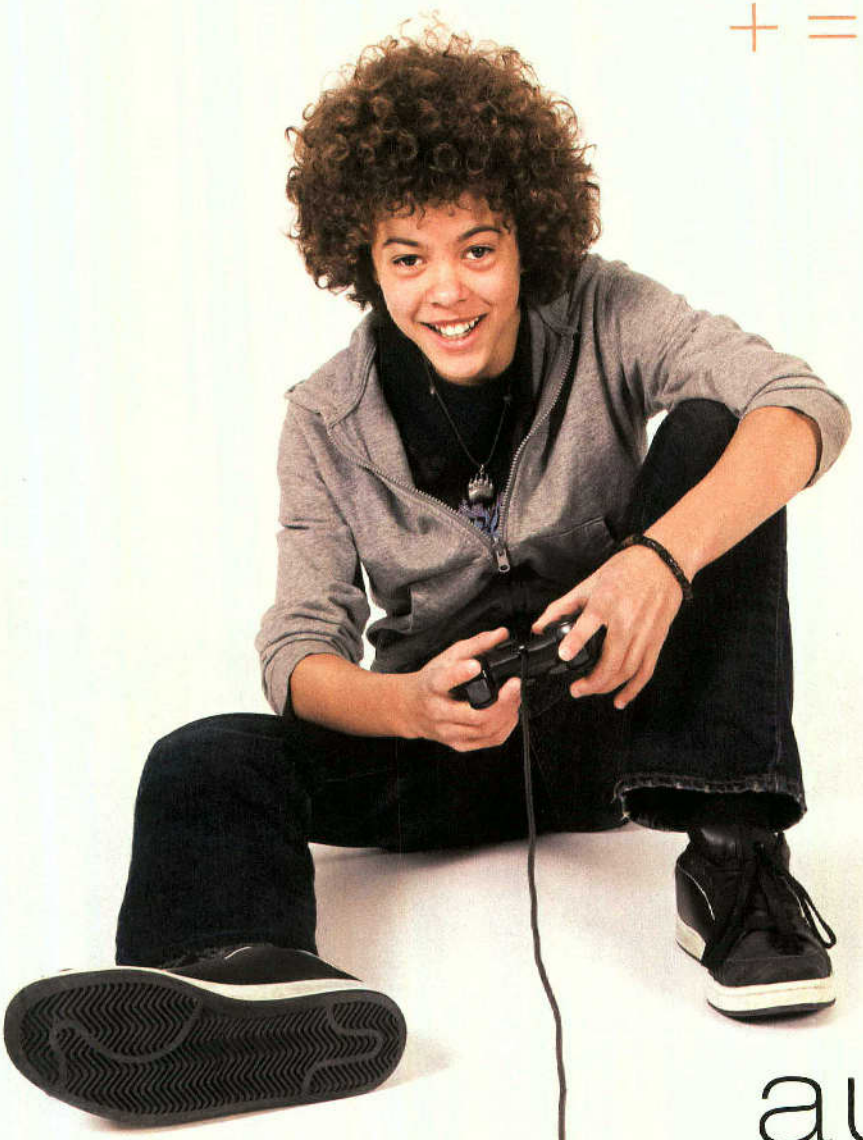

GAMING + autonomy = ACADEMIC Achievement

Don Hernandez

Students who are at risk of failure are allowed to play educational computer games for one hour a week.

The program encourages student autonomy, which facilitates the development of leadership and social skills.

The games appeal to students who are typically not involved in traditional extracurricular activities.

Preparing students from low-income, minority families to graduate is a challenge that begins as early as elementary school (Rumberger, 2004) but becomes a particular concern at the secondary level (Orfield, 2004). Low-income students are twice as likely as higher-income students to be poorly prepared for grade-level work and 1.3 times more likely to have learning disabilities, behavioral problems, and developmental delays (Balfanz, Ruby, & MacIver, 2002).

Such adverse circumstances make challenging subjects, such as pre-algebra and algebra, an ordeal. The National Council of Teachers of Mathematics (2008) cautions that students experience "frustration, failure, and negative attitudes toward mathematics and learning" when they are required to deal with algebra before they are ready. All of these factors result in a lack of student engagement, which is a strong indicator that students may drop out and a cause of poor academic achievement, truancy and absenteeism, and disruptive behavior (Catlin, Lewan, & Perignon, 1999). At Sam Houston Middle School in Garland, TX, we have addressed this challenge by introducing struggling math students to educational gaming and allowing them to pursue this particular remediation process on a voluntary basis.

Creating Maximum Motivation

My first experience with mathematics-based gaming was in 2008 when the school's math facilitator handed me a disk containing DimensionM from Tabula Digita, an immersive computer game that required players to use pre-algebra and algebra in action-adventure "missions" or games. She suggested that I let my son, who would be going to Houston in the upcoming school year, try the games over the summer so that I could see firsthand how children responded to the game. At about the same time, personnel from the district's instructional technology department saw a demonstration of DimensionM and determined that it was a viable option for motivating at-risk students.

