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Dan Swinney

An Expansion of the Manufacturing Connect Model of Secondary Education—the Next Iteration

We are working with Chicago Public Schools in exploring the upgrade of the manufacturing and auto technology programs at other high schools. We are building on our experience at the Austin Career and College Preparatory High School as well as what we see as "best international practice" and, particularly, the experience of the Basque Region in Spain—the home of the well-known Mondragon Cooperative Corporation. This complements the early influence of our understanding of the German, Dutch, and Danish vocational education systems.

Recently, I've been engaged in correspondence on these issues with Armin Isasti, the former Director General of the Saiolan—the business and innovation center for the Mondragon Cooperative Corporation (MCC). Isasti is one of the early leaders in the MCC. He wrote:

> *In my experience, manufacturing skills are the key issue but they are not enough. As professor of the Polytechnic School of the University of Mondragon I also learned how important it was to **add** to those manufacturing skills **the capacity to conceive and design products**--skills in **Product Development**). Gaining knowledge in Product Development gave us autonomy. Later on we supplemented our experience with management skills. This allowed us to create new companies (technological and value-added companies).*
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> *Thinking aloud, in your case, it may also be interesting to think about the application of those skills (manufacturing skills and product development skills) to create new companies (with their own final products). In particular, you should think about generating new companies specialized in supplying components for the key industrial companies in your region (automotive, electronics, engine industry, machine tool resources, tools, robotics, environmental engineering, health, etc.)*

With his advice in mind, we have broadened the scope of the Manufacturing Connect model to include Product Development and Business Development in addition to Engineering and Production that we now have at the Austin Campus. The program will represent the full cycle of the manufacturing process including the following components:

- **Engineering:** We promote the use of Project Lead the Way as a 3-4-year introduction to engineering. We currently have this at the Austin Campus.

- **Product Development:** This is the first stage in the manufacturing process where an idea for a product is developed, a prototype is made, and the general requirements of production are developed. This will require having a Fab Lab and instructor.

- A Fab Lab could include about $100,000 of additional equipment and an instructor. The Fab Lab could include:
    - A rapid proto-typer--typically a 3D printer of plastic or plaster parts;
    - Printed circuit board milling or etching machine providing two-dimensional, high precision milling to create circuit traces in pre-clad copper boards;
    - A microprocessor and digital electronics design, assembly, and test stations; and
    - Cutters, for sheet materials including a laser cutter, plasma cutter, water jet cutter, and knife.

- **Production Centers--The Manufacturing Technology and Auto Technology Center:** We designed the Manufacturing Technology at the Austin Campus to meet the accreditation standards of the National Institute for Metalworking Skills. We look to meet the equivalent standard for any program focused on production.

- **Business Development:** This needs to be a distinct course with an instructor qualified to teach entrepreneurship and business development focused on the cooperative business model. We will assist students in starting a manufacturing company at the school with a hybrid cooperative structure. This experience prepares students for leadership in any kind of corporate structure including the cooperative business model or the more traditional business models. This program will be based on both national as well as international best practice. We visited the Cardinal Manufacturing Company, a project of the Eleva Strum School District in Eau Claire, WI that has such a program and class. We have contact with the global leaders in this field in the Basque Region in Spain and in Mondragon in particular.

We believe that this offering completes our objective of "educating the next generation of leaders in all aspects of manufacturing including production, management, and ownership" and distinguishes the Manufacturing Connect program from the traditional vocational education model.