

Chapter 64

Transforming Chemistry Curricula and Courses to Support Adult Learners

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ABSTRACT

This chapter presents a compilation of best practices for preparing chemistry curricula and courses that consider the cognitive needs of adult learners. Chemistry instructors at the post-secondary level may receive little guidance on how to meet the needs of adult learners, members of a diverse undergraduate STEM student population. The author illustrates how adult learning theories and chemical education research can be applied to support reentry learners. Some aspects of distance education for adult learners in the sciences are examined, especially the unique challenge of offering laboratory coursework in this setting. The author makes recommendations for supporting faculty who engage in course revision with adult chemistry learners in mind. This chapter is relevant for university-level chemistry faculty, administrators and instructional designers.

INTRODUCTION

This chapter provides a review of best practices for designing and delivering chemistry courses that are impactful for adult learners. Reentry adults make up more than 38% of all college students (National Center for Education Statistics, 2016), but there is surprisingly little literature that puts the tenets of adult education into direct conversation with chemistry education research. The connection to chemistry is important because many academic programs require completion of foundational coursework in the sciences early in the curriculum. Because the highest rate of attrition for adult learners occurs during the first year of enrollment, fostering positive learning experiences in the chemical sciences presents a largely untapped opportunity to improve long-term persistence for adults in numerous pathways of study.

DOI: 10.4018/978-1-7998-8598-6.ch064

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A summary of academic programs that require chemistry coursework is given in Figure 1. For students majoring in pure and applied sciences, undergraduate chemistry coursework provides core career skills that they need to enter the workforce. In 2014, about 10% of all first university degrees awarded in the U.S. were in the sciences and 6% were in engineering fields, according to the National Science Board (NSB) (2018). For non-science majors, undergraduate science coursework is likewise included in curricula to provide career preparation, and to help learners strengthen their math and science backgrounds and become well-informed citizens (National Science Board, 2018). Students pursuing health professional careers make up a sizeable portion of all non-science majors enrolled in first-year chemistry coursework. More than 11% of all bachelor's degrees awarded in 2014-2015 went to health professions and related careers according to National Center on Education Statistics (NCES) (2018).

Figure 1. Programs requiring chemistry. Note that virtually all science majors, applied science majors, and health professional students require completion of introductory chemistry. Introductory chemistry courses include general chemistry, chemistry for the health sciences, GOB (general, organic and bio-chemistry) and consumer chemistry courses.

	Introductory Chemistry	Organic Chemistry	Advanced Topics
the chemical sciences	×	×	×
pre-health professions	×	×	some
the sciences	×	some	
applied sciences	×	some	
health professions	×	some	
liberal studies	some		

Not all reentry adults will complete science coursework, but nearly all chemistry faculty will work with adult learners in their classrooms and laboratories each year. The percent of adult college students who take a chemistry course is not tracked, but using the data presented above, it is possible to generate an estimate. One may consider the number of degrees awarded across the fields presented above (27%) in combination with the percent of all college students who are adult learners (38%). Assuming an even distribution of adult learners across all fields of study, a conservative estimate is that at least 10% of all adult college students will take one or more courses in chemistry. The true value is likely higher, as this estimate does not include chemistry learners who are completing a scientific reasoning requirement as part of a university's core curriculum, or who might be satisfying a personal interest in the field.

Though adult learners admittedly make up a minority of all chemistry students enrolled at traditional 4-year colleges and universities, devoting attention to their needs is important. Improved educational experiences for adults, especially in the first year, can contribute to higher overall enrollment and per-

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