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Laboratory Safety in Vocational Education: An Administrator's Perspective

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> When public school administrators first undertook the obligation of providing shop and laboratory experiences for youth and adults enrolled in their schools, they assumed a responsibility to provide an accident-free environment and a program of instruction which would include emphasis on effective safety practices (Williams, 1975, p. 50).

As school curricula have expanded to include more occupational and technical subjects, the potential for situations that contribute to accidents has increased (Kigin, 1983; Ramp, Johnson, & McLuckie, 1975). What are schools doing to ensure a safe environment for students? In a survey of administrators and vocational teachers in Missouri, Dyrenfurth and Lindhart (1981) found that classroom and laboratory instruction were most often cited as the major safety program activities.

Recognizing the importance of safety, several states (Dyrenfurth, et. al., 1981; Graham, 1981; Kirk, 1988; South Carolina State Department of Education, 1981) have published guides or handbooks on safety in occupational laboratories. Also, agricultural education researchers (Bruening, Hoover, & Radhakrishna, 1991; Fletcher & Johnson, 1990) have surveyed agricultural mechanics teachers to determine the extent to which selected safety practices were utilized and to determine the availability of selected safety materials and equipment. Although teachers have the primary responsibility for ensuring the safety of vocational students, teachers have difficulty meeting this responsibility without the support of school administrators (Bear, 1980; McMahon, 1975). It becomes important to use administrators as the subjects of safety investigations.

What are the potential consequences of neglecting the safety needs of occupational programs? Connors (1981) wrote that "we do live in a litigious society, and educators as public servants are increasingly frequent targets of litigation" (p. ix). Additionally, many schools no longer have sovereign immunity and may be held liable for accidents in negligence suits (Godbey, 1979; La Morte, 1990). It is increasingly important for educators to properly maintain equipment, provide instruction in safety, and adequately supervise students engaged in laboratory activities (Connors, 1981). Although the threat of injury and litigation are real, there is a need for objective data to assess the magnitude of the threat.

Purpose and Objectives

The purpose of this descriptive correlational study was to investigate the utilization of accepted safety practices, the availability of safety materials and equipment, the prevalence of accidents, and the extent to which schools have been engaged in litigation resulting from student injury. The research objectives were to:

Describe safety practices used by vocational teachers in comprehensive high schools with agricultural education programs as reported by school administrators.

Describe what safety materials and equipment are available in vocational laboratories in comprehensive high schools with agricultural education programs.

Describe and compare the number of accidents resulting in student injury by location over a two-year period in comprehensive high schools.

Determine the number and magnitude of lawsuits brought against educators as a consequence of school accidents over a two-year period.

Determine the number of schools providing liability insurance for faculty members and the average amount of coverage.

Describe relationships among selected indicators of safety and the number of accidents occurring in vocational laboratories.

Procedures

Population and Sample

The population for this descriptive survey included all principals of comprehensive high schools with agricultural education programs in Ohio (N=260). The Ohio Directory of Agricultural Education was utilized to develop the list of comprehensive high schools with agricultural education programs. Based upon Krejcie and Morgan's (1970) formula for a five percent margin of error, a random sample of 155 schools was drawn.

Instrumentation

The questionnaire utilized in this study was developed by the researchers. The questionnaire consisted of three parts including the administrator's safety attitude, policies, and facilities and inspection. Content and face validity were established by a panel of experts consisting of faculty and graduate students in the departments of Agricultural Education and Agricultural Engineering at The Ohio State University. Cronbach's Alpha was used to assess the reliability of part one (The Administrators' Safety Attitude) of the questionnaire. The reliability coefficient was .73. Since items in parts two and three requested factual responses, reliability was not estimated.

Data Collection

The questionnaire along with a cover letter and stamped return envelope were sent to all principals of comprehensive high schools with agricultural education programs included in the sample. Approximately four weeks after the initial mailing, a second complete package including the questionnaire, a cover letter, and a stamped return envelope was sent to all nonrespondents. The response rate was 83 percent. Nonresponse error was controlled by comparing early to late respondents (Miller & Smith, 1983). No

significant differences were found between early and late respondents. Although each package was addressed to the principal, some of the respondents were vocational administrators. Respondents were referred to as administrators.

Analysis of Data

All data were analyzed using the Statistical Package for the Social Sciences, Personal Computer Version (SPSS/PC+). Appropriate statistical procedures for description (frequencies, percents, means, standard deviations, Pearson correlations, and Spearman correlations) and inference (repeated measures analysis of variance and the Tukey Post-hoc procedure) were used. The alpha level was set a priori at .05. All correlation coefficients were interpreted utilizing Davis' (1971) descriptors.

