Chippewa Valley Schools CTE: Where autonomous vehicle engineers are born!

By Claire Brisson
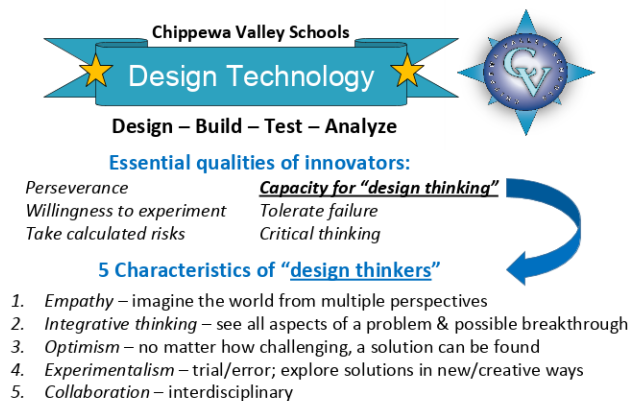*Director of Career and Technical Education*

In business, measures of success may include innovation, the satisfaction of your customers and, of course, profitability. In education, our customers are our students, and our profitability might be measured, in part, by their success after they leave us. If we did our jobs correctly, our students will graduate prepared for the next steps. If we achieve optimum profitability, we will find that they left us with not just a solid foundation, but also knowledge and skills that gave them some advantage, and continued to be useful years afterward.

It is, of course, only our alumni, and those who continue to educate and/or employ them, who can provide that invaluable perspective that time and hindsight provide.

Last December, staff from the Michigan Department of Talent and Economic Development (TED), spent a day at Dakota High School (DHS) visiting 4 of our 14 CTE programs: Construction Trades, Woodworking & Cabinetmaking, Mechatronics & Robotics, and Design Technology. It made sense to also include alumni and industry supporters. I would like to share highlights from two of our alumni.

The program of focus is Design Technology, a CTE program that can be taken all 4 years and is often referred to as "engineering".

For two decades, teaching it has been approached innovatively including a heavy emphasis on projects, fabrication, and exposure to advanced manufacturing technologies. It's notable that 3-D printing has been a part of this program all that time. As today's students advance, they are exposed to technologies like CNC machining, plasma cutting, laser engraving, welding, 3-D printing, and more, in a 3,000 square foot fab lab. Among the benefits, students gain the capacity for design thinking, perhaps best explained with this infographic:

Chippewa Valley Schools
Design Technology
Design – Build – Test – Analyze

Essential qualities of innovators:

Perseverance	**Capacity for "design thinking"**
Willingness to experiment	Tolerate failure
Take calculated risks	Critical thinking

5 Characteristics of "design thinkers"
1. *Empathy* – imagine the world from multiple perspectives
2. *Integrative thinking* – see all aspects of a problem & possible breakthrough
3. *Optimism* – no matter how challenging, a solution can be found
4. *Experimentalism* – trial/error; explore solutions in new/creative ways
5. *Collaboration* – interdisciplinary

What follows are selected highlights from interviews with Mandi Damman and Scott Herz from the class of 2003. Both completed multiple years of CTE Design Technology which culminates in a capstone course called Research & Development (R&D). In 15 short years, Mandi Damman has catapulted to becoming the Chief Engineer for Autonomous Vehicles at General Motors, and her former classmate, Scott Herz, is still her friend and colleague at GM and works as the Lead Test Engineer in the Battery Laboratory. They uniquely, and remarkably, travelled their career paths together.

First meeting at Seneca Middle School, they continued at Dakota HS, again at Kettering University—with co-op placements, eventually leading to full time GM employment—and along the way, completed graduate school at the University of Michigan together too.

Q: Did the CTE Design Technology program give you an advantage? Do you still use skills you learned here?

Mandi: Absolutely, it gave us a leg up! I really got my CAD skills here. We also created projects in the lab using tools like a scroll saw and drill press. I wasn't exposed to any of that until I came to this program, and because of that I'm the girl who knows her way around a machine shop; it was awesome.

At work, having such a good core, was really important. Even my handwriting is still drafting-like lettering.

There is so much that I go back to that I learned here that really set me up for success. We got so much out of our high school education, and I would have never, never chose engineering as a profession had it not been for this experience.

Scott: I agree. CTE is where you brought everything together and really developed your problem-solving skills. Just like in college when you would do a certain task, then have to show the pre-engineering work, ultimately give a pitch to your professor, and show the steps. In CTE, we learned to dive into a problem and figure out what's contributing to it and ultimately how to solve it.

Alumni (class of 2003) Scott Herz (Lead Test Engineer, GM Battery Lab) and Mandi Damman (Chief Engineer for Autonomous Vehicles, GM) with their high school CTE teacher, Scott Mitchell, who was selected as Dakota High School's Teacher of the Year.

If you're exposed to that early before you go to a university, the trades, or an apprenticeship, you can go all in.

I look at prints and 3-D drawings all the time and still feel like I'm in the classroom here. Being safe too, is something Mr. Mitchell, our teacher, really emphasized and still rings through my head. Safety is, of course, the most important consideration in the work I do at GM with high voltage batteries.

It's not obvious until you're in college, seeing somebody else learning something for the first time, and those who didn't have this high school experience are lost. And you're thinking, 'Didn't you have 4 years of engineering classes in high school?' And they say, 'No, we didn't do any of that.' So it didn't really hit home until college. "Absolutely," agrees Mandi.

