FlexFactor Program
Informs, Inspires, Attracts, and Recruits Talent

Emily McGrath, Clarence Chi, Mikayla Ridi, and Brynt Parmeter.

Interview by Barry Matties and Nolan Johnson
I-CONNECT007

Barry Matties and Nolan Johnson speak with Brynt Parmeter, Emily McGrath, Clarence Chi, and Mikayla Ridi about the NextFlex program FlexFactor. This initiative aims to help high school and college students see potential futures in the advanced manufacturing sector and combat common misperceptions young people might have about modern-day manufacturing.

Nolan Johnson: Brynt, tell us about your role at NextFlex and what the company does.

Brynt Parmeter: I am the director of workforce development, education, and training for NextFlex. We are a 501(c)(6) public-private partnership with nearly 100 members across the U.S., and we've been in existence for three and a half years. Our goal is to advance the technology associated with the manufacturing of flexible hybrid electronics in conjunction with our members. We operate under a cooperative agreement with the Department of Defense, and we are working toward becoming a self-sustaining organization. In addition to the 501(c)(6), we run our workforce development and learning programs under a 501(c)(3) nonprofit and our design and manufacturing services under a C corporation to include fabrication operations within a 20,000-square-foot cleanroom facility at our headquarters in San Jose, California.

Johnson: We could do an entire interview just on NextFlex, but today, could you talk about the vision of the FlexFactor program?

Parmeter: Since our start, we have focused on enabling the creation of the talent needed by our industry partners over time. We are very much looking at the problem from the demand side to identify and quantify the knowledge and attributes needed to tackle what is commonly known as the "skills gap" across the advanced manufacturing and technology sector. We don't have enough young people aware of the sector or the pathways that will lead

them to become competitive hires. We have a gender imbalance and need to figure out how to reach more women to join this sector as well as non-traditional populations.

We've have put a lot of energy into tackling this problem and are seeing some impressive results. Our flagship program is called Flex-Factor, and it's intended to do three things. First, the program aims to provide first-hand experiences that allow the next generation to see what a career in advanced manufacturing looks like. They learn what it is like to work in the field.

Second, it helps engage and familiarize students with the education pathways that lead into the sector and provide the skills and competencies necessary to become the competitive hires that our members, and those they represent, need in their future workforce when Industry 4.0 becomes a reality. Finally, as a project-based learning activity, FlexFactor gives participants the motivation and sense of purpose to want to take that journey and pursue the relevant education pathways to become competitive hires because they've become informed, inspired, attracted, and recruited into the sector through this immersive experience.

Barry Matties: What is the primary age group in the FlexFactor program?

> ## We started with high school students in grades 9–12 and then we expanded the program to include middle school and elementary school students.

Parmeter: We started with high school students in grades 9–12 and then we expanded the program to include middle school and elementary school students. We're also launching a program segment for transitioning ser-

vice members, veterans, and their spouses and dependent children in the school systems around military installations. We'll start to see the first pilots of these cohorts happen across the country in late 2019 and early 2020.

Matties: How responsive are the schools to this program?

Parmeter: They are very responsive because what is unique about the program is its ability to meet the needs of a range of stakeholders. Companies engage with the program as a strategic talent acquisition activity. Institutions of higher education use it to attract students into the pathways needed by various industries so they can fill seats in classes aligned to the coursework and relevant material. Finally, high schools and middle schools have a vested interest because they need to engage their students with real-world experiences in both higher education and multiple industries. In the words of one high school principal, "Schools and teachers need help understanding the world they're preparing their kids for rather than remaining insulated in purely theoretical settings." That's a large part of what this program does.

Matties: That might be the toughest challenge right there.

Parmeter: It's very difficult. We went through a significant learning curve and a lot of trial and error in the early stages of the program. This is a good bridge for Emily to discuss the strategy, including what we've learned and how the program has evolved into what it is today.

Emily McGrath: The program is intended to unite all stakeholders across a geographically aligned ecosystem who need to be engaged for effective workforce development. But those aren't players who traditionally communicate with each other. We find that high schools are talking to higher education to some extent, but they aren't talking to the industry. And the industry doesn't often engage with higher education outside of specific programs.

