



Investigation of the Impact of Learning Community Immersion on Chemical Hazard Communication Awareness, and Knowledge



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This study was funded by a Grant through the Society for Chemical Hazard Communication

Abstract

Phase one of this study was designed to compare the effectiveness of chemical hazard training as a consequence of exposure to standard "content only lectures", versus additional immersion in a chemical hazards communication learning community setting. This comparison was conducted with college students enrolled in first-year chemistry labs. Both groups were exposed to a series of identically structured lectures that focused on the safe handling and disposal of hazardous material commonly found in garages, bathrooms, laundry rooms, and garden sheds. A segment was included on identification and interpretation of Hazardous Material Placards and SDS literature. One group was then assigned to attend a weekly fifteen to twenty-minute learning community meeting as well. This study yielded interesting results in correlation to retention levels among participants. It was shown that participants in the general population showed an average of a 12 percent increase in chemical hazard knowledge, meanwhile the learning community showed an average of a 16 percent increase. However, time and logistical restraints presented scheduling difficulties. We then wanted to explore the effectiveness of using a short-term forum enhanced with interactive online videos. Non-science major students were exposed to standard video content lectures (of the same information the previous study contained) followed with a one-time immersion in a chemical hazards communication learning community setting. All student participants had no chemistry backgrounds. The results of this study claim that although the online portion did show an increase in chemical hazard knowledge (6.85 percent increase), the one time-learning community experience still allowed for the greater increase of chemical hazards communication knowledge (23.35 percent increase). One conclusion of this two phase study may lead universities and companies who are dealing with chemical hazard communication to more effectively train their students and workers by using the high impact practice learning communities as a tool for high retention training.

Content

The educational training included information located on the MSDS and the warning label found on various household chemicals, including:

- Identification and meaning of Hazardous material placards and Safety Data Sheets (Formally known as Medical Safety Data Sheets).
- Hazardous Material found in Households: how to properly handle, store, and dispose of:
 - i. Bleach
 - ii. Insect repellents
 - iii. Paint
 - iv. Antifreeze
- Chemical Placards
- Hazardous materials classifications
- Department of transportation placards
- Biohazard Symbol
- Globally Harmonized System Placards (GHS):
 - a. Flammable
 - b. Gas under pressure
 - c. Environmental hazard
 - d. Corrosive
 - e. Acute Toxicity
 - f. Oxidizers
 - g. Explosive
 - h. Carcinogen
 - i. Irritant

The information was presented in a 10-minute video recording accessible to the participants by a web link.

- (Part 1) <https://www.youtube.com/watch?v=N2k6bpuGz80&t=95s>
- (Part 2) <https://www.youtube.com/watch?v=TuBQXdbH7w&feature=youtu.be>

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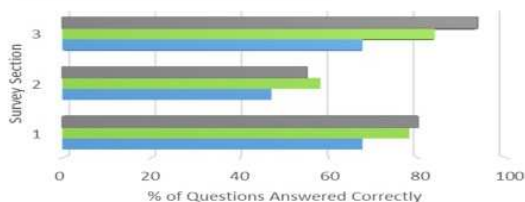
Phase I - Learning Community

- 66 general chemistry laboratory students (58% Freshman, 30% Sophomores, and 12% Juniors).
- The participants were 62% female and 38% male.
- 33 students were selected to partake in the non-learning community group
- 33 students were selected to partake in the learning community group.

- A pre-study survey was administered to all of the participants.
- Chemical communication lecture each week (Five weeks)
- Learning community, attends extra Learning Community meeting each
- The post-study survey (a scrambled version of the pre-study survey) was administered to all participants in both the learning and non-learning communities.
- The surveys were then analyzed to determine how participation in a learning community, in person or online, affected the students' performance on the surveys.

	Pre-Safety Lecture Survey Results All Participants (n=66)	Post Safety Lecture Survey Results Non-LLC (n= 31)	Post Safety Lecture Survey Results LLC (n= 34)
Section #1	67.6 (+/- 2.1)	78.1(+/- 2.4)	80.1(+/- 2.0)
Section #2	47.0 (+/- 2.1)	58.1 (+/- 2.1)	55.1 (+/- 4.1)
Section #3	67.6 (+/- 2.1)	83.9 (+/- 4.0)	93.5 (+/- 1.6)

- **Section #1:** Introductory multiple choice survey questions involving: proper storage, harmful effects from exposure, antidotes for ingestion and exposure, precautions for use, and remedy in case of spill.
- **Section #2:** Survey questions (matching descriptions) involving: proper storage, harmful effects from exposure, antidotes for ingestion and exposure, precautions for use, and remedy in case of spill.
- **Section #3:** Hazardous Material Placard Identification



- The learning community answered the chemical hazard multiple choice questions 80% correctly. (26.0% higher than the original pre-study survey results and 2.5% higher than the NLC).
- The learning community answered the chemical hazard placard identification matching questions 93.4% correctly. This is 19.2% higher than the original pre-study survey results and 10.0% higher than NLC.

