

# Developing an Advanced Manufacturing Certificate Program for High School Students

Christopher Reis

School District of Kettle Moraine (WI)

Donald Patnode

Second Chance Partners for Education

## ABSTRACT

Recently the teaching of high school technology education in the United States has confronted three significant issues: prohibitive costs of modern equipment, acute shortages of qualified teachers, and continued perceptions that four-year college degrees are the only reliable way of accessing the high quality job market. Despite these challenges, the demand for skilled workers in technology-intensive manufacturing careers is growing due to demographic shifts in the American workforce. The Kettle Moraine School District and Second Chance Partners for Education have partnered to establish a program to circumvent these challenges. Junior and senior students will complete academic coursework for approximately three hours per day; this academic coursework will satisfy high school graduation requirements while at the same time emphasizing topics with relevance to manufacturing careers. Students will also learn technical skills through employment experience with local and national manufacturing businesses. The work experiences will be evaluated by technical college system faculty; transcribed credit will be awarded when students demonstrate proficiency in specific activities. Students completing the program will be prepared for multiple post-secondary pathways, ranging from direct employment through traditional four-year college enrollment.

Keywords: STEM, Conference Proceedings, Partnering, Hands-on Learning

## INTRODUCTION

Schools in the United States are finding it increasingly difficult to provide technology education to their students, particularly in areas aligned to manufacturing. In 2001, 672 teachers graduated from 71 U.S. universities with licenses in technology education; 2,337 positions awaited them – a net shortage of 1,665 teachers in one year alone (Ndahi & Ritz, 2003). One reason for this is a one-third reduction in the number of career and technical education programs for future teachers (Gray & Walter, 2001). A further challenge are the capital costs necessary to maintain instructional equipment up to current standards; in just one building of the Kettle Moraine School District the cost of necessary equipment upgrades exceeds \$250,000. Finally, schools have to battle the perception that a four-year college education is a prerequisite to a successful career. In a survey of parents, 68% indicated that a four-year college education is as important as a high school diploma used to be (Immerwahr, 2000). A cooperative report produced by Deloitte and the Manufacturing Institute (a research organ of the National Association of Manufacturers) notes that 67% of manufacturers report a moderate to severe shortage of technical workers and 56% anticipate a continued negative trend in the next three to five years (The Manufacturing Institute, 2011). Until the problem of how to provide technology education to K-12 students is solved, these shortages can be expected to continue. In this article, a new

approach for technology education in K-12 buildings will be presented; this approach is a result of partnerships between Kettle Moraine, Second Chance, Generac Power Systems, and GE Energy.

### **PROGRAM STRUCTURE**

In 2012, the Wisconsin legislature enacted Act 156, which allows school boards to offer students technical diplomas, which require the same coursework as regular diplomas but promote students obtaining industry certifications, such as the MSSC manufacturing technician certification, before graduating high school. In response to this legislation, the Kettle Moraine School District and Second Chance Partners for Education have created the Advanced Manufacturing Certificate program.

Students will enter this program after the completion of their sophomore year of high school, having completed sixteen high school credits. The bulk of the core traditional academic requirements (e.g. coursework in government, history, and physical education) will be completed prior to program entry. Students will be interviewed first to ensure that they are interested in technology education and manufacturing; manufacturers will also have the option to interview students for suitability and perform typical pre-employment screenings. Upon acceptance, students will complete the balance of their high school graduation requirements at an education center located at a nearby manufacturing plant. This coursework will focus primarily on language arts, mathematics, physical sciences, and topics relevant to manufacturing (e.g. blueprint reading, robotic welding, CNC machining, metal fabrication, and tool and die). Where possible, courses will be transcribed for college credit with the local technical college system, so that students are fulfilling high school graduation requirements while simultaneously completing coursework towards an associate degree in manufacturing. This academic coursework will consist of approximately three hours per day, roughly equivalent to four high school class periods. The balance of the students' workdays will be spent engaged in work experience developing proficiency in technical skills, such as those described above. Faculty from the local technical college will evaluate their proficiency and award college credit when students demonstrate proficiency equivalent to college-level coursework; for example, a student learning welding would receive credit for a welding course when he or she could demonstrate the same degree of proficiency at welding as students exiting a course at the technical college. Students will be mentored and supported by experienced technicians and operators and will earn wages for the production work they perform. The businesses will also provide scholarship support to participating students upon graduation.

### **PROGRAM OUTCOMES**

The advanced manufacturing certificate credential will prepare students for one of four principal post-secondary pathways. First, students could enter the workforce directly upon graduation, using their acquired skills as an entrance credential. Second, students could complete their two-year associate's degree program in manufacturing at the local technical college (evening courses are often available making it possible to enter the workforce while completing the associate degree). Third, students who have the necessary interest and aptitude could enroll in a 2+2 engineering program (offered in Mechanical Engineering and Electrical Engineering) with the local technical college. These students would transfer to regional public or private four-year

institutions to complete their engineering degrees after finishing their associate degree in engineering at the technical college. Again, students could continue working while in school through internship or co-op programs. Finally, students whose interests lie outside manufacturing and engineering could enter four-year institutions for other career pathways (all college preparatory requirements would be fulfilled through the academic portion of the program).

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## AUTHOR INFORMATION

Christopher Reis has been a mathematics and engineering teacher with the School District of Kettle Moraine since 2004. He has served as the district's Director of STEM Education since 2010. He received a bachelor's degree in electrical engineering from the University of Cincinnati, and a master's degree in secondary education from Xavier University. Prior to entering the teaching profession, he worked in industry as a systems analyst with Procter and Gamble. He can be emailed at [reisc@kmsd.edu](mailto:reisc@kmsd.edu).

Donald Patnode currently serves as a Program Administrator with Second Chance Partners for Education. His past educational experience includes six years as a high school mathematics teacher, and twenty years in a variety of administrative positions including high school associate principal, high school principal and K-12 at-risk principal. He has also worked with Northwestern Mutual as a financial representative. He received bachelor degrees from the University of Wisconsin-La Crosse (business administration) and the University of Wisconsin-Whitewater (mathematics education). He also holds a master's degree in educational leadership from Cardinal Stritch University. He can be emailed at [dpatnode@scpfe.org](mailto:dpatnode@scpfe.org).