


Problem Based Learning in Laser Safety Training

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- * Laser safety training for users of Class 3B and Class 4 laser users has been required since 1973, when the first laser American National Standards Institute (ANSI) standard, Z136.1, *Safe Use of Lasers*, was published. Professional laser safety training firms provide well-crafted laser safety courses, but the training method has not significantly changed in more than 40 years, except for modifications such as embedded videos and PowerPoint effects. With limited exceptions, all have a passive lecture format. Problem-based learning (PBL) was originally developed for use in medical education and was quickly adopted by schools of business. It has only recently become more prevalent in technology and engineering education because it teaches students the process of solving open-ended problems at the same time as they are learning new material. PBL can be applied to LSO training and have significant rewards.

Laser Safety Training

- * **Laser safety training for users of Class 3B and Class 4 laser has been required since 1973**
- * **Dating back to the first laser American National Standards Institute (ANSI) standard, Z136.1, *Safe Use of Lasers***

Commercial training

- * **Professional laser safety training firms provide well-crafted laser safety courses**
- * **Unfortunately the training method has not significantly changed in more than 40 years**
- * **The options offered are:**
- * **Classroom based lecture**
 - * **Little change except for modifications such as embedded videos and PowerPoint effects**
- * **Online presentations**
 - * **Tailored to a general audience**

Problem Based Learning

PBL

- * **Was originally developed for use in medical education and was quickly adopted by schools of business.**
- * **It has become more prevalent in technology and engineering education**
 - * **Think of famous MIT engineering programs**
- * **Why? because it teaches students the process of solving open-ended problems at the same time as they are learning new material**

My position is

- * **PBL can be applied to LSO & User training and have significant rewards to Users and Laser Safety Officers**
- * **PBL in some circles is called: Knowledge Retention Program**

Training

* I have taught laser safety to:

- * **My own users**
- * **For Professional Society, short courses**
 - * SPIE
 - * HPS
 - * OSA
- * **For major laser safety firms**
 - * Laser Institute of America
 - * Rockwell Laser Industries
- * **For major firms & Universities**
 - * Motorola University
 - * KLA-Tencor
 - * Newport Corp
 - * Hong Kong University of Science & Technology
 - * Univ of California
 - * University of Sydney
 - * Just to name a few

Closer Look at LSO training

- * The standard 3-4.5 day LSO course, provides a great deal of information**
- * Once completed the LSO goes back to their home setting and tries not to drown in a sea of work and demands for their time**
- * How prepared are they post the training course?**
- * They are full of ideas, but have they had time to practice them in a stress free environment?**

In House User Training

- * **Length can range from 30 minutes to 3 hours and in some cases 3 days**
- * **Some institutions have additional training requirements for users**
- * **Might be a Laser Lessons Learned Class**
 - * **Very effective**
- * **Hands on alignment class**
 - * **Of mixed value in my opinion**

The Laser Safety Officer-LSO

- * **Designate an individual as LSO with the authority and responsibility to effect the knowledgeable evaluation and control of laser hazards and the implementation of appropriate control measures**
- * **One key item is knowledgeable**

Knowledge

- * **How strong is my knowledge foundation if it is all based on passive lecture?**
- * **By problem solving real life laser safety scenarios that foundation is stronger**
- * **Good and bad decisions can be evaluated in a no penalty setting**
- * **Supporting the old adage, we learn from our mistakes**
- * **The memory and use of training class knowledge stays with one longer**

How do they become knowledgeable?

- * **Education before Laser Safety Training**
- * **Laser Safety Training**
- * **Experience meaning On the Job Experience**

Working PBL into your training

- * Few of us can go the MIT approach, give the class an assignment and stand back
 - * i.e. build a robot that can transverse a course at night
- * Rather include PBL exercises in support of class lessons and concepts

Is anyone doing this today?