	Study Participants Self-Evaluation 1-10 (1 lowest- 10 Highest)		
	Self-Evaluation Pre-Lecture All Participants (n=66)	Self-Evaluation Post Lecture Non-LLC (n= 31)	Self-Evaluation Post Lecture LLC (n= 34)
Initial Evaluation	6.2 (+/- 0.11)	7.0 (+/- 0.13)	7.1 (+/- 0.11)
Re-Evaluation	4.3 (+/- 0.6)	6.1 (+/- 0.10)	6.4 (+/- 0.05)

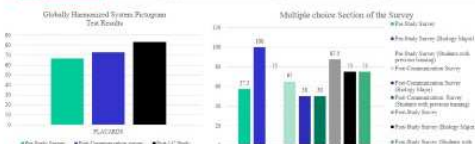


Phase II- Online Dissemination

- 10 college students participated in an online video lecture covering the same material presented in Phase I
- The age range was 18 to 21, with the median being 18 and the mean being 18.6 years old.
- 90% female to 10% Male
- Field of Studies represented: Music, Criminology/ Biology, Education (3 Subjects), Psychology (2 Subjects), Nursing, Government and Foreign Affairs, Art History
- All ten students participated in an online video communication lecture and then attended a one time Learning Community information session

- A Pre-Lecture survey was administered to all participants.
- All students watched an online chemical communication video lecture
- A Post-Communication survey was administered to all participants
- Students attended an In-person learning community
- The post-study survey (a scrambled version of the pre-study survey) was administered to all participants for a final time..
- The surveys were then analyzed to assess if participation in a learning community enhance retention of the material

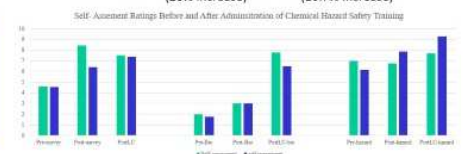
	Q1-Q10 Self-assessment	Q11-Q15 Multiple choice	Q16-Q17 Self-assessment	Q18-Q19 DS matching	
Pre-Study Survey (Pre-Ready Survey (Storage Stage))	4.575	57.5	4.525	66.6	66.6
Pre-Study Survey (Students with previous training)	6.85	75	6.825		
Post-Communication Survey (Post-Communication Survey (Storage Stage))	8.475	85	6.4	72.8	
Post-Communication Survey (Students with previous training)	6.75	50	7.875		
Post-Study Survey (Pre-Ready Survey (Storage Stage))	7.5	87.1	7.975	83.3	
Post-Study Survey (Students with previous training)	7.75	75	8.5		
	1.6875	75	9.25		



Pre-Study Survey: Correct Responses- 57% multiple choice – 67% pictogram matching (Baseline)

Post Communication Survey: Correct Responses - 65% multiple choice - 73% pictogram matching (8% increase) (6% increase)

Post- Learning Community Exercises: Correct Responses- 87% multiple choice- 83.7% pictogram matching (20% increase) (16.7% increase)



Conclusion

The results from the first study were somewhat inconclusive. Although students improved in their knowledge of Hazardous Material Identification and handling, the learning community outperformed the Non-Learning community significantly in only one category, that of GHS pictogram identification. The LLC performed marginally better than the Non-LLC group in answering introductory questions, and slightly worse in the third category which involved reading and assessing more complicated situations. Since these questions were more involved, the students may have given up and guessed. In addition, both groups performed identically in handling the case study scenario.

The results from the second phase have shorter questions in the survey, the surveys were given pre and post study to assess improvement, and the group as a whole was a non-science control. Many professionals at the Society for Chemical Hazard Communication Conference in the Spring of 2017 suggested that another trial be ran to test certainty, but perhaps utilizing a more modern form of training, such as the internet. This was the basis for the second study. The results show that person to person contact, in a setting where attention is demanded, may prove to hold higher retention levels than an online training seminar.

These results may shed some light on the way that chemical hazard communication training should take place in the future. These increases of 8% and 6% respectively were not the high achievement results expected when an online forum was used. Participants were more likely to answer questions about the data correctly when an in person delivery method was used. It was found, that however, when students came to the classroom and participated in one 30-minute learning community session, the scores made significant improvements. In order to account for the repetition of presentation of data, this particular increase will use the post-online training scores as the baseline for this calculation of learning community immersion improvement. Although, this may be a reflection of the small sample size, it is an observation worth noting, and perhaps further investigating.