Results

From a list of 15 teacher safety practices, administrators were asked to indicate which ones were utilized by vocational teachers in their schools. Administrators in 100 percent (128) of the schools indicated that teachers instruct students in how to properly use equipment and demonstrate proper use of equipment. Additionally, vocational teachers in 97.7 percent (125) of the schools give an equipment test to students (Table 1).

Table 1. Teacher Safety Practices

Practice	Frequency	Percent
Maintains equipment	127	99.2
Instructs pupils in how to properly use equipment	128	100.0
Gives pupils an equipment test	125	97.7
Makes sure that pupils understand what is wrong	115	89.8
Demonstrates proper use of equipment	128	100.0
Each student demonstrates proper use of equipment in the presence of the teacher	116	90.6
Evaluates each pupil every year regarding proper use of equipment	108	84.4
Enforces the constant use of safety glasses when appropriate	126	99.2
Requires pupils to sign a safety checklist each year	59	46.1
Requires pupils to dress appropriately for each activity	121	95.3
Balances the danger of an activity against its educational value	112	88.2
Only permits one dangerous activity at a time and supervises it closely	72	57.1
Does not allow pupils to use unsafe equipment	125	97.7
Never leaves the shop while students are using equipment or chemicals	108	84.4
Stresses safety above all else	114	89.1

Only 46.1 percent (59) of the administrators reported that pupils were required to sign a safety checklist. Additionally, administrators in 57.1 percent (72) of the schools reported that vocational teachers permit only one dangerous activity at a time and closely supervise it. According to administrators, vocational teachers never leave the shop while students are using equipment or chemicals and evaluate pupils every year regarding proper use of equipment in 84.4 percent (108) of the schools.

More than 90 percent of the administrators reported that the following safety materials and equipment were available in their schools' vocational laboratories: fire extinguishers, marked exits, fire alarm, and safety guards on all equipment (Table 2). On the other hand, fewer than 50 percent of the administrators reported the availability of the following safety materials and equipment in their vocational laboratories: color coded power tools, nonskid areas around power tools, fire blanket, safety cabinets for explosive materials, and vehicle safety stands.

Table 2. Safety Materials and Equipment Available in Vocational Laboratories

Item	Frequency	Percent
Safety zones around power tools	95	74.2
Color coded power tools	42	33.6
Nonskid areas around power tools	26	20.8
Safety rules posted near power tools	107	85.6
Ohio eye safety law posted	90	71.4
First aid kit	111	88.1
Fire blanket	62	49.2
Fire alarm	119	94.4
Exits marked	122	96.8
Safety cabinets for explosive materials	58	46.4
Safety cans for flammable liquids	86	68.3
Safety guards on all equipment	116	92.8
Fire extinguishers	123	97.6
Welding exhaust system	104	83.2
Welding booths have screens/curtains	107	85.6
Vehicle safety stands	47	37.9

The number of student injury accidents occurring in vocational laboratories over a two-year period ranged from none in 47.5 percent of the schools to 14 in .8 percent of the schools (Table 3). The average number of student injury accidents occurring in vocational laboratories over a two year period was 1.5 with a standard deviation of 2.35. Table 3 further shows that three or fewer vocational laboratory accidents resulting in student injury occurred in 90 percent of schools over a two-year period.

Table 3. Number of Student Injury Accidents Occurring in Vocational Laboratories Over a Two Year Period as Reported by School Administrators

Number of Accidents	Frequency	Percent
0	57	47.5
1	15	12.5
2	27	22.5
3	9	7.5
4	4	3.3
5	2	1.7
6	2	1.7
10	2	1.7
12	1	.8
14	1	.8

Mean = 1.5, Standard Deviation = 2.35

Table 4 compares the number of accidents resulting in student injury over a two-year period by location. On average administrators reported 1.5 accidents in vocational laboratories, 4.96 accidents in physical education courses, .39 accidents in science laboratories, and .87 accidents in other areas (i.e. classrooms, hallways, cafeteria, and stairs). Repeated measures analysis of variance and the Tukey post hoc procedure revealed that the number of accidents in physical education courses was significantly greater than the number of accidents occurring in vocational laboratories, science laboratories, and other areas.

Table 4. Number of Accidents Resulting in Student Injury Over a Two-Year Period by Location in the School

	Voc Lab	P.E. Classes	Science Lab	Other Locations	F	Prob
Mean	1.50[a]	4.96[b]	.39[a]	.87[a]	33.83	.001
Standard Deviation	2.36	6.19	.88	2.98		

Note: Means with different letters differ significantly.

Further analysis revealed that accidents occurring in vocational laboratories, physical education classes, science laboratories, and other areas accounted for 22.36, 65.29, 3.60, and 8.75 percent of the total number of school accidents respectively.