What we had to do was figure out coordination steps that allowed these groups to interact smoothly on a regular basis. The program acts as a "Rosetta Stone" of sorts and speaks three different "languages." The key to the success of the program are the project managers, such as Clarence and Mikayla. They need to be able to speak all three languages and ensure that all three stakeholders can communicate with one another about the challenges they have in common. FlexFactor's coordination process is what allows the program to unfold smoothly and achieve the desired outcomes.

Matties: What is the greatest challenge?

Clarence Chi: Industry participation is one of the most critical aspects of the program. Our ability to directly engage students with advanced technologies and professional mentors is transformative, and you see their faces light up after they see how advanced technologies are changing the world around us.

Johnson: For example, a U-2 spy plane just took off and is flying right above us.

Parmeter: That plane is a perfect example because we work with a range of industry partners, including Boeing, Lockheed Martin, and others. FlexFactor is designed to get students interested not just in the technology of flexible electronics but also in the advanced manufacturing sector in general. Many students don't realize that amazing products—such as the U-2 that just flew over, medical devices that are helping to save our loved ones, or automotive technologies—are all products from the advanced manufacturing industry.

Chi: To expand on that idea, the program casts a wide net because it works with existing classes—it's not something students self-select into. The program's touchpoints were designed in a way that allows it to work with any subject—English language development, AP biology, environmental science, mathematics, history, robotics, etc. What all the students have in common is their reaction to seeing modern

Clarence Chi

manufacturing in action. Touring advanced facilities gets them really excited about what's ahead for them in the future and what they can actually do, and they picture themselves working in these environments.

Matties: In this environment, there are jobs for every level. You can come right out of high school and be in a job, or you can advance through higher education or specific corporate training.

Chi: Yes. Our industry partners offer a wide variety of career opportunities and pathways, ranging from technicians who come in right out of high school to technologists who need a two-year degree and engineers who need bachelor, master, or Ph.D. degrees. In addition to the technical pathways most people think about when they consider advanced manufacturing, there are also career opportunities in business development, marketing, supply chain management, and other fields that support advanced manufacturing but don't necessarily require a STEM-based education.

Matties: What excites the students?

Chi: The combination of being exposed to this high-performance, high-technology environ-

ment and working on projects they care about. During the program, students work in teams to identify a real-world problem that they want to solve and conceptualize an advanced hardware device to solve that problem. They then build a business model around their product concepts. Next, we immerse them in experiences with higher education and various industries to help them understand the range of technology and entrepreneurship considerations. Through these experiences, they think about problems they want to solve rather than simply the degree they want to pursue. By going through this program, they can picture themselves doing the jobs that will let them address the problems they are interested in solving in the future.

Johnson: Can you describe that process of how they go from problem to product and the business-model pitch?

Chi: The program uses a project-based learning approach and seven touchpoints that include basic instruction in hardware development and entrepreneurship as well as field trips to companies in numerous industry and post-secondary education campuses. At the end of their experience, student teams give a four-minute pitch on their product concept and business model to a small panel of mentors. Each team is responsible for identifying a problem and researching and designing their hardware solution and business model.

Through this process, they learn how to develop an argument, create a value proposition, and research empirical evidence to support their value proposition. Along the way, they also learn to engage both business and technology themes to come up with innovative, logic-based products and think through details like how much it will cost to manufacture and distribute to their target markets as well as a range of other considerations.

Johnson: Do you go as far as prototyping and actually building these? Obviously, you work through concept design, starting to plan out the components that go into it. How far down the design path do you go with students?

Chi: Most of the products are conceptual, although students do need to explain what their product sensors will measure or detect, what boundary conditions their processors will use, and other aspects of hardware devices, such as power sources and communication capabilities. Some technical classes will create prototypes of components of the device or use AutoCAD to create a mechanical drawing or rendering.

Parmeter: That largely depends on the class too. The beauty of the program is that we don't sign up individual students; we sign up classes. For example, if it's an engineering design class, their learning objectives may include taking more time to develop a prototype whereas the English class may want to focus on the concept and other learning objectives that this program helps reinforce for the teacher and subject. Regardless of whether the class is going to conceptualize the product or try to build a prototype, the program layers over the existing curriculum and is equally applicable to a wide range of subjects.

Matties: Clarence and Mikayla, both of you are project managers. What does your typical day look like?

