

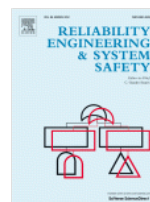
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## Reliability Engineering &amp; System Safety

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Review

## From learning from accidents to teaching about accident causation and prevention: Multidisciplinary education and safety literacy for all engineering students

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### Abstract

In this work, we argue that system accident literacy and safety competence should be an essential part of the intellectual toolkit of all engineering students. We discuss why such competence should be taught and nurtured in engineering students, and provide one example for how this can be done.

We first define the class of adverse events of interest as system accidents, distinct from occupational accidents, through their (1) temporal depth of causality and (2) diversity of agency or groups and individuals who influence or contribute to the accident occurrence/prevention. We then address the question of why the interest in this class of events and their prevention, and we expand on the importance of system safety literacy and the contributions that engineering students can make in the long-term towards accident prevention. Finally, we offer one model for an introductory course on accident causation and system safety, discuss the course logistics, material and delivery, and our experience teaching this subject. The course starts with the anatomy of accidents and is grounded in various case studies; these help illustrate the multidisciplinary nature of the subject, and provide the students with the important concepts to describe the phenomenology of accidents (e.g., initiating events, accident precursor or lead indicator, and accident pathogen). More importantly, the case studies invite a deep reflection on the underlying failure mechanisms, their generalizability, and the various safety levers for accident prevention. The course then proceeds to an exposition of defense-in-depth, safety barriers and principles, essential elements for an education in accident prevention, and it concludes with a presentation of basic concepts and tools for uncertainty and risk analysis.

Educators will recognize the difficulties in designing a new course on such a broad subject. It is hoped that this work will invite comments and contributions from the readers, and that the journal will support the publication of exchanges on this subject.

### Highlights

- ▶ System accidents are a distinct class of adverse events.
- ▶ They have temporal depth of causality, and diversity of agency contributing to their occurrence.
- ▶ We articulate the value streams for teaching engineering students about system accidents.
- ▶ Safety literacy should be an essential part of the intellectual toolkit of all engineering students.
- ▶ We offer one model for an introductory course on accident causation and system safety.

### Keywords

Engineering education; Accident causation; Prevention; Safety literacy; Safety value chain

Figures and tables from this article:

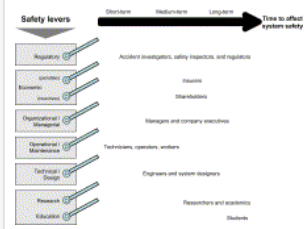


Fig. 1. Safety levers and stakeholders in the safety value chain (not meant to be exhaustive).

Figure options



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