SPONSORED BY

Grassroots Robotics

by Tom Atwood with Cliff Zintgraff

DaVinci Minds, Partners, adds VEX robotics to academic classrooms

Students engage with robots in a full-year math class

It was our pleasure, this issue, to catch up to Cliff Zintgraff, CEO of DaVinci Minds, Inc., to learn how his San Antonio, Texas based company is using VEX Robotics in core classroom curriculum to prepare students to become tomorrow's innovators. DaVinci Minds offers products and services for middle schools, high schools, community colleges and universities in a broad array of programs that center on the intersection of technology, education and workforce development. This interview focuses on an important and quickly expanding high school course titled Analytical Integrated Math (AIM). AIM was developed by a partnership including DaVinci Minds and other K-12, college and curriculum development partners. AIM has become a keystone curriculum for high school seniors that simultaneously addresses the needs of students, teachers and the community. —Tom Atwood

Cliff Zintgraff, founder of DaVinci Minds.

ROBOT: When did DaVinci Minds come into being and how did it get started?

CLIFF: DaVinci Minds incorporated in early 2008 as a result of some ongoing work I was performing with several colleagues. My colleague Jim Brazell is a long time K-12 advocate and nationally-known public speaker on education and workforce issues. In San Antonio, he conceived and helped start Space TEAMS, a K-12 robotics program that incorporates Technology, Engineering, Arts, Math and Science. In the years before we incorporated, I had been involved in San Antonio as a co-founder of the Information Technology and Security Academy (ITSA), which brought students into a dual-credit program involving IT and information security. Although perhaps not widely known, San Antonio is second only to Washington, D.C. in the number of professionally certified information security professionals. It was with this Academy that I cut my teeth on K-12 education, career pathways, the workforce pipeline, articulation of credit in curriculum, and more. I owe a lot to Dr. Richard Butler of Trinity University, a mentor and the "father" of San Antonio's Academy programs. Jim also introduced me to Dr. James Bower, the creator and co-founder of Whyville.net, the learning-based virtual world for teens and tweens. You can find Whyville at www.whyville.net, and DaVinci Minds' program and curriculum for middle schools at www.whycareers.com. Before DaVinci Minds' founding, I was working with Whyville to bring Whyville.net into formal K-12 classrooms. Both Dr. Bower and Jim Brazell helped me see the opportunity and the need to build in-classroom lessons around innovative platforms using constructivist, inquiry-driven learning. We saw an opportunity to create lessons that fundamentally integrate career, math and science education, and to connect classroom lessons to real careers local to the students.

Waco ISD teacher and co-developer of the AIM curriculum, Dennis Oubre, works with AIM students at the end-of-year competition. Teams are judged on their engineering notebooks and on teamwork, in addition to being judged on the performance of their robots.

About this time, Jim Brazell and I met Donna McKethan. She was the Career and Technology Education (CTE) Director for the Waco Independent School District (ISD). Donna was thinking about the impact of the "4 by 4," a new Texas requirement for four years of high school credit in four core subject areas. One of those subjects is math. The 4-by-4 added a fourth year of math to what had been just a three year Texas requirement. The first graduating class that had to meet this requirement was that of 2010-2011. Donna helped convene a group to envision and create a new course that became AIM, a year-long in-class curriculum for our high school seniors that involves hands-on designing and building of VEX Robots, but with a focus on teaching math. During the first few years, AIM was a pilot program. The experience with AIM contributed to the creation of an official Texas class called *Engineering Math*, and the AIM program and curriculum met the requirements (and helped inspire) the Engineering Math course and standard. AIM is a core *academic* class, meeting core academic math requirements for Texas high school seniors.

PHOTOS COURTESY OF WIKIPEDIA AND BERNAMA

ROBOT: What were the initial considerations in approaching the design of AIM?

CLIFF: Donna was working with Jim Brazell and also with educators at Texas State Technical College Waco (TSTC Waco) and at Baylor University's Center for Astrophysics Space Physics and Engineering Research (CASPER). At the time, only about 30% of graduating seniors had taken a fourth year of math. Those students were generally taking pre-calculus, and the question was whether there could be a better alternative. Donna went into industry and asked companies what math was used in jobs that were filled by two-year and four-year degreed students (Associates and Bachelors degrees).

Donna pulled this together and also worked through TSTC Waco, CASPER and Baylor's GEAR UP program to secure funding. DaVinci Minds performed project management, and took the lead in researching how VEX robots should be packaged and delivered to best work for teachers and students in the classroom.

The creation of AIM was timely. About 50% of community college freshman and 22% of university freshman require remedial courses in spite of having passed the state-mandated Texas Assessment of Knowledge and Skills (TAKS) tests. In 2007 the state budgeted $206 million in General Revenue Funds for the related instructional costs over two years.

