Health and Safety Knowledge, Skills and Work Practices of Vocational College Graduates at One Year Post-Graduation

Technical Education Curricula for Health and Safety (TECHS) Study Findings: 2016-2017

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BACKGROUND

Technical Education Curricula for Health and Safety (TECHS) study is an educational intervention conducted in partnership with two vocational colleges in Minnesota. After an extensive baseline evaluation of the materials and methods used prior to enrolling in the TECHS study, new curricula was designed and developed with input from all instructors in the auto body collision technology (ABCT) and machine tool technology (MTT) programs in both colleges, and was implemented beginning with the 2015-2016 academic year.

Goal: evaluate the impact of a newly designed, trade-specific comprehensive safety and health curricula, delivered systematically throughout a 2-year program.

Hypothesis: vocational students that receive comprehensive safety and health information about the hazards in their trade and learn safety-related skills while in college, will have significantly better knowledge, skills, and work practices at 1 year after graduation.

METHODS AND MATERIALS

The TECHS curriculum for each trade included the following modules:

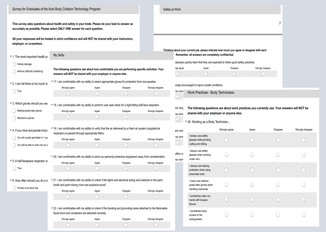
ABCT	
FULL MODULES	**REFRESHER MODULES**
Acids and Bases	Solvents, Acids and Bases
Solvents	
Electrical Safety	Electrical and Fire Safety
Fire Safety	
Eye Protection	Eye and Hearing Protection
Hearing Protection	Isocyanates
Isocyanates & Respirators	Respirators

MTT	
FULL MODULES	**REFRESHER MODULES**
Machine Guarding	Machine Guarding
LOTO Awareness	LOTO Awareness
Material Handling	Material Handling
Eye Protection	Eye and Hearing Protection
Hearing Protection	

Each module includes: Instructors' Guide, Student's Guide, classroom presentation (PowerPoint presentation with narrative and notes for each slide), lab activities, homework, quiz, and supplemental materials on the topic of the module. At the end of the year, students took an anonymous test. All materials were uploaded within each college's on-line learning environment: Desire to Learn (D2L).

Instructor activities: Prior to the start of the 2015-2016 academic year, all instructors teaching in the ABCT and MTT programs attended a 4-hour training session on: (1) how to manage course content in D2L; (2) practice teaching a classroom presentation; (3) review the lab activities, homework, and quizzes; (4) plan each module delivery to optimize students' ability to use the information in an immediately relevant context; (5) learn to use curriculum delivery tracking forms.

Graduates follow-up: ABCT and MTT graduates class of 2015 and class of 2016 were received an electronic survey distributed 1 year after graduation. Respondents were compensated $20 for participation. ABCT graduates answered 16 questions on isocyanates, respirators, solvents and acids, fire and electrical safety, and, eyes and hearing protection. MTT graduates answered 8 questions on machine guarding, lockout/tagout, materials handling, and, eyes and hearing protection. All graduates rated their safety-related skills and work practices, and completed a 13-question safety climate survey.



RESULTS

Curriculum Implementation

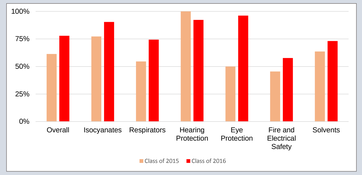
All instructors delivered the classroom presentations, but lab activities, homework, and quizzes were not implemented. All ABCT and some MTT instructors reported difficulties using the D2L, which resulted in students not having access to materials. Lack of time and not knowing how to complete some activities were most frequently cited barriers to implementation.

Surveys Returned

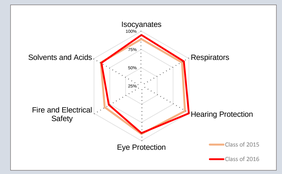
ABCT: Class of 2015: 40 graduates → 18 surveys returned → 11 working in the trade (61%) Class of 2016: 29 g → 20 s. r. → 13 wk in the trade (65%)
MTT: Class of 2015: 71 graduates → 52 surveys returned → 46 working in the trade (88%) Class of 2016: 57 g → 33 s. r. → 28 wk in the trade (85%)

RESULTS - ABCT

Knowledge - Mean Scores



Skills - Mean Scores



* significantly different (P < 0.001)