Mikayla Ridi: A typical day usually involves implementing one or more of the seven program touchpoints with the classes going through the program. We might start at 8:00 a.m. and go into a class that's just beginning the program to do a kick-off presentation where we give the students an overview of FlexFactor, and tell them what they're going to be working on for the next four to five weeks as well as some basic instruction in technology and entrepreneurship.

On another day, with a class that's a little further along in the program, we might have Industry Engagement Day. That usually starts around 9 am, and we meet the students at the industry partner we'll be visiting that day—locally, that's usually either Jabil or DuPont. Students tour the facility where they see everything from advanced robotic assembly lines to

supply chain management processes. They also interact with the people working at the facility who act as mentors to the students and can describe their jobs and what they studied to get their job.

Afterward, the students participate in a product development workshop and have the chance to begin defining the components of their devices. We tell them to not treat this as a field trip but as a work trip so that they can gain a full experience of what a day at work could be like in the advanced manufacturing and technology sector. On another day, we would take them to a college partner to tour the campus, meet instructors and students, and learn about the education programs they can study to acquire the knowledge needed to work at a company like the one they toured the previous week.

Matties: You're tour guides of their future.

Parmeter: Exactly.

Matties: How does the school become engaged? Do they approach you or do you approach the schools?

McGrath: Locally, the program has grown very naturally in Santa Clara County (California) where we run it with our industry partners and our primary college partner, Evergreen Valley College. We usually engage with the school district through the career technical education (CTE) coordinator who identifies a principal in their school district who further identifies the teachers who are creative enough to run the program.

Johnson: Are you expanding nationally?

McGrath: Yes. We're in the middle of a national expansion of the program. We currently have several expansion sites underway, including one in Elyria, Ohio, with Lorrain County Community College and two in Huntsville, Alabama, in partnership with the Alabama Community College System and Boeing. We're further expanding across both New England, the

southern portion of the U.S., and several other regions throughout 2019 and early 2020.

Matties: Do you track the progress of a student who has been at this for a number of years?

Parmeter: One of the aspects of the program that we're working on is developing a series of national metrics so that we can track the students who have gone through the program to chart their subsequent education and career pathways. The program is still very young—we launched our initial pilot in 2016 with eight students—so the majority of FlexFactor students are still in high school (e.g., the sophomores are now in 11th grade, etc.).

In the interim period before we launch our formal national study on the program, we're measuring the impact through survey tools with the students before and after to gather an initial set of data points and feedback. One metric we have as a result of these surveys is that upward of 80% of our students indicate a higher degree of familiarity and affinity for this type of career field than they did before the program, which is a huge win for us going back to our goal of helping them see potential futures in the sector.

> ## Students are impacted by the opportunity to engage with the educational pathways that they are exposed to as part of the program.

Further, students are impacted by the opportunity to engage with the educational pathways that they are exposed to as part of the program. In Santa Clara, for example, all students who go through the program are enrolled with our partner Evergreen Valley College. We also track the impact on teachers, and one of the metrics that we're very proud of is that every

teacher who has done the program—and we've had upwards of 80 iterations of this across the country—has asked to do it again.

Matties: Do the teachers go on the facility tours with the students?

Parmeter: Yes, the teachers participate in every step. The program is truly a partnership between the project manager—who provides technology, entrepreneurship instruction, mentorship, and external coordination—while the teacher ensures students meet their learning objectives and project milestones and coordinates the activities.

Matties: You're also teaching the teachers some new skills to take into the classroom. What is the greatest challenge about teaching a teacher a new skill set?

Chi: The teachers have varying degrees of technological savviness. So, we have the opportunity to help participating teachers learn how the technology works and how they can incorporate FlexFactor to reinforce or build on their existing in-class learning objectives.

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Parmeter: One of the teachers who implemented the program was actually Clarence's teacher about 10 years ago—a computer science teacher at one of the schools we work with.

Chi: She was so shocked to see me! Her class is incredible. And working with my former instructor again is an amazing thing. She is a big fan of FlexFactor and wants to do it every year. She does an amazing job, and her students won the FlexFactor Finals—all three of her classes. The FlexFactor Finals is an event

we throw at the end of the year where the top teams from each class compete. It has been a great joy working with her.