ROBOT: Can you describe the kinds of math and any related subjects that are part of AIM?

CLIFF: As I previously noted, the State (the Texas Education Agency — TEA) defines the *Engineering Math* course and standard. The course includes algebra, geometry, as well as trigonometry, and also a review of other math topics that students struggle with on college entrance exams. AIM also exercises "computational thinking," which simply defined is the thinking skills required to do math and program computers, and generally approach problems in a logical, systematic and analytical manner. Federal organizations like DARPA and the National Science Foundation are increasingly focused on computational thinking and on expanding computer science education in our high schools. From a science standpoint, AIM includes subjects like electrical measurements, pneumatic pressure and flow, and mechanical drives, in addition to math and programming.

ROBOT: Texas is noted for its job growth and innovative companies like DaVinci Minds—what is behind this?

CLIFF: I think it is our state's focus on education and our strong entrepreneurial spirit, as well—which permeates not only business but the education community and even our government organizations. I think of it as "pioneer spirit," which you can find anywhere in the U.S., and, excuse my bias, especially in Texas!

ROBOT: Can you clarify the relationship between DaVinci Minds, Whyville.net and AIM?

CLIFF: DaVinci Minds is our company, and Whyville and AIM (and VEX robots) are products we help develop or sell. In both cases, we don't own the whole offering, but are part of partnerships we helped form that bring key competencies to bear, working in concert. Whyville is owned by our partner Numedeon, Inc., and we partner with Power Across Texas (a Texas non-profit corporation), Numedeon and Alamo Colleges in our development efforts. We also just received a major national grant to help develop this work — I can't talk about it yet, but maybe by the time this is published, you can read about it at our web site!

Waco ISD is the creator of the AIM program. Texas State Technical College (TSTC), a community college with four campuses statewide, helped develop the program and hosts AIM's end-of-year VEX Robotics competitions. DaVinci Minds is the first line of contact and support to school districts and the teachers in the classroom, and we custom kit the VEX robots for the classroom. Teaching Systems, Inc. (TSI) is the Texas company that sells and trains the curriculum and the online learning system locally. Intelitek is the original developer of the online learning system that is the delivery platform for the curriculum. VEX robots are exclusively used in the program.

ROBOT: How does DaVinci Minds serve the educator?

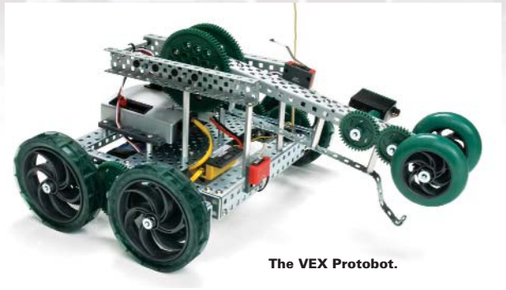
CLIFF: The vast majority of educators are focused on meeting student needs, and preparing students for their next academic or career steps. Educators do this work in a high-pressure environment that is increasingly regimented. Too often, products like AIM are delivered into classrooms with large amounts of preparation time required, and with little ongoing assistance — approaches that are out-of-sync with the reality in public schools. We believe strongly that innovative programs work if they do a better job of engaging students and teaching students, and if they arrive "ready to go" with support standing by. We serve educators by providing products and services that help them teach students, with ongoing support for those efforts.

ROBOT: Can you tell us about the DaVinci Minds teaching philosophy?

CLIFF: A moment ago you asked about the relationship between DaVinci Minds, AIM and Whyville. From the standpoint of pedagogy, Whyville and AIM (specifically, the VEX robots) are

the kinds of products we love to build curriculum on! DaVinci Minds is committed to inquiry-based, project-based learning.

Our programs and curriculum integrate math, science and career education in single lesson plans. Bill Daggett, CEO at The International Center for Leadership in Education, www.leadered.com, has shown that when you integrate academics with career and technical education, you get improved outcomes. Other research agrees with that finding. We believe that integrating math, science and career education fosters a higher level of readiness among our graduates to pursue the next level of education and, ultimately, a higher paying job. AIM integrates math, science and careers in every lesson. You can't tell where one starts and the other stops. For example, suppose that you are in an AIM class and are building a VEX robot. The robot may, for example, need to move across a field, pick up a ball and drop it into a goal. That is math, and it is science, and it relates to a career position where you may be operating and controlling machines, and wouldn't it be nice to learn about those careers and local positions available right after you complete this lesson? That narrative nicely summarizes our philosophy at DaVinci Minds.



The VEX Protobot.

dents in a class. We've had several organizations comment to us that we are providing a "high value add." The kitting process is time consuming — but one we've gotten very good at! We do it this way, and that saves a great deal of time for schools and adds consistency to program delivery.

VEX ROBOTS

ROBOT: Why did you select VEX for AIM?