Q: Did the hands-on, fabrication projects help you? Did you better understand math and science as a result?

Mandi: Yes. Prior to the CTE classes, I didn't know why I was taking the math. I was generally pretty good at it, but I didn't care a lot about it; it was the simple question of "Am I ever going to use this again?" When I started seeing how it would apply to engineering, it made me much more interested. Then I wanted to learn what the teacher was presenting in science and physics classes.

What we were doing, [in CTE] with the projects and design-engineering challenges, all made sense from a physics standpoint.

Even as I was going through physics in college, I knew why we were solving problems. In CTE, we had a bunch of different challenges. We would design on the computer, and then actually get to build and test the design.

I would put so much effort into these projects, and then it was really exciting to see how they would do in testing and competition. There's a ton of that that I've been able to apply, certainly to college, and in my professional life and career at GM. The exposure to engineering concepts of Design-Build-Test is so important.

It has all translated very nicely into an engineering career where now I apply those same concepts—the math and science, and the same [design thinking] methodology—to vehicles.

Scott: As you work through projects, it's all about team work. To design something, then pass it on to a classmate to build, brings up the questions that need to be answered.

There is an iterative, back-and-forth communication and problem-solving process that takes place until you actually get the part that you need. Once you've achieved that, you can test it, make sure that it functions appropriately. Of course, when it doesn't, you continue the critical thinking process until you successfully achieve your goal.

The dual design and fabrication aspects of the courses here really helped me to understand how to write a procedure for somebody else to follow to do the work that I want done.

For an engineer, that translation into the real world and real parts is important to understand at an early stage. And in the world of work, it's all about the team, being a part of the team, understanding what your role is in the team and ultimately succeeding in that role regardless of whether you picked it or not. Your team needs you. Very rarely does the lone soldier succeed.

Q: Did CTE Design Technology prepare you for university studies?

Mandi: There were 5 or 6 of us that went through the engineering program at Dakota HS who all went on to Kettering together. We were known as this 'group from Dakota' because we were so much further ahead in our CAD classes and we knew our way around the machine shop. We came in with the basics of engineering, and we knew so much more than students from other high schools.

Scott: I wanted to pursue my passion, which is the technical world and engineering. I decided that I wanted to go to Kettering because I wanted a smaller, engineering school where the student-to-teacher ratio was much lower.

I felt like that was what I had here—more face time and personal teaching time—which was important to me and very beneficial.

Q: How important it is to be a good collaborator and communicator in what you do?

Mandi: It's incredibly important. Being a good communicator and collaborator is really #1, maybe #1 and #2. A good engineer knows what makes a good design, what makes a bad design, how to manufacture things; it's kind of the price of entry. Then everything you can do above and beyond that, to make sure you're communicating with your team, collaborating with individuals that work for you and with you is a big thing; it's all about team work.

Scott: We work with people all around the globe. You and I might use words that we both understand, even slang, to get a point across, but when you translate that, you may not get your point across to the team in China, Italy, or Brazil. It forces you to create a communication style that might be a little bit slower, and choose words that are more precise.

Q: What advice might you have for younger students, especially young women?

Mandi: We know that around middle school girls start to shy away from math and science, despite the fact that they're very good at it.

Although young women may not necessarily see themselves in the CTE lab, if you're good at math and science—or even just interested, you don't have to be great at it—try it out and see if it's something you like.

There are so many different things you can do within engineering and related careers.

Give it a try and if you don't like it, you gained that experience which may help you somewhere else. But if you're great at it, then you just found something incredible you can do.

For both men and women, my advice is, give it your all in every situation. Get the most out of it, even if it's a class that's challenging that you don't necessarily love, or an assignment, or a co-op opportunity, make the most of it.

It's tough to tell sometimes how much you are learning and getting out of it at the time, but you'll always find ways to apply it later.

To the women, it was tough leaving here, going to Kettering, and starting as an 18-year-old girl in some of my co-op assignments, just to be myself. What I've learned now, be authentic, be you, it's the best way to go, and advice that serves both men and women well. Be yourself and work hard and you'll be successful. Take it all in.

Every one of these experiences is an opportunity to learn; even negative experiences. As you go through your education, being exposed to people, relationships, and teamwork, really immerse yourself and learn everything you can. You'll need it later and you'll be glad you have it.

Scott: Whatever you pursue, whether it's engineering, the trades, IT, or whatever it is, just give it your all.

Everyone has the potential to take information, harness it, and grow it into something. You just have to show up every day, be dedicated, and give it your all, and you'll do great. It all starts here.

Q: Final thoughts?

Scott: A powerful engineer is someone who knows the theory, can do the calculations, and then apply it and make it work. That is something—to be honest with you—that started here in this CTE program.

Mandi: To sum up my CTE experience in one word, it's opportunity. If it weren't for this, I have no idea what I would be doing. I can't say enough about how important this program is; it truly opened my eyes to engineering.

If it weren't for this program, I wouldn't be where I am.

So I'm super thankful for it, even for the friendships and the people...meeting my husband in engineering school as well as many great friends, and now, the great life that it has offered us. It all comes back to this CTE program, and the fact that I took a chance, tried it out and loved it!