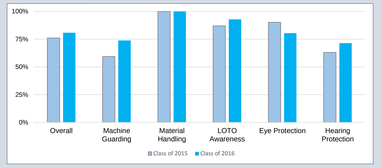
Work Practices - ABCT

		2015		2016	
		SA (%)	A (%)	SA (%)	A (%)
I sometimes spray isocyanates without using a respirator	P	57	43	50	50
I am NOT always clean-shaven when wearing a tight-fitting respirator	P	29	29	25	25
I sometimes spray isocyanates-containing products outside the paint booth or prep station	P	43	0	0	25
I sometimes forget to perform a seal check when I put on a tight-fitting respirator	P	57	29	38	25
I sometimes block access to fire extinguishers.	P	57	43	63	38
	BT	56	33	73	27
I sometimes clean my hands with lacquer-thinner	P	57	29	38	63
	BT	56	33	56	33
I always use safety glasses while grinding, cutting and drilling	BT	67	22	100	0
I never use medical-grade latex gloves when handling chemicals	BT	56	0	36	18

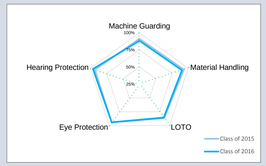
P = painter; BT = body tech; SA = strongly agree; A = agree

RESULTS - MTT

Knowledge - Mean Scores



Skills - Mean Scores



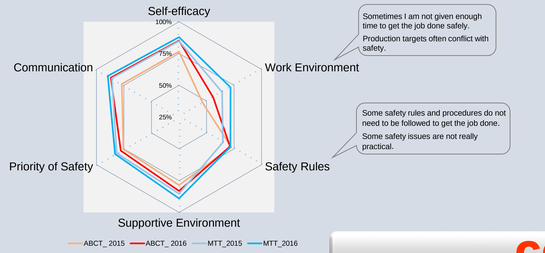
[a] Significantly different (p=0.02)

Work Practices - MTT

	2015		2016	
	SA (%)	A (%)	SA (%)	A (%)
I use safety glasses regardless of the task I perform.	76	22	61	29
I remove guards if they get in the way of production work.	33	54	61	25
I sometimes bypass the interlocks to inspect a part in a CNC machine.	13	28	61	25
I would never remove locks placed by a LOTO "authorized" person.	78	17	71	14
I sometimes clean machines with compressed air above 30 p.s.i.	22	50	36	32
I sometimes remove chips using my hands without wearing gloves.	46	24	50	21
I tell my supervisor when a guard is missing or is broken.	61	35	57	32
I wear hearing protection when doing a noisy task.	72	26	71	25
I ask for help when I have to lift an object heavier than 50 pounds.	46	46	54	39

SA = strongly agree; A = agree

Safety Climate - Mean Scores – ABCT + MTT



% employed by business size

N employees	ABCT		MTT	
	2015	2016	2015	2016
< 5	18	23	-	-
6 to 10	27	38	7	4
11 to 24	55	23	11	4
25-50	0	15	13	14
51 to 100	-	-	24	21
> 101	-	-	41	57

Regression Analysis Results

	Coefficient	P value
WkPx & Knowledge	0.13	0.16
WkPx & Skills	0.51	<0.0001
WkPx & Safety Climate	0.6	<0.0001

All data analyses were completed using only the answers from the graduates working in the trade.

CONCLUSIONS

When classroom presentations are delivered during the 2nd year of a 2-year program, graduates' knowledge about safety and health increases, sometimes significantly. However, without conducting the lab activities, and assigning and discussing homework tasks, no significant impact on skills and work practices is observed at 1 year after graduation. Since nearly 72% of collision repair shops technicians and 47% of the machinists working in manufacturing companies attended some classes or graduated from vocational college programs in their trade[1,2] these institutions play an exceptionally prominent role in graduates' safety and health education.

Several barriers to implementing a comprehensive safety and health curricula in vocational college exist, even when materials are created with direct input from instructors. Primarily, barriers are administrative, but also due to instructors' gaps in safety knowledge and lack of pedagogic skills. After 1 year of using the TECHS curricula, instructors had positive feedback as well as several suggestions and recommendations. These were used to update the TECHS materials used beginning 2016-2017 academic year. Challenges are addressed through continuous instructor coaching and by creating and delivering additional instructor training on specific safety and health topics. The TECHS curricula implementation continues and results will be reported in future publications.

1. Parker DL, Yamin S, Xi M, Gordon R, Most I, Stanley R [2017]. Findings from the National Machine Guarding Program: Safety Climate, Hazard Assessment, and Safety Leadership in Small Metal Fabrication Businesses. J Occup Environ Med. Sep 19. doi: 10.1097/JOM.0000000000001166. [Epub ahead of print]
2. Parker DL, Brosseau LM, Bejan A, Xi M [2014]. Understanding safety climate in small automobile collision repair shops. Am J Ind Med. Jan;57(1):78-86

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