



**Project Name:** *STAR Chemistry Program: Inspiring Educating and Preparing Young Science Talent for an American Ready Workforce*

The ultimate goal of the proposed project is to graduate uniquely trained/educated chemistry majors who are well prepared to fill the critical gap in the technical workforce in northeast Ohio. Recently, many reports have highlighted the existing employment gap is due to a lack of skilled talent. One report estimates that 10 million manufacturing jobs worldwide are left unfilled due to a lack of qualified scientists and engineers.<sup>i</sup> In the United States, it is estimated that over 3 million jobs that require science, technology, engineering and math (STEM) expertise remain unfilled due to poor alignment between the workforce and open jobs.<sup>ii</sup> In Ohio the skills gap has left over 2 million high-pay, high-skilled jobs unfilled.<sup>iii</sup> It is estimated that by 2018, 274,000 STEM-related jobs will need to be filled.<sup>iv</sup> The majority of these jobs is not Ph.D.-level positions for research scientists within academia or industry, but is at the technician-level for a variety of production and analysis purposes.<sup>v</sup> To compound the problem, it has been estimated that 10% of those possessing bachelor's degrees, 20% of master's degrees, and 25% of doctorates in science and engineering are held by international students. This trend might not continue in the future as the standard of living increases in developing countries. As a result, there is a critical need to increase the number of well-educated and trained U. S. graduates with degrees in the STEM disciplines.

The chemical, biotechnology, and related industries mirror the general situation with many positions left unfilled due to lack of appropriately skilled candidates. The Dow Chemical Company has been a leader in advocating for science education reform hosting a virtual conference<sup>vi</sup> and a leading participant in a recent national conference<sup>vii</sup>. A recent report in Chemical & Engineering News discussing the skills gap in the biotechnology industry states that companies are looking for candidates with practical industrial experience along with academic knowledge.<sup>viii</sup> Locally, Stephan Rodewald a recruiter and research scientist for Goodyear Tire & Rubber located in Akron, OH comments that "We have trouble filling all the interview time slots with candidates that we think are qualified for the positions that we have. And when we ... invite them out for closer scrutiny, often we find that they're really lacking key skill sets."<sup>ix</sup>

There is a general agreement the technical jobs require mathematical literacy and critical thinking skills that are beyond most applicants current capabilities.<sup>2,3</sup> This results in the applicant's inability to apply critical knowledge to solve real-world problems.<sup>2,3</sup> Companies are not only looking for candidates with technical skills, but also for people who possess excellent

communication skills and are team driven. For example, a chemist should not only be able to pipet, weight, calibrate instruments, manage data and understand basic chemical manipulations, but they should also be able to work collaboratively, communicate needs, deal with customers and vendors in a professional manner and be innovative.

To address the skills issue, Walsh University has developed a model curriculum that will better prepare students to either directly enter the workforce or pursue advanced education in a STEM discipline. Three themes are threaded throughout a comprehensive and strategically designed curriculum: environmental chemistry; materials and polymer chemistry; and nanochemistry and alternative energy. These areas were chosen because they align with critical industries identified by the Ohio Skills Bank: Environmental Technology; Polymer and Advanced Materials; and Advanced Energy.<sup>x</sup> The curriculum is based on having students develop critical thinking and problem solving skills while applying their foundational chemistry knowledge to practical problems within the chosen focus areas.

In the first two years students will be introduced to the focus areas through a professional seminar series and in examples used within their introductory and foundational courses. In their final two years, students will continue to gain experience by participating in an internship program and a modular project-based integrated laboratory course series, while completing their course work. Students will also be encouraged to participate in optional research opportunities throughout the academic year and during summer research experiences. Critical to the success of the program is the four year seminar series which is designed to formally introduce students to the departmental areas of focus, to explore chemistry related jobs, to develop soft skills, and to increase student retention.

The chemistry curriculum developed at Walsh can be used as a model because it addresses factors that have led to the skills gap. Two key components of the curriculum include 1) provides students with a mathematically rigorous curriculum that develops their critical-thinking and problem-solving skills and 2) provides students with practical industrial experiences and project management experiences, fostering an earlier understanding of workforce science and innovation tactics.

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