

Addressing health and safety issues in museums: collaborative teaching between occupational and environmental health sciences and museum studies programs

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Abstract

Students enrolled in Occupational and Environmental Health Sciences (OEHS) programs complete a specific curriculum designed to provide students with technical knowledge of industrial hygiene practices. Practical experience in occupational health and safety may depend upon a student's ability to secure internships, but students can benefit from the more thorough integration of practical experience into their academic training. This case study highlights how, through a variety of partnerships, a series of unique experiences related to occupational health and safety in museums were created for OEHS students to apply the health and safety knowledge learned in the classroom to a real-world setting. Students gained both technical and interpersonal skills through these activities and provided services and learning opportunities for museum studies students and museum personnel.

Keywords: multi-disciplinary curriculum; museum studies; occupational health

Introduction

Occupational and Environmental Health Science (OEHS) education primarily focuses on proficiency in core areas, such as industrial hygiene, toxicology, epidemiology, and safety. OEHS students often complete courses geared toward obtaining technical knowledge in specific topics, such as aerosol science, ergonomics, and engineering control strategies. Technical competency, however, is not sufficient to prepare students for careers in complex, changing work environments: cross-disciplinary, team-based practice-focused training opportunities should complement technical competency development.

In the museum field, there is a growing need for understanding and resolving the conundrum of contamination and hidden health hazards in museum collections. During the 1800s, museums addressed pest

infestation by treating items with toxic-metal based poisons (such as arsenic and mercuric salts). By the 1940s, organic compounds (such as DDT) were developed and employed as pesticides and herbicides (Hawks and Makos 2000; Hawks, 2001; Makos 2001). Museums historically treated collections items to prevent insects from destroying valuable museum collections, but we now know that many of these historic treatments pose serious health risks to the museum staff and volunteers who regularly handle and care for these items without proper personal protection (Boyer et al. 2005; Hawks and Makos 2000; Hawks et al. 2010). This setting is an ideal place for cross-disciplinary, team-based training. Not only do museums have myriad health and safety hazards but they also have experience with students and volunteers in their workplace. Herein, we describe our experience with a collaborative, team-based training approach

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for occupational health and safety professionals in the museum setting, which has developed over several years with a series of community partners.

Partnership with IMHM

Our first team-based collaboration was with the Indiana Medical History Museum (IMHM) in 2021. The museum was formed in 1969, is housed in a building originally built in 1896, and used as a mental hospital (Cohen and Cohen 2000). It is remarkably intact with most of the original furnishings, equipment, specimens, books and records, and of course chemicals. IMHM offers guided tours of the building and adjacent Dead House and operates numerous public and school programs and lectures. There is also a medicinal plant garden, a native tree arboretum, and a prairie patch on the grounds where the museum demonstrates and interprets plants that have historically been used for medicinal purposes.

Initially, a university-based OEHS student group initiated a project to address issues of mold exposures in the museum industry. Students developed a presentation discussing the hazards associated with mold and recommended control strategies and delivered it virtually to a class session of a museum studies course. Subsequently, in partnership with a medical history museum, and in-person experience was developed for OEHS graduate students to use a portable x-ray fluorescence instrument to scan a variety of items housed at the museum for contamination.

In the following semester, museum-based projects were incorporated into an existing OEHS course. The major project for the course was a review of the existing health and safety policies of the museum, with groups of students assigned to examine specific policies. A walk through of the museum was arranged for the students to understand the hazards firsthand and to ask the museum director clarifying questions. In addition, the course tasked students to create a short safety training session. After consulting with the collaborators, the topic of ladder safety training was chosen, as museum workers frequently climb ladders as part of their duties with little to no training in safe use of ladders. Students developed PowerPoint slides and quiz questions to cover each element of ladder safety. A live presentation of the training session was made to an audience of museum workers and students in the Museum Studies program, and participants demonstrated an increase in knowledge for three of the six topics in the training.

