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## Achieving Academic Success in Algebra

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# Academic Leadership Journal

When we look at landmark legislation that significantly impacted the face of education in our country, we often think of events such as the passage of the Education of All Handicapped Children Act of 1975, whereby students with disabilities would now be brought into our public school system and educated alongside of their non-handicapped peers. We may also think of the landmark decision in *Oliver L. Brown et. al. v. The Board of Education of Topeka (Kansas)* in 1954, abolishing legalized racial segregation within the United States public school system. In 2006, the ground significantly shifted again for educators—at least those in the state of Michigan.

On April 20, 2006, Governor Jennifer Granholm signed into law the Michigan Merit Curriculum outlining the new, highly rigorous graduation requirements for all high school students, beginning with the class of 2011. This curriculum is historic in that the rigor it imparts is one of the most stringent in the nation. Students in this state are required to take 4 credits of math to include Algebra 1, Geometry, Algebra 2 and a fourth year math-related class; 4 years of English, 3 years of science to include Biology, Chemistry or Physics and an additional third year of science; 3 credits of social science; one credit of physical education, and an online learning experience. Two years into this new curriculum, many educators and administrators are frustrated with the high number of students that are failing courses, particularly Algebra 1. Make no mistake; students must pass/demonstrate competency in each of these classes in order to be eligible to receive a high school diploma in the state of Michigan. With those kinds of stakes, we must take a closer look at what we are doing well as educators, while closely investigating that which we need to improve. With that, it would be prudent look to our elementary, career and technical education and special education counterparts.

Bill and Melinda Gates redefined the traditional “three r’s” as: rigor, relevance and relationships. Although one could argue with the said order, there is no disputing that all three need to be firmly in place if we are to adequately prepare today’s students for the new “flat” world. The question remains, “How do we get there, if schools continue to operate as they always have?” Some would reply, “We don’t.” If we are to lift our students to a more rigorous standard successfully, then we must not continue to conduct “business as usual.” When embracing the new three r’s model, it could be argued that the foundation for learning is cemented in relationships: The relationship between student and teacher (not student and computer module, an increasingly popular means to recoup lost credit); the relationship between staff and administration; the relationship between students. Cultivating these relationships is imperative to building the trust needed to help students realize their ability. It could be debated that our educational system has taught many of our students how to be unproductive.

Educators will often complain about “lack of student motivation,” as if it were something that kids are born to exude. It is an arguable point that the job of the teacher is to motivate and inspire students, while building the trust required to get to that point. Relationship building is more than just asking about a child’s weekend or complementing students on various aspects of his or her progress. A complete overhaul of the educational environment also constitutes positive relationships. Walking into a student focused building and/or classroom says much more about the belief system of the schools’ staff than any comment a teacher could make to a parent or administrator. Imagine being one of 45 students

crammed into a small classroom with one teacher, trying to learn Algebra. Unfortunately, that is exactly the scenario that one might find should he or she wander through a typical high school classroom. With education budgets constantly being slashed and funds being reallocated toward new initiatives and away from student centered, researched-based practices, administrators are often left wondering how to pay the bills. As a student, one might feel as if actual learning and student success was secondary to the financial issues that opening up a new course section might present. As adults, if we don't feel valued and validated, generally we are less likely to perform. Why would we expect any more from teenagers? It stands to reason that if students feel important to the people that teach them and run their school, then they exhibit buy-in to what is being asked of them and take ownership in their own learning.

With that in mind, it is important to note that the cultivation of a nurturing environment extends beyond small class sizes and student validation. Educators must not dismiss the need to get to know their students personally. Relationships that are positive between teachers and students yield positive academic results. Those close relationships with instructors lead to increased student achievement and classroom engagement. (Pianata, 1999). Students build relationships that are akin to a mentor/mentee. Students tend to "work harder for teachers who treat them as individuals and express interest in their personal lives outside of school" (Stipek, 2006). With the curriculum demands and the required assessment standards that teachers face each day, it is easy to brush aside the affective piece of educating a child. However, in doing so, we lose the most valuable tool we have as teachers to motivate and inspire students to reach for that piece of "something special" that many of us desire, but not all of us attain.

