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Operationalizing the Duty of Care Through Rubrics

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By Emily Faulconer

Laboratory experiments are a key aspect of science education. However, they do have risks, and accidents do happen. Science educators have a duty of care, which includes duty of instruction. One tool that can be leveraged for duty of instruction is course rubrics. Including clear safety criteria in the rubric operationalizes the duty of care and allows students to clearly understand safety expectations and competencies. Specifically, the use of organizing schemes such as RAMP (recognize hazards, assess risks, minimize risks, prepare for emergencies) in rubrics can provide clear communication to students.

The use of hands-on laboratory experiences is widely considered a best practice to deepen and extend the learning process in the sciences (American Chemical Society, n.d.a). Academic science laboratory environments have inherent physical and chemical safety risks. Accidents can and do happen (Gibson et al., 2014; Gosavi et al., 2019). Student safety must be a primary consideration. U.S. Occupational Safety and Health Administration (OSHA) regulations do not apply to students in educational laboratories, though faculty teaching laboratory courses are considered chemical workers. However, in the event of an accident, determination of liability requires consideration of factors such as negligence, foreseeability, and attractive nuisances. Negligence includes conduct that falls below an established standard of care or the failure to exercise duty of care. Foreseeability refers to the reasonable anticipation that a specific event might take place. Attractive nuisances are inherently hazardous scenarios that may be attractive, such as unattended containers. While OSHA does not directly apply to students, OSHA regulations can be used to establish a relevant standard of conduct in a tort case against a school or instructor (Standler, 2013).

Beyond the ethical imperative to do so, science faculty have a duty of care to ensure the safety of their students (though the exact nature of the legal responsibility will vary state to state). A duty of care exists where a person or legal entity engages in an action that could be reasonably expected to impact others. While you may argue that faculty fall under the “sophisticated user” legal doctrine due to their level of training, which allows them to recognize and understand the risks of their work, this cannot be argued so easily for students, particularly undergraduates. Students cannot be expected to act as a trained professional would in the same or a similar situation. Therefore, adequate safeguards must be put in place to provide basic training to students.

Duty of care can be broken down into three basic areas: duty of instruction, duty of supervision, and duty to properly maintain facilities and equipment. Duty of instruction directs faculty to communicate with students regarding identified specific hazards, proper procedures, and appropriate behavior. While there are a plethora of options for communicating hazards and emergency response procedures to students, this communication can be reinforced as an expectation of student understanding through course rubrics. Through rubrics, the duty of care and, specifically, duty of instruction can be operationalized by embedding the core safety communication. For example, Clemson University (n.d.) uses a lab technique rubric that assigns 20% of the grade to safety in the laboratory. A published science laboratory experiment rubric (Stevens & Levi, 2013) has been used by faculty at Colorado State University (n.d.). I teach chemistry laboratory asynchronously online using mail-order laboratory kits. In this course, students complete a post-lab that includes submission of lab notes and responses to specific prompts. One prompt is a safety self-reflection, which is worth 15% of their post-lab grade.

Rubrics help both the instructor and student identify the important tasks for an activity. These rubrics allow instructors to clarify what proficiency looks like and enable students to self-evaluate their work against a standard (though this self-evaluation may be misaligned or inconsistent with the instructor's evaluation; Reynders et al., 2019). The value of rubrics can be seen in published literature that reports on rubrics designed for specific science laboratory skills and activities (Harwood et al., 2020; Tobajas et al., 2019). However, the published rubrics tend to provide superficial evaluation of safety, with little elaboration on the evaluation criteria. To improve my own duty of instruction, I will revisit my laboratory rubrics to ensure clear communication of safety skills and expectations. A source of inspiration is the example rubric published by the American Chemical Society's Committee on Chemical Safety (n.d.b), which is designed to allow faculty to evaluate demonstration videos for use in the classroom. This rubric uses the RAMP organizing concept for understanding hazards and risks, which stands for recognize hazards, assess risks, minimize risks, and prepare for emergencies (American Chemical Society, n.d.c). This rubric could easily be adapted so it could be applied to student projects in a laboratory course. The core idea of using RAMP in the rubric can also be incorporated into rubrics for laboratory techniques and experimentation.

An article by Finster (2021) provides a detailed explanation of RAMP and addresses aspects of using RAMP in academic laboratories. Addressing the issue of recognizing hazards, Finster (2021) advocates for providing training to students on the Globally Harmonized System (GHS), promotes the utility of PubChem as a teaching tool, and suggests providing clear definitions for safety-related words such as "lachrymator" and "pyrophoric." Addressing the task of assessing risk, Finster (2021) outlines the complexities of risk assessment based on severity and probability of harm. The article continues by presenting an overview of the hierarchy of controls used to minimize risk, including elimination and substitution, engineering controls, administrative controls, and personal protective equipment. Finally, Finster (2021) covers preparations for emergencies in an academic teaching laboratory by developing a written emergency response plan.

The resources at each institution will vary, with some institutions having certified chemical hygiene officers and well-staffed environmental health and safety offices, while other institutions may have a single faculty member with variable levels of training on chemical and laboratory safety. In addition to adopting Finster's (2021) suggestions of embedding RAMP into the safety precautions portion of experiment instructions and presenting safety in a pre-lab session, instructors can further embed RAMP as an organizing principle in academic teaching laboratories by infusing RAMP into their course rubrics.

Finster (2021, p. 21) skillfully articulated a key takeaway: "Teaching RAMP is not a process that can be adequately addressed in a single 15-minute prelab discussion in general chemistry. It needs to be addressed continuously and in a spiral fashion, with plenty of opportunity for practice." As science faculty teaching laboratory courses, we have a clear duty of care. We can enhance our duty of instruction through the clear inclusion of safety in our laboratory rubrics by articulating the safety-related evaluation criteria and describing the level of competency expected for all of them. Embedding RAMP in our rubrics is one method for providing that scaffolding and spiral focus on safety, as well as an opportunity for practice.

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