Matties: I think that schools must see this as a breath of fresh air too in many ways.

Ridi: The exposure that students gain through our industry and college partners is very impactful. When I was in high school, I didn't know what the real world looked like. Being able to expose these students to the real world is great and something I wish I had when I was in high school.

Johnson: What response do you get from working with the universities watching this program? Are you getting much feedback from them?

McGrath: We highlight the range of educational pathways available to students, which means we emphasize the variety of institutions of higher education that can provide the skills needed by our industry partners, including both two-year and four-year options. Locally, we engage students with both Evergreen Valley College (EVC), which is a two-year program, and San Jose State University (SJSU), highlighting the fact that students can go to either school or they can transition from EVC to SJSU.

Parmeter: We've also had some fairly advanced conversations with the University of Massachusetts System as well. They see this as an interesting program because of its value as an economic and workforce development bridge to create the talent needed by industries in the region. FlexFactor can be used by university systems not just to recruit students directly to the school but also students from the two-year systems as well.

Matties: We see a lot of interest in computer technology jobs and not in manufacturing. However, there's a shift in manufacturing jobs. It's not loading a board into a machine; it's more of an activity that blends computer and

production technology. Is that something that is appealing? What sort of response do you get toward a manufacturing job of the future?

Parmeter: We have been very conscientious about approaching Generation Z as a generation that's uniquely suited to Industry 4.0. If you look at Industry 4.0 as defined by IoT blended with the internet of people (IoP), that looks a lot like the world that young people are growing up in right now; they fully expect to be communicating with machines through technologies designed to facilitate human-machine interface and interaction. Generation Z is uniquely suited to adapt to Industry 4.0 environments.

One of the most rewarding things we have overcome through the program is the common misperception about working in advanced manufacturing. After students tour an innovative manufacturing facility, they realize that working in the field requires them to operate in extremely advanced environments. That is the most important aspect of Industry Engagement Day where students get to see that future for themselves and make decisions based on firsthand experience instead of what their parents or guidance counselors have told them. As Clarence said before, it is a very high-performance, high-technology environment that excites the students—one that lets them solve problems they care about for our whole society.

McGrath: One of the things that the program highlights is that technology is used to solve problems for students who really want to do good for the world and have a positive impact on people. Students often think the best way to help people is through a medical profession or something similar, but once they get to a place like Jabil or DuPont, they realize that helping invent a new technology is a way to impact far more people than they could if they were just going patient to patient. It really opens their eyes.

Matties: There are definitely a lot of ways to contribute to society.

McGrath: Yes, we've partnered with the Morgan Family Foundation, which is a nonprofit that focuses on several things, including environmental education. To help achieve their objectives of increasing student engagement with local environmental issues, we are running several iterations of FlexFactor focused on problem areas related to forestry, water resource, and global climate change. Students in those classes are looking at the intersection of environmental challenges and technology and learning how advanced products and materials can make a positive impact. Clarence and Mikayla just kicked off the first iteration. Do you want to talk about that and what the students saw at DuPont and the Silicon Valley Water District?

Ridi: Yes, we brought the first Morgan Family Foundation class to DuPont's new Silicon Valley Technology Center where the students toured the facility to learn about the range of products and materials DuPont makes and see how they can be used to lower greenhouse gas emissions, etc. Additionally, DuPont's CTO, Alexa Dembek, gave the students a presentation on the biggest challenges the world is facing and how technology can be used to address them. Her remarks helped the students to think about their own product ideas.

Mikayla Ridi

Chi: After that, we took them to the Silicon Valley Water District where they toured the facility and learned about the complicated process of water purification. This was really helpful because most students probably think clean water just comes out of the faucet like magic. Seeing the entire range of activities involved in water purification not only helped them understand how complex this process is but gave them good ideas for their own product concepts.

Matties: How many people are currently at NextFlex?

Parmeter: Right now, 31.

Matties: How many students are involved in the programs at any given time?

Parmeter: We're approaching 3,500 students who have completed the program since we launched in the fall of 2016 with our pilot cohort. At any given time, there are approximately 200–300 students in various stages of the program between our local program and the national expansion. By this time next year, we'll triple or quadruple that number.

Johnson: That's quite a reach.