The "new 3 Rs" revolution that the Gates' have helped to fuel and educators across the nation have embraced, reminds us that we must not forget the relevancy piece. This is the glue that keeps students engaged and learning. When they can see how learning relates to the real world and that it is not just arbitrary trivia, then teachers see students reach beyond what they never thought they could achieve. What better example of relevancy do we have to draw from than that which takes place within the walls of our career and technical education courses? Take for example, the student with a diagnosed math disability who performs trigonometry operations within the context of his heating and cooling class and is sought out by employers as a potential employee. Does this not suggest that the "disability" only occurs within a traditional classroom setting, whereby the student may not be able to see and conceptualize the cause and effect relationship between the numbers on the paper and how it might be used in a relevant way? Does this also not suggest that educators need to take a pedagogical leap from teaching curriculum to teaching kids? Imagine what would happen if all teachers worked together toward a curriculum that was brimming with real-world, hands-on applications that opened educational doors for students who had previously thought of themselves as incapable of learning complex material.

When educators take a page from career and technical education, one can deduce that students are being motivated to reach and achieve by their instructors. At the Bay-Arenac Intermediate School District Career Center in Bay City, Michigan, students are all interviewed toward the end of their senior year about their experience at the school. One of the questions probes, "Why did you decide to attend the Career Center?" Based upon tabulated results of all responses for the 2008-09 school year, 47% of the 558 graduating seniors interviewed indicated that the "hands-on" instruction was appealing to them. Yet, as one peruses the halls of typical high schools across not only Michigan, but all over the country, what is occurring is anything but hands-on.

Due to the great need for credit recovery, coupled with the desire to experiment with tried and true practices in special education, early elementary education and career and technical education, the Bay-Arenac Career Center embarked on the reinvention of a typical “summer school” and credit recovery program, favoring a hands-on relevant approach toward instruction. A simple enough thought, certainly supported and validated by volumes of research, but one lost on many high schools today. A model academy was put together for the summer of 2008 to put this very concept into practice. Although staff at this facility was able to learn a great deal from revamping the “new academy”, they took what they learned from that summer, based upon student surveys, observations and assessment results and once again redefined themselves, keeping in mind best practices and what students said they needed from their teachers. The end result is discussed below within the context of Algebra 1, a course that an estimated one third of Michigan students failed during the 2008-09 school year.

The preparation for the summer of 2009 Algebra 1 courses began months before the snow even melted off of the slick Michigan sidewalks. Teachers for these courses were hand selected, based upon observations by highly qualified math instructors of these individuals teaching algebra to students. The goal was to hire teachers who were kid-focused first and content focused second. Individuals who would reach out to struggling learners, wrap their proverbial arms around each child and do whatever it took to help them achieve success were sought out for employment. Additionally, a support teacher for each course was hired. Credentials for these teacher assistants included highly qualified teacher status in mathematics with instructional experience at the middle and/or elementary school levels. All teachers were considered “highly qualified”, as defined by the state of Michigan. Middle school and elementary teachers tend to be well versed in use of hands-on activities and materials for teaching. The goal was to bring in their expertise and merge it with the content knowledge of the high school teacher. Additionally, this gave students two skilled math instructors to assist them with learning the material.

Math teachers met with the academy coordinator and a math consultant that contracted with the school several times prior to the onset of summer school to prepare for and plan not only the lessons, but also the instructional design. Our first semester Algebra 1 students would come to the academy having failed the course multiple times, in most cases. (Course content standards can be found within the Michigan Department of Education’s website at:

[http://www.michigan.gov/documents/mde/Algebra1\\_216634\\_7.pdf](http://www.michigan.gov/documents/mde/Algebra1_216634_7.pdf).) The course content for this semester lent itself well to the use of hands-on manipulatives and projects. The instructional design was set up so that students could rotate through a series of “learning stations”, facilitated by the instructors and one teacher volunteer. Students were presented with new content in a small group by the lead teacher. She then took half of the group and worked with them in a guided practice situation, utilizing graphing calculators, when applicable, or the laptop computers that were readily available to students, on a daily basis. Computer sites were pre-identified so that the teacher could direct students to instructional websites and perform activities that reinforced content. Guided paper/pencil activities were also integrated, so that students could begin to understand the relationship between the activity and solving actual problems. It was noted by the teacher that kids could do well with the hands-on activities but struggled to apply what they did to an actual problem. That skill had to be directly taught. The support teacher would then work with a group of students on the concept, using algebra-blocks, calculator-based ranger technology, VersaTiles<sup>®</sup> and/or Kagan cooperative learning activities. This teacher helped facilitate and support instruction in his/her group. Again, concepts were related back to the application on paper and directly taught and/or reinforced, as needed. After approximately 35

minutes of instruction, the groups switched. Independent practice then followed to assess how kids were doing with the new concept.

