

# CASE study



## Math teacher uses gamification to help at-risk students succeed

by Peter Ross

**Kate Fanelli is happy now.** It turns out her new approach to teaching actually has a name.

"When somebody would ask me to explain what MathLand is, it would take me 20 sentences to explain it," says Fanelli. "Now I just call it gamification."

The special-education high school math teacher from Canton, MI, just west of Detroit, has enjoyed a string of teaching victories since she launched MathLand, her gamified high-school math program, five years ago.

"A couple of students have commented that the class is set up like a game," says Fanelli, "Though I never tell them that. They might be tempted to rage against the machine if they thought I was trying to take their fun and make it educational. I just present MathLand as a simple grading system with levels and MathLand guys. They love that."

Fanelli's school accepts students referred from throughout her county who struggle with emotional issues. These mostly-capable students arrived at Fanelli's school after exhausting the resources of their local districts. Their emotional issues manifest themselves as extreme versions of classroom problems that most teachers would recognize:

- Work avoidance
- School avoidance
- Acting out in class
- Poor relationships with school personnel
- A reluctance to work independently

Fanelli's job is to get her students to successfully complete the three math courses that are mandatory for high school graduation in her state. Curiously, this new champion of gamification is not a gamer herself.

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"I have read a lot about computer games, but I don't play them much" says Fanelli. "I find them complicated and annoying. Every so often my family or friends will convince me to sit down with one. But I don't really understand how they work, and then I get frustrated. So I don't play them."

But, Fanelli points out, gamification isn't about her. "When my students walk into the class on Monday morning and start talking about their weekends, guess what they all talk about?" You guessed it. Gaming.

And, as Fanelli's experience would suggest, you don't have to be good at gaming to be good at gamification. Fanelli only arrived at gamification after abandoning hope that her standard teaching method could deliver her students from the seemingly-futile loop of boredom, stagnant scores, and chronic absenteeism.

The inspiration for her gamified MathLand concept came when Fanelli was attending a conference in 2006. The keynote speaker at that event suggested that young people like computer games because they crave the reward feedback they get from leveling.

Leveling indicates a graduation day in the world of games. Players level each time they achieve some in-game goal or some standard of experience. Leveling is both a celebration and a rite of passage. New honors and powers are heaped upon gamers each time they level up.

For Fanelli, this concept of *leveling* triggered an "aha moment."

"Lecturing wasn't working for me. I would give a 20-minute lesson in class. I would use overheads, call on students to answer questions, get students to come up to the board and solve problems. Then I would hand out the worksheets. The next thing I know, every hand has gone up. No-one was listening to me and none of the students have any idea what they are supposed to be doing.

"So when I heard the keynote speaker explain leveling, I immediately turned to my colleague and told him, 'we can do that'. By the end of the keynote, I had drawn up an outline for MathLand."

At its most basic level, MathLand has two components. The first is an organizational structure for the curriculum. MathLand structure is premised on gaming levels, while the Common Core State Standards for high-school math curriculum are sorted into topics. Fanelli simply takes the topics and subdivides them into levels. Students earn credit for mastering a level.

The current version of MathLand has 20 levels. Each level has three components:

1. A lesson with step-by-step instructions, necessary information, and a few mandatory exercises;

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2. A practice problem section. This is completed by students on a needs basis. If a student feels he or she is competent on a given topic, they can skip this section and go straight to the mastery test.
3. A mastery test is the final component of any level. It must be completed without help in a quiet part of the classroom. Students are allowed to use their notes, calculators, manipulatives, or computers. However, they are not allowed to talk to other students or ask the instructor for help. Students tell the instructor when they feel they are ready to take the test. If they do not pass, they are welcome to redo the test until they do succeed, or go back and try some practice problems.

"Points are awarded only for successfully completing the mastery test", says Fanelli. "I tell the kids, the lesson and practice are for learning, the mastery test is for showing you've learned it. That's what they earn points for: actually demonstrating they've learned something."

The other key component of MathLand is a visual tracking system for the students – what Fanelli's students call the MathLand Board. Each student creates an avatar on the first day of class. "The avatars are pretty basic at first," says Fanelli. "That's intentional."

The avatars evolve as students level-up in math learning. The avatars begin to move up the board and gain colored dots as badges of accomplishment each time the student levels up. At certain thresholds of accomplishment, students are allowed to replace their basic avatars with ones that are fancier.

"The Avatar Board tells a story," says Fanelli. "It doesn't have a lot of bells and whistles, but students love watching their avatars moving up the board."

The story of MathLand's success is even more impressive. In its first year, MathLand led students to a 17% improvement in statewide assessment performance. Attendance increased 13% in the first two years. Standardized test results continued to move upward -- by 22% at the end of year three.

"I don't think [my students] would be intimidated by a college math course," says Fanelli. "And some will feel that they can handle a career that requires math."

Fanelli hedges a bit when asked if she thinks gamification would work in every classroom? "Personally, I get frustrated when a teacher tells me that their current approach isn't working, but then they refuse to try anything different. I'm not trying to tell people what to do, but if I was handed an English class tomorrow, the first thing I would do is create EnglishLand."

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**For more details about MathLand, contact Kate Fanelli at [katefanelli@gmail.com](mailto:katefanelli@gmail.com)**

# The Challenges of Gamification

Gamification isn't difficult to implement, but Fanelli flags some challenges teachers are likely to encounter:

## Teaching may feel more repetitive

Gamification largely eliminates the need, and the opportunity, for group instruction. Each student proceeds at a pace they set for themselves. Where, in the past, you could present a lesson to the whole class at once, you may now have to present it to each student individually. Fanelli says peer tutoring and group work are two good ways to share the instructional load. Fanelli says, that after some reflection, she now reserves one day a week for group instruction.

## Increased record keeping

Fanelli maintains three sets of student records for each class:

1. **The school's computerized grading system** remains a requirement. This may become an issue, if, as is the case at Fanelli's school, the system only accepts percentages. "The MathLand point system doesn't easily mesh with the school's electronic grade book", says Fanelli. "I need to trick [the grade book] into accepting my scores. I also need to manually input the final grades at the end of the quarter."
2. **The Avatar Board** is the most obvious new record keeping tool. It exists mostly for the benefit of the students who use it to track their progress. The students are powerfully motivated by the Avatar Board, so the rules that govern it need to be clearly understood by all. The board must be updated only with the teacher's supervision, and always in the most scrupulous and punctual fashion.
3. **Lesson plan records.** Along with her attendance records, Fanelli records a short note explaining what each student was working on each day. This replaces her normal requirement to submit the day's lesson plan. Those daily lesson plans don't apply because each student is working on something different. Fanelli says this is a lot of work, but provides a very useful record of class time.

The need for record keeping increases, but most of the grading effort happens during class time. There are fewer evenings at home spent grading papers. At the end of each quarter, Fanelli compares all the records and reconciles any differences.

## Advanced planning required

Perhaps the greatest challenge of implementing a system like MathLand is the need to have the entire unit planned, written, copied, and ready to go, before the first class starts. Fanelli says her summers are spent tweaking the system with notes she has made for herself throughout the year. On the plus side, the program works on cruise control once the school year starts. And Fanelli says that the dilemma of dreaming up interesting lesson plans the night before class has entirely disappeared.