Parmeter: Yes, it's done in a very scalable way. Through our supporting materials and training process, adopting FlexFactor into a given ecosystem is turn-key. For any industry that's having trouble finding local talent, this program is a comprehensive solution that can help recruit students into the pathways where they will become the talent you are looking to hire in the future.

Matties: How are you funding all of this?

Parmeter: We started using a combination of sweat equity and investment from Next-Flex. After a few months, we realized that the program was creating a spectrum of value, including education, workforce development, economic development, talent acquisition, and social responsibility for a wide variety of stakeholders across the labor market. Once we identified the groups the program was creating value for, we used a cost-share approach where each of the partners helps resource a bit of the program, and the result is far larger than any one entity could create or support on their own.

Matties: Did a group of people want to form an organization or what was the impetus?

Parmeter: The program started with the workforce development team at NextFlex. We were interested in creating a program that achieved strategic talent acquisition objectives for our industry partners, but we were eventually able to do so in a way that generated enough revenue to support itself. A program is only able to do that if it solves problems for the actors in the ecosystem. We worked hard to align the program to the needs of multiple stakeholders, including K–12, higher education, government, nonprofit, and industry partners. The program is supported on a cost-share basis by all of the entities who benefit from it.

Matties: And is it zero cost for the individual students who go through the program as a part of their classes?

Parmeter: Correct.

Matties: That's fantastic.

Johnson: Where do you want to see this program in five years?

Parmeter: I would love to see FlexFactor in as many ecosystems across the country as needed. I don't want to say we want to have five million kids, though, because we don't want to create a workforce that exceeds the needs of various industries. But if we need 20 million employees in the workforce, I hope we're able to put 20 million students through. We want to meet the demand of the market in a way that effectively allows a lot of different groups to work together to fire up young people about their futures in advanced manufacturing.

Matties: Has there been any thought given to troubled youths, maybe in detention centers or something along those lines?

Parmeter: Yes, we've run the program with foster youth, and with a continuation school for students who have struggled in the conventional school system. These iterations highlight the social responsibility aspect of the program because you engage a population of students who would not normally find themselves exposed to this type of environment. We also work with a wide variety of public schools—many of which have student populations that are largely on low-cost and free lunch programs.

Interestingly, we often come across student teams from these schools with drastically different product ideas than those from more affluent school systems. One team had a member whose cousin was recently incarcerated for drug use, so they conceptualized a low-profile, flexible parole monitor that used advanced sensors and microfluidics to flag drug use. If drugs were detected, the bracelet would alert friends or family members so that they could intervene before the wearer got in trouble.

> ## Interestingly, we often come across student teams from these schools with drastically different product ideas than those from more affluent school systems.

A team of 16-year old students conceptualized this device, embracing advanced technology to solve real problems. Creating the drive in students to solve the world's big problems goes back to the program's ability to engage students with a range of career opportunities in advanced manufacturing. We aim to create that kind of drive, inspiring and empowering them to solve the big problems facing society and giving them the tools to do that.

Matties: Part of the change is knowing that there is employment out there too. This is a new climate for kids coming out of college; they're able to get a job that is meaningful for which they now owe a quarter of a million dollars or whatever the number might be for education costs.

Parmeter: Many of our industry partners have described this. One of the NextFlex Governing Council members stated that he will take a person who graduates from this program at the same time they graduate high school, and if they demonstrate the propensity and desire to want to work, he will bring them in. He will then work with the company to help fund their two-year college and four-year college if that fits both the student's and employee's future pathway.

Matties: It's a different climate, and foundational knowledge is everything, so great job. Is there anything that we haven't talked about that you want to include?

Parmeter: It's a rewarding program across the board. As I said, for any of the audience that wants to be a part of it, we're a phone call away and can be up and running in just a matter of months. We also have great partners, such as Evergreen Valley College, Lorain County Community College, Jabil, DuPont, Boeing, the Alabama Community College System, and many others. This program is for them and the myriad of others they represent so that they can help inform, inspire, attract, and recruit the future of advanced manufacturing one class of students at a time.

Matties: This has been wonderful. Thank you.

Parmeter: Yes, thank you for the opportunity to chat about it.

Ridi: Thank you.

McGrath: Thank you. FLEX007