In the second Algebra class, which focused on second semester objectives for the state of Michigan's required Algebra course, the teacher's approach was very different. This course also had a support teacher that was recruited from a local middle school, with a highly qualified high school math teacher as the lead. Whole group instruction was the instructional design, with hands-on experiences more limited than that of semester one. Part of the reason for a reduction in the amount of hands-on activities had to do with the required content that was to be taught. Much of it did not lend itself well to use of the manipulatives. With that, the teacher used several of the Kagan cooperative learning strategies with students and employed some effective, non-threatening ways to get all students participating and instant teacher feedback. For example, students were given mini white boards on which to solve problems. The teacher led students in whole-group instruction, providing them notes on how to do the problems, as opposed to examples of problems. Students responded favorably to this method in surveys they filled out, upon completion of the course. The teacher then would post a problem to be solved, while students solved it on their mini white boards. When finished, the students would hold up their boards. The teachers would then either give a "thumbs up" if it was accurate or come to them for one-on-one assistance, if it was not correct. The students also pointed out in their surveys that that type of support made a positive impact on their learning of the material.

In both classes, testlets were given to students, as opposed to large exams, covering volumes of information and concepts. Students were able to demonstrate their understanding of the content over shorter periods of time, thus giving teachers good feedback as to where they needed to re-teach. In addition, relevancy was woven into the context of the class through lessons steeped in real-world applications. Students were exposed to how basic algebraic concepts stretched into the culinary arts, as well as into playing golf. The previous summer, students learned algebraic concepts through machining and engineering and drafting-both programs at the Bay-Arenac ISD Career Center. The goal was not necessarily to teach algebra content standards, but rather to show kids what algebra might look like in the "real world." Although most people may never be asked to solve a quadratic equation in the course of their daily living does not mean that they are not dealing with algebra on a daily basis. These types of relevant experiences gave kids an opportunity to identify opportunities to implement algebra within the context of their own environment. Many indicated on their surveys that they found that piece of the course valuable. Finally, the students in both courses took a field trip to one of our local universities, Saginaw Valley State University, to receive algebra instruction with a hands-on approach from two of the University's finest math instructors, Mr. Garry Johns and Ms. Cathy Malotka. Students were introduced to the calculator based rangers at this time and participated in a series of activities that got them up and moving. The goal was to look at learning styles and ensure that all students were being reached. Additionally, we wanted to show students how the equations they were solving translated into something concrete. Most students that we worked with had verbalized their confusion about what the equations mean and why it is necessary to solve them. Activities whereby students are not only told and/or shown but also **experience** how this relationship works are the most effective and memorable pieces of learning the mathematical content. The proof of the effectiveness of this type of instructional environment is in the results.

The first semester Algebra 1 class had an 87% passing rate, with only 4 students failing the course. In looking at their final scores, 3 of the 4 students that failed were within 4 or fewer percentage points of

passing and had made great gains throughout the span of the course. The second semester class boasted a 100% passing rate, with most students scoring in the average to above average range. The first semester class had 34 students, while second semester had 26 students.

It is also important to note that students could only miss one day of instruction, throughout the entire 24 day course, without being dropped from the class. In special situations where a student might be absent for additional days, the teacher would meet with parents to develop a plan to keep the child on track. Students, by and large, adhered to the attendance policy. Only one student was dropped from the Algebra courses, due to attendance. In this summer situation, students had to either obtain rides from family and/or friends, walk, bike, or rely on public transportation. The motivation to recoup lost credit was definitely present, and as such, students showed up every day. Weekly attendance drawings were held for students that had perfect attendance for any given week, whereby selected students received a \$5 McDonald's gift card. Weekly classroom attendance challenges were also held, with students in the "winning" classes earning an ice cream treat, if everyone was present that week. This helped students to motivate each other to be there every day. Classes ran Monday-Thursday, with Fridays off. This allowed families to take long weekend trips, without missing class. Additionally, the four-day work week gave students a much earned and needed break, after 4 days of intensive Algebra instruction. Kids worked from 8:30am until noon, each school day. That amount of sustained focus was attainable with having Fridays off. Students were surveyed about how they felt attending the summer academy until nearly the end of July, as a trade-off for having Fridays free. An overwhelming majority preferred having the long weekends and noted that the four days of class went by quickly, as the activities were fun and had them up and moving.