And finally, OEHS students were asked to apply their skills to measure potential formaldehyde exposures of staff and visitors at IMHM (Fig. 1). Concern was raised about whether seals of the containers storing the specimens in formaldehyde were degrading and possibly allowing formaldehyde vapors to accumulate in storage



Fig. 1. Students calibrating sampling pumps for formaldehyde testing.

cabinets and display cases. This testing also revealed the presence of heavy metals was noted on various surfaces and objects located in the Indiana Medical History Museum.

Expanding opportunities

Our multi-year collaboration with IMHM led to new teaching and learning opportunities in the Indianapolis area. In spring 2022, we partnered with the City of Indianapolis's Eagle Creek Ornithology Center, a nature center focused on studying birds designated as an Audubon Important Bird Area (Eagle Creek...2024). Here, Interdisciplinary student teams worked to identify any potentially contaminated taxidermy items on exhibit, and the OEHS students learned proper object handling following museum best practices. A sampling plan was developed in conjunction with management to ensure the highest priority items were tested. Museum staff identified specimens in which they either suspected may have been treated with arsenic or did not have information from the taxidermist about the methods used to preserve the

specimens. Students received academic credit for their activities through an independent study course designed to provide experience with planning and conducting a workplace exposure assessment. Where heavy metals were identified in taxidermy, those specimens were removed from display. This action prevented visitors from being exposed to heavy metals, such as arsenic, by touching or brushing against the specimens. The work these collaborative student teams conducted ensured that the Center is a safe environment for staff and visitors alike.

That same spring, we were invited to partner with the Collections team at the Children's Museum of Indianapolis (TCMI) to assist with testing items housed in the museum's vast collections storage spaces. The campus includes a museum building almost 500,000 square feet in area, with over 130,000 artifacts, and a 7½ acre outdoor park ([The Children's Museum of Indianapolis 2023](#)). Like museums worldwide, the collections staff does not have complete treatment records for many of the items in their care.

Student teams were able to test cultural objects and natural history specimens for heavy metal contamination utilizing XRF, consulting with curators regarding specific locations on each item to obtain XRF readings. Careful records were maintained to pair results with catalog numbers of specific items.

The student team was also able to conduct testing for metals and pesticides on cultural items recovered by the Federal Bureau of Investigation's Art Crime Team ([Fig. 2](#)).

Benefits to students

Both OEHS and Museum Studies students were learners and teachers. OEHS students learned from their peers in the Museum Studies program about proper handling procedures of artifacts in collections storage and on display as they conducted their exposure assessment. OEHS students taught museum studies students about workplace health and safety. Effective communication between members of the interdisciplinary student teams enabled the exposure assessment to be completed without damage to objects or historic building structures.

The OEHS students obtained real-life experience planning and conducting industrial hygiene assessments. Students were not provided with instructions for conducting the assessments, as occurs with the regular coursework in the curriculum. Instead, students consulted with management at each location to determine where and how sampling was to be conducted and communicate their plans and procedures to museum personnel and students in the Museum Studies program.

Students were acknowledged for their success. The interdisciplinary team presented results of the exposure assessment at the AIHce 2022 conference in Nashville, Tennessee. Their poster, "Dust, Mold, and Heavy



Fig. 2. Students conducting XRF testing on seized items.

Metals: Health Hazards in Museums,” won multiple awards, including the Bronze Best in Show, Best Student Research Poster from the Museum and Cultural Heritage Working Group, and Best Student Poster from the Exposure Assessment Strategies & Aerosol Technology Committees. Their work was featured in the November 2022 issue of *Synergist Magazine* in an article highlighting these serious human health and safety issues present in museums ([Roberts 2022](#)).