CLIFF: We did an analysis of four platforms and VEX was the best platform based upon price, reliability and flexibility. Price was important, and also the ability to wrap the educational content around the platform.

ROBOT: How are VEX robots used in the classroom?

CLIFF: Simply put, the VEX Protobot is used continuously throughout the year to teach a formal academic course. We are not talking about electives, but rather core academic credit for students. In terms of using robots in core academic classes, I believe that DaVinci Minds is a leader in the field.

Dennis Oubre in his AIM classroom in Waco ISD.

ROBOT: How has the VEX Robotics team treated you in terms of customer service?

CLIFF: IFI and VEX have been wonderful to work with. You get a person on the phone when you call. They turn around issues in a timely manner. Of the few times there were hardware questions, they gave us solutions quickly. VEX provides a very high level of customer service that we have been very pleased with and that has created a strong sense of loyalty with us.

The VEX robots are kitted by DaVinci Minds for use in AIM full year classes. The kits arrive "ready to use" on the first day of class by each three-student team.

ROBOT: How are the kits customized?

CLIFF: We package VEX robots specifically for a team of three students. An original requirement from Waco ISD was to deliver AIM in a turnkey fashion into the schools—and we understand that teachers are often overworked and understaffed. We wanted the VEX robots to land in the classroom ready for the three-student teams. That usually equates to seven kits distributed to 21 students in a class. We've had several organizations comment to us that we are providing a "high value add." The kitting process is time consuming — but one we've gotten very good at! We do it this way, and that saves a great deal of time for schools and adds consistency to program delivery.

ROBOT: Which version of VEX robot are you using?

CLIFF: We are using the VEX Protobot. That specific robot has the right mix of features to exercise the math and science found in the curriculum. In the not-too-distant future, we may upgrade to a WiFi based VEX system.

ROBOT: How quickly has the program grown?

CLIFF: AIM is now in its 4th year. In our first year we piloted AIM in three Waco ISD high schools. The following year we expanded to one additional high school in the Rio Grande Valley, in San Benito, and last summer was the first time we offered AIM for general availability. We are now in 21 schools in 11 school districts in Texas. In 2010-2011, about 1,000 high school seniors were enrolled. As everyone in our business knows, it is a difficult school funding environment right now, but nevertheless we expect to sustain our growth. There are about 1,500 high schools in Texas. The future of promoting innovative thinking with VEX Robotics is bright!

We will also offer AIM in other states, and will work with early adopters in other states to cross-match to their academic standards. Eventually, we'll work with our partners to cross-match to national math standards.

ROBOT: Is DaVinci Minds a commercial entity?

CLIFF: We are a for-profit corporation collaborating with both commercial companies and 501C(3) nonprofits. Whenever I answer this question, I also like to highlight our numerous public/private partnerships. Public/private partnerships are essential to move educational programs forward, especially cross-disciplinary, innovative programs that require a mix of capabilities to become successful.

ROBOT: How is the course received by students?

CLIFF: The students love the program and they are strongly engaged. Teachers note anecdotally that the absentee rates in our classes are lower. The students we've met almost to a person said they would recommend taking the AIM class to other students.

ROBOT: How does the AIM program and VEX Robotics prepare students for technical careers?

CLIFF: If you look at the workforce, about 20% of jobs are professionals, and about 60% are "skilled" with some amount of college education required after high school. AIM prepares students for both 2- and 4-year degree programs. The two-year programs point students to high tech, high paying jobs. AIM also prepares students for four-year programs. One of our students enrolled in AIM at a Waco high school will next year will be an incoming freshman at Trinity University, which is regularly named one of the top liberal arts schools west of the Mississippi in U.S. News and World Report rankings. That's a not-so-subtle plug for Trinity, my alma mater!

ROBOT: What kinds of skills are promoted by the collaboration among a team designing, building, programming and running VEX robots in AIM?

CLIFF: These courses promote critical thinking, collaboration and teamwork as a team of three students design and build the robot to meet a variety of challenges over the course of the class. AIM helps build the skill sets regularly sought by employers in industry. AIM helps develop these skills starting at the high school level.

ROBOT: Thank you so much for your time and for the opportunity to conduct this interview, and please keep us posted as you expand use of the VEX Robotics Design System in our schools.

CLIFF: My pleasure!

Links

DaVinci Minds, Inc.,
www.davinci-minds.com, (210) 399-1314

VEX Robotics Design System,
www.vexrobotics.com, (903) 453-0800

AIM Program, www.texasaim.com, (210) 399-1314

WhyCareers (DaVinci Minds' Whyville program and curriculum):
www.whycareers.com, (210) 399-1314

Whyville, www.whyville.net

International Center for Leadership in Education, www.leadered.com, (518) 399-2776

For more information, please see our source guide on page 89.