When one talks about the "relationships" piece of the "new three Rs", I believe that we are addressing the most important component of educating our youth successfully. For years, educators have been aware of the significant relationship between students' emotional states and their capacity for learning (Vail, 1994). Daniel Goleman, author of the popular *Emotional Intelligence (1995)*, states, "The extent to which emotional upsets can interfere with mental life is no news to teachers. Students who are anxious, angry or depressed don't learn; people who are caught in these states do not take in information efficiently or deal with it well." With this in mind, educators must be vigilant in cultivating and nurturing an environment that is conducive to learning. We must provide opportunities for students to connect with their teachers and support staff, listening to concerns, getting to know the students as people, as well as learners. When educators are in tune with what is going on with the children that they teach, only then can they work to ensure that all kids are learning. For example, if I am a teacher who just teaches math, I may not know that "Sara" is anxious about her family's financial situation at home. I may then assume that she is not studying or no longer cares about getting her work done, and therefore may assign her a failing grade. On the other hand, if I am a math teacher that teaches students, then I am going to make the time to find out what might be going on with Sara and offer assistance. In the best case scenario, Sara will come to me with her issues because she knows that I am a caring teacher who **wants** to know what is going on with her students; the classroom environment is structured to reflect this belief.

Within the summer academy, students spend a great deal of time working with a team of two teachers. Additionally, nurturing support at a building level is built in, where students feel cared about and know that we are willing to go the extra mile to support them. Foundational to the students' success is the belief that the child will be addressed first and the student second. Once students feel valued and

appreciated for being a unique individual, they are more likely to extend themselves, and thus their learning. It does take some time to build these types of trusting relationships-especially since many of these students may no longer trust educators. However, if the tone for a caring, positive learning atmosphere is set early, students will come to school because they feel safe and valued. Excellent Summer Academy attendance is proof of that notion.

When one examines the intricate and complex process by which humans learn, it becomes increasingly clear that the foundation for academic rigor and the generalization skills necessary to make the connection to relevance cannot occur successfully with many students until the relationship piece is solid. Using the Bay-Arenac ISD Career Center's Summer Academy as a prime example, one realizes fairly quickly that the bottom line rests with great teachers. Students learn best from, as one student stated in his/her survey, "great explainers". What education needs are more teachers armed with an arsenal of teaching strategies, other than the traditional "sit and get" method, favored by many secondary educators. Teachers need to be able to address the diverse abilities of our student population, while making it relevant and holding the kids before them to high standards. Elemental to this, is the establishment of positive, encouraging relationships with the adults educating them. Carving out time each day to create a connection with students, listening to their concerns, and working with each child as an individual will go a long way toward achieving success. Couple that with strong teaching methodologies and the conviction that all students can learn, holding **every** child to a high standard, and educators have a recipe for success. With our current educational climate, overflowing with a packed curriculum and a national, as well as local, demand for high assessment scores, many educators may feel that they cannot afford to sacrifice instructional time for affective needs. In an era of "No Child Left Behind," within a society that now seems to place a higher value on intellectual property than people, with our current educational system teetering on the brink of global failure, we need to ask ourselves, "Can we afford not to?"

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Students can have requirements amended if parents request a personal curriculum and one is granted.

Reference to Thomas Friedman's work, *The World Is Flat: A Brief History of the Twenty-First Century*, 2005.

Michigan Department of Education does not record state totals. Estimates were derived through conversations with local and ISD officials around the state.

On January 8, 2002, President George W. Bush signed into law the No Child Left Behind (NCLB) Act of 2001, which is a reauthorization of the Elementary and Secondary Education Act of 1965 (ESEA). This federal law required all teachers of core academic subjects be "highly qualified" by the end of the 2005-2006 school year. **To be highly qualified a teacher must meet three requirements:** holds at least a bachelor's degree, has full state teacher certification, and has demonstrated competence in each core academic subject in which the teacher instructs.

This is an instrument that works with TI graphing calculators to collect motion data in your math, physical science, or physics classroom.

Combining the challenge of a puzzle with the purposeful practice of a workbook, this supplemental program allows students to practice skills independently and at their own pace.

Dr. Spencer Kagan created simple "structures" that allow teachers to guide the interaction of students. Kagan's structures have been found to lead to greater cooperativeness. They have also proven positive results in many areas, including greater academic achievement, improved ethnic relations, enhanced self-esteem, harmonious classroom climate, and the development of social skills and character virtues.

According to the James Madison Dictionary of Student Outcome Assessment, a testlet is a group of items within a test that measure the same factor or which relate to the same stimulus. Items that are part of a testlet are not statistically independent.

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