Of those administrators providing useable data, four percent (4) reported that one lawsuit had been filed as a result of school accidents occurring over the last two years. Two lawsuits were decided in favor of students. One settlement (.8 percent of the schools) was for $150,000 while the other (.8 percent) was for $500,00 .

Of those administrators providing useable data, 82.4 percent (103) indicated that their school provided liability insurance for faculty. Of the schools providing liability insurance, 78.1 percent (75) had policy amounts in excess of $200,000 (Table 5).

Table 5. Liability Insurance for Faculty Members

Policy Amount	Frequency	Percent
$25,000 to $49,999	1	1.0
$50,000 to $99,999	4	4.2
$100,000 to $149,999	14	14.6
$150,00 to $199,999	2	2.1
More than $200,000	75	78.1

Pearson correlations and Spearman correlations were calculated to describe relationships between selected indicators of safety in vocational laboratories. Coefficients ranged in magnitude from negligible to moderate. The administrators' perception of vocational teachers' preparedness to provide safety instruction was significantly related to the administrators' safety attitude, and the administrators' competence in determining whether or not a vocational laboratory is safe. The administrators' safety attitude was significantly related to the number of safety materials and equipment available, and the number of teacher safety practices utilized. Additionally, the administrators competence in determining whether or not a vocational laboratory is safe was significantly related to the number of safety materials and equipment available

and whether or not administrators inspect vocational laboratories for safety. The number of accidents occurring in vocational laboratories was not significantly related to any of the selected indicators of safety (Table 6).

Table 6. Relationships Among Selected Indicators of Safety in Vocational Laboratories

	Intercorrelations						
Variables	X1	X2	X3	X4	X5	X6	X7
Vocational teacher (X1) preparedness to provide safety instruction (X1)	1.00	.24*	.13	.18	.01	.20*	-.10
Administrators' safety attitude (X2)		1.00	.22*	.31*	.04	.06	.09
Number of safety materials and equipment available (X3)			1.00	.10	-.01	.22*	-.04
Number of teacher safety practices utilized (X4)				1.00	-.05	.09	-.14
Administrators inspect facilities for safety (X5)					1.00	.26*	-.18
Administrator competence in determining whether a vocational laboratory is safe (X7)						1.00	-.18
Number of accidents in vocational laboratories (X7)							1.00

*p<.05.
All coefficients for teacher preparedness to provide safety instruction were Spearman correlations.

Conclusions and/or Recommendations

According to school administrators, vocational teachers use many of the safety practices espoused in the literature on laboratory safety. Most encouraging is the fact that all administrators reported that vocational teachers instruct pupils in how to properly use equipment and demonstrate proper use of equipment. There remains room for improvement on other teacher safety practices, however. Although some teacher safety practices may seem less important than others, each contributes to the overall safety of the vocational laboratory. Teacher educators should make certain that pre-service teachers appreciate the importance of each practice, and develop ongoing strategies for reinforcing the use of these safety practices by practicing teachers.

The nonexistence of several safety materials and/or equipment in many vocational laboratories is discouraging. For example, approximately 12 percent of the administrators reported that first aid kits were not available in vocational laboratories. Additionally, many inexpensive safety materials (color coded power tools, safety zones around power tools, and safety cans for flammable liquids) were not available in some schools. Other materials and/or equipment (safety guards on equipment, welding exhaust

systems, and safety cabinets for explosive materials) were not available in some schools. Although some of the materials and/or equipment are expensive, their potential contributions to the overall safety of a given vocational laboratory should not be ignored. Administrators should be encouraged to place higher priority on the acquisition and subsequent maintenance of safety materials and equipment for vocational education laboratories.

The administrators' attitude toward safety was significantly related to both the number of safety materials and equipment available and the number of teacher safety practices utilized. It becomes important that efforts be made to create more positive safety attitudes in public school administrators. Administrators must be convinced of their legal and moral obligation to provide for the safety of students and teachers under their supervision.

Vocational education laboratories are relatively safe when one considers the nature of the laboratory environment. On average, administrators reported less than one vocational laboratory accident per year that resulted in student injury. On the other hand, vocational accidents accounted for more than 20 percent of the total number school accidents which is considerably more than the nine percent estimate made by Ramp et. al. (1975).

Over a two-year period only four lawsuits were filed of which two were settled in favor of students. The fear of negligence suits may be exaggerated. Even so, teachers in 82 percent of the schools were provided liability insurance and most policies amounts were in excess of $200,000. La Morte (1990) wrote that "although a strong case for liability may be made against them, impecunious and uninsured educators are unlikely candidates for suit" (p. 403). One should consider the possibility that liability insurance may actually encourage lawsuits. This possibility may be worthy of consideration, but the reader should not construe this as a recommendation that educators be without liability insurance.

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