- * **The second day of the UK Laser Safety Forum refresher training contains problem based learning exercises**
- * **R&D Course I teach**
- * **There may be others out there, but I am unaware of them**

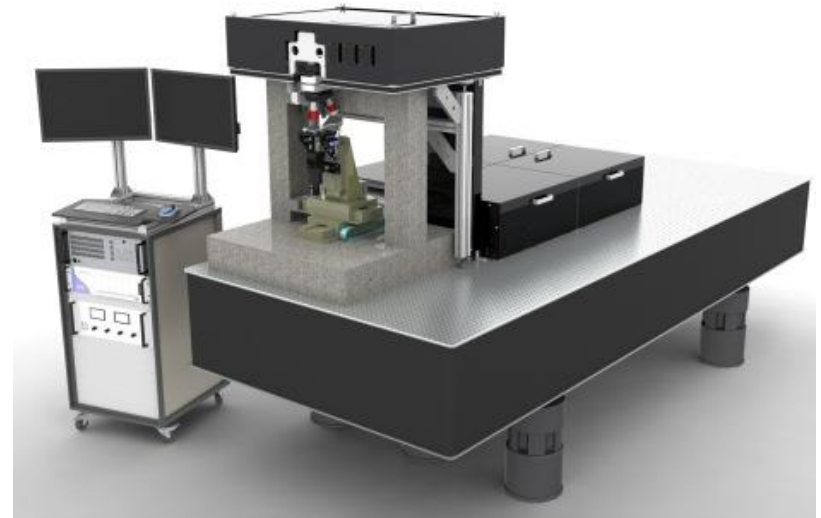
PBL Exercises

- * **In classes that does laser calculations**
- * **Give students specifications on the laser system**
- * **Ask to calculate Optical Density**
 - * **Non calculation class would start with given OD & wavelength**
- * **Then pick the best eyewear from a list of filters**
- * **Then ask if choice would change if lighting was reduced, what to wear for alignment**
- * **One goal achieved is LSO sees what filters are out their that fits their need for OD, VLT, Style & Cost**

Other exercises

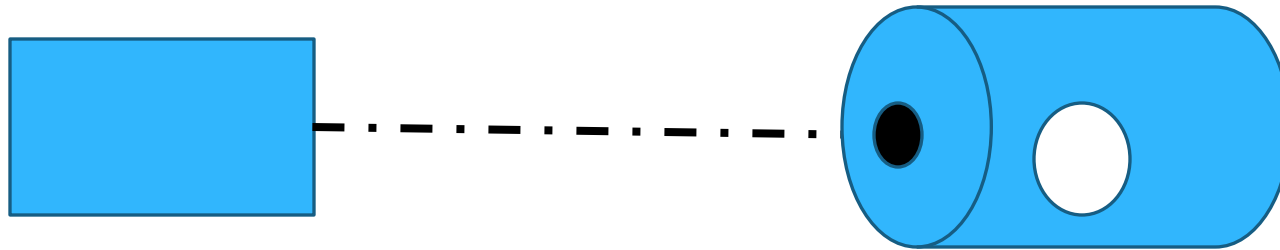


How to make safer, on factory floor, operation & service



Control Measure Example

Laser is on moveable cart. The beam path is open between laser and chamber. The laser cart is on a track. Experimental need requires the beam path distance to change with different samples in chamber. Wavelength 10,600nm.



Beam path between the two stations needs to be changeable with experimental needs, from 0.3meters to 1.5 meters. Height of beam path is 4 feet from the ground. Once beam enters the chamber a plasma is generated. **Set up is in Hi-bay style room, with multi user set ups around this experiment. How would you make this safer, deal with posting and alignment? Would your controls change if the wavelength was 632nm or 1064 nm?**

Exercise Prize

- * **Medical exercise or laser light show exercise**
- * **\$10 first person to describe one during my allotted question period**
- * **Only three slides left**

Class 1 Exercise

- * Describe (diagram) a biotechnology lab set up, all class 1 systems
- * Ask how they would provide safety when service requires the system to be open exposing class 4 laser beams
- * Give different scenarios
 - * Service man has room to himself
 - * People need to access room during service
 - * Windows from hallways looking into lab space

Conclusion

- * I am not trying to say today's laser safety training is bad or not effective
- * Just that in today's environment we can and need to do better

Thank you for your time

- * You can send me any comments or suggested exercises to:
- * Ken Barat
- * lasersafetysolutions@gmail.com
- * Any questions or comments?
- * Anyone ready to earn this \$10?