Adapting the Line Operation Safety Audit to the Agricultural Mechanics Laboratory

Isaac Sponheim
imsponheim@gmail.com

Dr. Dustin Perry
dustin.perry@montana.edu

Montana State University
P.O. Box 172830
Bozeman, MT 59717-2830

(406) 994-2132

Introduction/Framework

It is long-standing knowledge that the agricultural mechanics laboratory environment can possess numerous safety hazards (Chumbley et al., 2018; Perry et al., 2012; Saucier et al., 2014). In early reports, Swan (1993) indicated a mean of 13.3 minor accidents (not requiring medical attention) and 1.3 major accidents per classroom, thus prompting questions of safety assessment. Bear and Hoerner (1986) assert that to accurately assess safety in an agricultural mechanics laboratory, one must identify the safety practices taught, examine the safety-based instructional methods, and investigate the available safety equipment. Noticeably absent from this assessment list, however, is human involvement, especially since a high percentage of accidents are preceded by human error (Hickey et al., 2015; Klinect, 2008).

The Line Operation Safety Audit (LOSA) is an assessment tool that takes human action into account. Originally developed for Delta Airlines, this safety audit uses Threat and Error Management (TEM) as a framework to discern what events surrounding multiple aspects of a flight crew contribute to the safety of the flight (Klinect et al., 2003; Maurino, 2005). Within this framework, threats are defined as events that occur beyond human influence, and errors are actions or inactions that can result in an unexpected outcome. Threats and errors are often linked together, forming what is known and an error chain. The LOSA can help break this chain by proactively finding potential and/or existing threats and errors before they result in an undesired state (Klinect, 2008). Recognizing the LOSA's and TEM's abilities to inform safety decisions and find weak points in regular operations in multiple fields (Hickey et al., 2015; Klinect et al. 2003; Maurino, 2005), it stands to reason that there may be use for this tool in the agricultural mechanics laboratory. According to Kolb's (1984) Experiential Learning Theory, learning is the creation of knowledge, and reflection is a necessity in that creation (Kolb et al., 2003; Kolb, 2012). The examination of student/teacher interaction, such as in the safety assessments discussed by Bear and Hoerner (1986), can be representative of the reflection portion of Kolb's model. By utilizing TEM through the LOSA, teachers can not only reflect upon and learn what threats and errors are impacting their laboratory spaces, but they can also be better prepared to teach students how to recognize threats and properly react.

How it works

The purpose of this innovative pilot study was to assess the useability of an adapted LOSA instrument in an agricultural mechanics laboratory setting. The original LOSA worked by having an impartial observer on the flight deck to record threats and errors (Klinect et al., 2003). Similarly, our adapted LOSA instrument used three observers to assess threats and errors in a college-level, small engines class during the Spring of 2023. The observers were to first fill out a checklist intended to be used as an indicator of what procedures or types of work were being done. This portion also included a notes section and a threat/error code index. The first two columns of the instrument were for recording the threat or error and to assign the appropriate code from a provided index. For example, if the observers witnessed an oil spill, this would be considered a spill threat and assigned the corresponding code. The next two columns focused on whether the threats and/or errors were recognized and addressed, either by students or teachers.

The resolution column had three possible responses and allowed the observers to record the outcome of each threat and/or error. These indicated whether the instance was inconsequential, left in an undesired state, or resulted in injury. An inconsequential resolution indicated that nothing of note happened on account of the threat or error. Undesired states referred to situations in which there was a negative outcome, but not on the same scale as an injury. Injury was indicated if someone in the laboratory space was injured in any capacity on account of the threat or error in question. The final two pieces were optional time associations and allowed for time stamps on threat/error recognition and action.

Results to Date/Implications

There have been four versions of the adapted LOSA developed. Version one was adapted as visually identical to the original LOSA form obtained for the pilot with only slight changes to the wording of the form. The first observation found this to be entirely unsuitable for the agricultural mechanics laboratory, being far too focused on individual behavior rather than recognition and approach to managing/maintaining a safe environment. Version two introduced all the features of the final form except for the time stamps. This iteration also introduced the cover page with the omission of a notes section. Observer discussions after version two resulted in the addition of a beginning time stamp and the change of result three in the resolution section from “additional error” to “injury.” A notes section was also added to the cover page. Observers felt this version accurately captured what was happening in the laboratory and only suggested the addition of an ending time stamp column for version four, an oversight from version three.

The most significant discussions surrounding the form involved the time stamps and resolution column. Concerning the time stamps, observers shared that even though a given threat or error may have been both recognized and addressed, it may take most of the class time for that to happen. Including the option of time stamps provided greater context for readers on the back end as well as another data point for reflection and instruction. Regarding the resolution column, it was found that this field was the most subjective since it can sometimes be difficult to find the exact line between what is inconsequential and an undesired state. This is less of an issue if each observer is consistent.

Future Plans

Data collected from a study planned for Fall of 2023 will provide a look at not only what threats and errors are most common throughout a university level construction course, but also how well students, teaching assistants, and instructors react. Results would ideally be used to inform the safety curricula for the course going forward. Not only could the LOSA create a safer laboratory environment, but in alignment with Kolb (1984), the audit provides a glimpse into the reality of student safety and offers an initial opportunity for reflection. Reflection on what safety items need to be addressed would be a valuable instructional tool for students and teachers alike (Kolb, 1984). Upon completion of the study, pending approval by publishers of the original LOSA, the form would become available for open use by any agricultural mechanics instructor.

Some future areas of research related to the adapted LOSA could include refining intervention protocol, inter-state cooperative studies to gather a data pool large enough to generalize results, and qualitative studies concerning student and teacher behavior during observation.

Costs/Resources Needed

To date, there have been no financial expenditures since the accessed LOSA form was available at no cost, however, future studies might want to consider student or instructor incentives to ensure maximum accuracy. There was a large indirect cost in terms of man-hours. Time spent obtaining IRB exemption, collecting data, analyzing data, and redesigning the instrument were significant.

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