In addition to the cognitive thrill of overcoming obstacles and triumphing over challenges or challengers, the games' visual appeal of colorful, three-dimensional graphics and fast-paced animation piques players' interest (Vorder, Bryant, Pieper, & Weber, 2006). The games also have a built-in self-efficacy factor, so they offer mastery experiences to novice players and then increase the level of difficulty as players' skills improve. This in turn motivates individuals to keep playing in the face of opposition and obstacles as well as to return to the game later (Klimmt & Hartmann, 2006). By repeatedly performing the

Sam Houston Middle School

GARLAND, TX

Grades: 6–8

Enrollment: 880

Community: Urban (in a generally suburban district)

Demographic: 83% Hispanic, 8% Black, 2% Asian, less than 1% Native American; 76% economically disadvantaged

Administrative team: 1 principal, 2 assistant principals

Faculty: 55 staff members

math tasks within the games, the players hone their problem-solving skills and computational fluency.

The DimensionM gaming software consists of first-person, three-dimensional, immersive games that are similar in appearance to popular action adventure video games. Each game contains embedded math concepts, such as identifying prime numbers, adding and subtracting integers, performing linear equations, and finding the greatest common factor. Players must master these concepts and apply them to achieve game objectives. In this way, the software transforms mathematics from abstract exercises into meaningful tasks.

When Houston started using the gaming software in January 2009, we knew that it was not something that all our math teachers would adopt. After years of being introduced to the latest, greatest solution for enhancing student learning, the attitude of many understandably was, How is this going to fit into the curriculum?

But the majority of Houston's student population fits the description of "at-risk." More than three-quarters of the student population are from economically disadvantaged backgrounds. Further, in 2007 only 63% of our eighth graders met or exceeded math proficiency standards on the Texas Assessment of Knowledge and Skills (TAKS). Despite the reservations, we knew that gaming software could support and encourage those students.

Houston students who do not succeed on the state assessment must take a regular mathematics class plus a lab. Instead of forcing the new gaming program on the regular mathematics teachers, we simply focused on those students and, by extension, the lab teacher, who was very receptive. We did not want the games to become a regular part of the lab, however, because we felt it would be best for students to spend their time in the lab focusing on the things they needed to learn for class.

The mathematics lab teacher introduced his students to the games by taking them to the computer lab during one session. Once the kids had familiarized themselves with the games, he invited them to play for an hour each weekday after classes had ended. Once he introduced the games, they caught on, and other students who were not attending the mathematics lab began playing the games. Before we knew it, so many students were showing up for the sessions that he had to add a morning gaming session from 8:00 a.m. to 8:45 a.m. We have had to turn students away because the 30 computer lab seats were all filled, and I have encountered some students taking their school-provided breakfast into the lab so that they can play.

Middle school students are at a point in their development when they crave more autonomy in their lives, but traditional teaching methods require them to be passive recipients of instructional content. The more say that students have in a learning activity, the more engaged they become in the activity (Catlin et al., 1999). So although the lab teacher volunteers his time to supervise these before- and after-school sessions, the students can play whichever of the games they choose. They organize themselves into teams for the multiplayer games or opt to conduct solo missions until they can join a team.

Social Effects of At-School Gaming

Despite their previous lack of success on state tests, on the most recent math TAKS test 80% of the math lab students passed on grade level. It should also be noted that we have witnessed a positive social transformation in the players.

For example, one of our eighth graders had problems with discipline as a sixth and seventh grader. He was defiant, refused to participate in class work, and frustrated his teachers and family. The first time I went into the computer lab during game time, however, I saw him there. I asked what he was doing there, and he replied that he had come to try the games. I said, "Great. Give it a real try before you say no."

Once he got involved with the games, the student completely changed. Not once did we have to call his parents or take disciplinary action. He was in the computer lab both morning and evening and became an unofficial team leader.

We have never questioned him about the exact cause of his transformation, but Klug and Schell (2006) theorize that competitive games provide a socially acceptable outlet for aggression, and Von Salisch, Oppl, and Kristen (2006) posit that interactive games provide some children with a sense of power or control that they may lack in other aspects of their lives.

In addition, the autonomy that students have in the gaming sessions has strengthened students' leadership skills and initiative. The players typically are not athletes or honor students, but they are now performing complex social tasks, such as forming themselves into teams, cooperating, and coordinating their individual actions.

Those social skills were further promoted when Houston participated in an intercampus gaming tournament in May 2009. Five-player teams had to pick their own captain, agree on what game each team would play in the first round of the tournament, and effectively assess team members' strengths and weaknesses. Although our students had only been exposed to the games for approximately five months at the time, they won the tournament. Later that month, students from our school district competed in and won a championship tournament against students from New York. Houston students were six of the seven representatives who participated.

The mathematics lab students' change in behavior and attitude about school has improved significantly. Although they do not participate in traditional school activities—such as the band or athletics teams—at-school gaming and the tournaments have made them feel that they are part of the school, that someone cares about them, and that they are good at something. They have experienced success at school, which previously was not a place where they had any sort of success. As a result, the overall atmosphere of Houston has changed for the better.

Conclusion

Other schools have instituted educational gaming in different formats than Houston, such as pulling students out of elective classes for remediation or including the programs in the regular curriculum. But our model offers maximum student autonomy, which has allowed students to develop initiative and take ownership of this learning activity.

We had originally been focusing on those students who took the TAKS while at Houston, that is, the seventh and eighth graders. But the success that those students have had prompted us to expand our efforts. In the 2009–10 school year, we will have mathematics lab (and gaming) for sixth graders.

As for gaming itself, as long as the selected computer games meet the requirements of state standards, they serve as an excellent supplement to instruction. The more you can introduce hands-on instructional content that captures students' interest, the better the learning outcomes. PL

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