lesson. Students can watch more than one teacher's presentation if they want, but typically watch just their own teacher's.

Student Reaction

Students like the change. At the most basic level, they appreciate having one less textbook to lug

around in their backpacks. They like that the videos are short--10 or 15 minutes at most. One notes, "If I'm out sick or have to miss a class for some reason, I don't fall behind. I really like that." Students also have to take more responsibility for their own learning. Although almost all of Byron's students have high-speed internet access at home, they still have to be creative in organizing their time to watch the videos.

Teachers see greater parental involvement as well. Although initially teachers got some calls from parents asking, "Where are the homework problems?" most parents are now happy with the new methods and curriculum. Jen Green, who teaches Geometry and English, tells of one student who previously had struggled with math. "He started watching the videos with his grandfather," Green says. "Soon the grandfather was able to help his grandson. Together, they are learning--and relearning--geometry."

National Recognition

Byron educators describe the flipped classroom as just one example of the continuous improvement process guiding the high school. Five teachers have been given small stipends to serve as data coaches, leading the efforts to collect, analyze, and interpret test data. "We won't let a student fail," says Principal Duffy. If students fall below 70 percent proficiency in a course, they are "invited" to a mandatory support study hall at lunchtime, staffed by teachers who choose to be lunchtime tutors rather than cafeteria monitors.

"We want to go from maximizing learning opportunities to maximizing *learning*," Duffy says. Math mastery at Byron High has jumped from 29.9 percent in 2006 to 73.8 percent in 2011, according to the Minnesota Comprehensive Assessments. ACT scores have risen from an average composite score of 21.2 (on a scale of 36) in 2006 to 24.5 in 2011. This school year, 86.6 percent of Byron's seniors will have completed four or more credits of math.

In 2010, Byron was selected as a National Blue Ribbon School by the US Department of Education. In September 2011, Byron was honored as Intel <http://intel.com> 's "School of Distinction" for high school mathematics. "Raising expectations for everyone--teachers and students--was at the heart of our continuous improvement process," Duffy says.

Success and innovation are contagious. Other Byron teachers are watching the math department, and are eager to adopt the flipped classroom model in their courses. The Byron community seems to be listening too. In November, by a 61 percent margin, citizens gave the school district a vote of confidence that translates into a $546,294 operating levy per year for the next six years. It's a Cinderella story that bears repeating in other schools and districts.

About the Author

Kathleen Fulton is an education consultant who specializes in transforming educational practice with technology. She recently retired as the National Commission on Teaching and America's Future's director for Reinventing Schools for the 21st Century. Prior to that, she was project director for the Office of Technology Assessment for the US Congress.