Reflecting on this unique learning experience, former student Kenneth Burnell, now a Senior Associate Industrial Hygiene with the Eli Lilly & Company wrote:

My experiences assessing potential hazards and collaborating with organizations such as the Indiana Medical History Museum, the FBI, Eagle Creek Park, the Children's Museum, and the Ziibiwing Center provided not only valuable experience in cross-functional teamwork, but also a deep appreciation for the passion museum curators have for preserving history and cultural artifacts. These experiences highlighted the importance of incorporating diverse viewpoints when addressing complex challenges—especially those involving sensitive, centuries old artifacts. As I've begun my career as an Industrial Hygienist, these lessons have already proven valuable, and I remain grateful

for the opportunities I had as a graduate student.
[Personal Communication, 1 August 2025]

Conclusions

Students gain valuable skills and knowledge from a collaborative, multi-disciplinary learning environment. Important skills for career success include relationship building, flexibility, adaptability of skills, effective communication, and willingness to help others (Kello 2015). This kind of learning undoubtedly is enhanced and more meaningful when working with community partners and those from other disciplinary backgrounds. Activities of the OEHS students described herein meet the environmental, health, and safety program management criteria for Baccalaureate level ABET accreditation of Environmental, Health, and Safety and similar named programs (ABET 2023). Many museum professionals have only basic knowledge of or experience in identifying and mitigating chemical hazards in their collections, making the plethora of general educational information about safe handling of chemicals in laboratory settings overwhelming. Our partnerships provided increased accessibility of health and safety information by tailoring it to the museum context. Occupational health and safety educational programs may greatly enhance the learning environment for their students through the establishment of similar collaborations.

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Conflict of interest

The authors declare no conflict of interest relating to the material presented in this Article. Its contents, including any opinions and/or conclusions expressed, are solely those of the authors.

Data availability

No data were used in this study.

References

- ABET. 2023. Criteria for accrediting applied and natural sciences programs effective for 2024-2025 accreditation cycle. c2025–2026. Baltimore (MD). <https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-applied-and-natural-science-programs-2025-2026/GC2>
- Boyer L et al. 2005. Understanding the hazards: toxicity and safety. In: Odegaard N, Sadongei A, editors. Old poisons, new problems: a museum resource for managing contaminated cultural materials. AltaMira Press. p. 73.
- Cohen P, Cohen B. 2000. Indiana medical history museum in Indianapolis. *J Coll Sci Teach*. 29:442.
- Hawks C. 2001. Historical survey of the sources of contamination of ethnographic materials in museum collections. *Collection Forum*. 16:2–11.
- Hawks C, Makos K. 2000. Inherent and acquired hazards in museum objects: implications for care and use of collections. *Cultural Resource Management*. 23:31–37.
- Hawks C, et al. 2010. Health and safety for museum professionals. SPNHC/AIC.
- Indy Parks & Recreation. Eagle Creek Park Ornithology Center—Indy Parks & Recreation. Indianapolis (IN); 2024. <https://parks.indy.gov/facilities/eagle-creek-ornithology-center/>
- Kello J. Seven critical attributes of success: leaders in diverse fields have these common skill sets. *Gale Business Insights: Industrial Safety & Hygiene News*; 2015. link.gale.com/apps/doc/A430892569/GBIB?u=purdue_main&sid=bookmark-GBIB&xid=13948b79
- Makos KA. 2001. Hazard identification and exposure assessment related to handling and use of contaminated collection materials and sacred objects. *Collection Forum*. 17:93–112.
- Roberts A. Preserving history, protecting safety: an interprofessional approach to controlling hazards in museums. *The Synergist*; 2022. <https://synergist.aiha.org/202211-preserving-history-protecting-safety>
- The Children's Museum of Indianapolis, Cision Prweb.com. Readers around the country voted on the best children's museum in the country and selected The Children's Museum of Indianapolis. Indianapolis (IN); 2023. <https://www.prweb.com/releases/readers-around-the-country-voted-on-the-best-children-s-museum-in-the-country-and-selected-the-children-s-museum-of-indianapolis-894725774.html>