



Teaching Toxicology to Summer Interns Through Integrated Online and Immersive Instruction

Lauren Aleksunes, Debra Laskin

Environmental and Occupational Health Sciences Institute and Ernest Mario School of Pharmacy,
Rutgers University, Piscataway, NJ

Abstract

Background and Purpose: Many college students lack awareness of toxicology and its fundamental principles. To increase understanding of toxicology among students participating in a 10-week summer research internship at Rutgers University, we capitalized on the recently developed ToxMSDT learning modules to couple asynchronous instruction with in-person activities.

Methods: Students completed three online ToxMSDT modules: Principles of Toxicology, Regulatory Toxicology, and one additional module of their choosing (Genetic Toxicology, Pathophysiology, Biochemistry and Molecular Genetics, or Applied Systems Toxicology) along with the Lead in Drinking Water Case Study. The timing of these modules was aligned with in-person activities at Rutgers. These included a simulated lead testing exercise, sampling of personal drinking water, field sampling for lead contamination in East Trenton, NJ, a field trip to a pharmaceutical company, and a hands-on risk assessment activity focused on personal care products. Students rated the usefulness of the online ToxMSDT modules on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree).

Results: Nineteen summer interns completed the trainings and post-survey. Students agreed that the ToxMSDT online modules expanded their knowledge of toxicology (mean: 4.1, SD: 0.6) and complemented the field trips and activities (mean: 4.2, SD: 0.5). In addition, the students felt they had sufficient baseline scientific knowledge to complete the modules (mean: 4.2, SD: 0.5).

Conclusions: An integrated approach that combines asynchronous didactic instruction, field trips, and hands-on activities can be used to convey the fundamental principles of toxicology to summer interns. Based on post-survey rankings, the program was highly successful as it expanded student knowledge of toxicology.



Target Learning Community:
19 Undergraduate
Students in a Summer
Research Program

Goals of this Assessment

- Establish a foundational knowledge base for undergraduate students with diverse prior exposure to toxicology.
- Leverage expert-curated resources to ensure high-quality, undergraduate-level toxicology education.
- Promote autonomous learning through flexible, asynchronous modules.
- Minimize traditional lectures during the summer internship and to prioritize hands-on, experiential, and interactive learning.

Acknowledgments

Supported by R25ES020721, P30ES005022, UL1TR003017, U54AR055073 and the SOT and ASPET SURF Intern Programs.

<https://surf.rutgers.edu>

SURF Website:



Integration of ToxMSDT into a Summer Research Fellowship Program

What are the ToxMSDT Learning Modules?



Toxicology Mentoring and Skills Development Training (ToxMSDT) is a longitudinal training program for undergraduate students interested in toxicology.



ToxMSDT was created by toxicologists at UC Davis, in collaboration with the Society of Toxicology, Iowa State University, The Ohio State University, Tuskegee University, and Michigan State University with support from NIH/NIGMS R25GM113989 and R25GM139200 awards.



Free online lessons were developed for undergraduate students and other learners by undergraduate educators in the Society of Toxicology.



Materials include modules, which provide overviews of areas within toxicology, and case studies, which allow learners to explore specific toxicology-related issues.



Those who demonstrate content mastery through a series of questions receive a certificate of completion.



Assessment

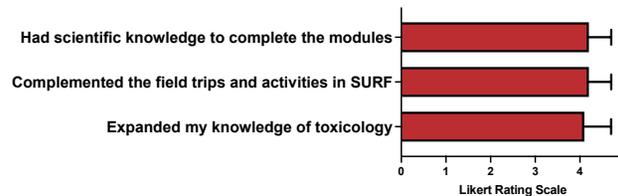


Figure 1. Post-Assessment of ToxMSDT Modules Integration into the SURF Program. Students were asked three questions during the end of program survey. N=19 participants. Data are mean \pm SD on a Likert Scale of 1-5 (1=strongly disagree to 5=strongly agree). * p<0.05.

Integration of ToxMSDT Learning

Weeks	ToxMSDT - Principles of Toxicology Module	Introduction to Research Projects
Weeks 1-2		
Weeks 3-4	ToxMSDT - Lead in Drinking Water Case Study	<ul style="list-style-type: none"> Science Take-Out Kit on Lead Poisoning Home Drinking Water Activity Environmental Lead Sampling
Weeks 5-6	ToxMSDT - Regulatory Toxicology Module	<ul style="list-style-type: none"> Field Trip to Bristol-Myers Squibb Pharmaceutical Company Workshop on Risk Assessment of Personal Care Products
Weeks 7-8	ToxMSDT - Pick Your Own Module	Communicating Science Training
Weeks 9-10	No Online Learning	Finish Projects and Survey of Activities

Tips for Implementation

- Encourage exploration of various modules and case studies available by ToxMSDT
- Ask questions from the modules at the beginning of the interactive sessions to reinforce key concepts
- Require submission of certificates prior to release of stipend checks

Take Home Message

An integrated approach that combines asynchronous didactic instruction, field trips, and hands-on activities can be used to convey the fundamental principles of toxicology to summer interns.