

THE EFFECT OF INTENSIVE SAFETY INSTRUCTION ON THE
LEVEL II INTERMEDIATE SCIENCE CURRICULUM
STUDY STUDENT

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by

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Chapter 1

INTRODUCTION

The Intermediate Science Curriculum Study (ISCS), developed at the Florida State University in cooperation with the National Science Foundation, is an individualized course of study involving activities rather than the lecture method of instruction. Specifically, Level II ISCS focuses on the building of a model to explain the nature of matter. While working with various chemical reactions on a daily basis, the middle school student finds himself in a potentially dangerous laboratory environment.

Safety tips to students are an important part of the ISCS text, Probing the Natural World 2.¹ Suggestions have also been made in the ISCS teacher module, Classroom Organization,² to improve safety conditions. The fact remains that little research has been focused on the role of an intensive laboratory safety program in reducing the number of students involved in accidents. Basically, research has been limited to studying factors associated with the cause of accidents.³

The purpose of this study was to determine if students in a Level II ISCS classroom receiving intensive safety instruction had significantly fewer accidents than students who received only minimum safety instruction.

Chapter 2

REVIEW OF THE LITERATURE

Ulrich⁴ concluded from a survey of the safety conditions in various New York public schools that comprehensive safety programs were lacking. In a recent survey of safety conditions in high schools in the State of Illinois, Young⁵ has concluded that accidents do not just happen. Most accidents can be eliminated and should be eliminated through proper techniques and adequate anticipation.

To date the Florida Department of Education has published a handbook⁶ to guide the science teacher in taking the proper safeguards in the laboratory as prescribed by Florida Law. This, however, fails to guarantee that accidents will be eliminated or even reduced in the classroom.

Intensive safety education programs have been shown to be effective in reducing the frequency of accidents in several areas outside the realm of the ISCS laboratory. Doss⁷ has shown that students having successfully completed a course in driver education possess greater driver knowledge in terms of driving practices and principles than students not receiving the same treatment. Using data from the Seibrecht Attitude Scale, it was further shown by Doss that the treatment group possessed a more favorable attitude toward safe driving practices.

It appears that if the individual's attitude toward safety is improved, then the number of accidents may subsequently be reduced.

This is stressed in a study by Linhardt.⁸ The study involved the effects of selected instructional methods on student attitude toward shop safety instruction. The intensive safety course including lectures, demonstrations, and a series of safety films proved to be significantly effective in reducing the frequency of shop accidents.

Fugal,⁹ in a study investigating the relationship of safety education to industrial accidents, concluded that a conventional group safety education program did not work. It only served to increase the reporting of accidents. Further experimentation by Fugal using a variation of the Herbartian training method, an intensive individualized training program, was found to be extremely effective in reducing accidents.

Another method of instruction, involving an intensive laboratory safety program, is worth noting. Rubinsky and Smith¹⁰ have developed a technique for accident simulation with power tools. Water jets were installed on an off-hand grinder to simulate an exploding grinder wheel. This was controlled by the experimenter as the subject used the machine improperly. In this way the accident was simulated without placing the student in danger. The study that followed by Rubinsky and Smith provides one with strong evidence to justify the use of this technique in an intensive safety education program. It was discovered that accident simulation was significantly effective in reducing the number of accidents in the shop.

Chapter 3

METHOD

To determine the relative effect of an intensive safety education program in reducing accidents, two working hypotheses were constructed.

HYPOTHESES

1. In the Level II ISCS laboratory, no significant difference in the number of students who have accidents will exist between students receiving intensive safety instruction and students receiving minimum safety instruction.

2. In the Level II ISCS laboratory, no significant difference in the frequency of accidents will exist between students receiving intensive safety instruction and students receiving minimum safety instruction.

DEFINITIONS

The intensive safety instruction, an independent variable, consisted of fifteen periods at fifty minutes per class period. The classes met during the second, third, and fourth weeks of the 1973-74 school year. A four-fronted approach to instructional method was employed. Not necessarily listed in order of importance, the following tools were used:

1. Lecture
2. Demonstration
3. "Accident simulation"
4. Learning Thru Discussion (Hill, 1969)¹¹

Table 1 shows the topics covered and the number of class periods spent with each in the intensive safety programs.

Table 1
Topics Covered in the Intensive
Safety Program

Topic	Class periods
Identification and function of equipment	2
Location of equipment	2
Classroom traffic patterns	2
Heating techniques	2
Identification of dangerous chemicals	1
First aid in the ISCS classroom	2
Safety poster project	2
Role of clean-up in preventing accidents	2

The minimum safety instruction, an independent variable, was a program of instruction as outlined by the Florida Handbook for Laboratory Safety.

Accidents, the dependent variable, were defined as occurrences in the ISCS laboratory involving the misuse of equipment and/or materials in such a way that any one of the following criteria or any combination thereof was met:

1. Breaking glassware
2. Spilling chemicals
3. Personal injury resulting in at least first aid

SUBJECTS

With the exception of twenty pre-selected eighth grade students, the entire eighth grade student body at New River Middle School participated in the study. The twenty advanced students were excluded from the study because they had been previously selected to take part in a special class different from the ISCS program. Two hundred twenty four subjects were randomly assigned to one of the four treatment sections or to one of the four control sections.

Random assignment of the subjects was accomplished by assigning a number to each subject in an alphabetical list. This list was then subjected to a table of random numbers.

RESEARCH DESIGN

The research design used in this study was the post-test only control group design. The treatment groups received the intensive laboratory safety instruction. The control group received the minimum safety instruction as defined.

PROCEDURE

The treatment was administered during the second, third, and fourth weeks of the 1973-74 school year at New River Middle School, Fort Lauderdale, Florida. The control was administered during the last two days of the fourth week of the same school year. Following

completion of each method of instruction, the subjects began to work with the individualized ISCS material. During the next twelve weeks, a record of the students who had accidents and the frequency of accidents was kept by student aide observers.

ANALYSIS

In order to reduce the possible influence that a few students might have had on the entire group, (both treatment and control), analysis by the Chi-Square Contingency Table was used to determine the significance of the treatment. A probability level of 0.05 was considered to be significant.

A second method of analysis, a Chi-Square Test of Goodness of Fit was used to determine the significance of the frequency of accidents. Again the 0.05 level was considered to be significant.¹²

Chapter 4

RESULTS

A summary of the data collected by the student aide observers is shown in Tables 2, 3, and 4.

Table 2

Frequency of Subjects Having Accidents
And Not Having Accidents in the Control Group

Control group	Number of subjects having accidents	Number of subjects not having accidents
1	7	17
2	14	18
3	9	19
4	10	16
TOTAL	40	70

Table 3

Frequency of Subjects Having Accidents
And Not Having Accidents in the Treatment Group

Treatment group	Number of subjects having accidents	Number of subjects not having accidents
1	3	21
2	7	25
3	2	26
4	6	24
TOTAL	18	96

Table 4

Frequency of Accidents Observed per class
in Control and Treatment Groups

Group numbers	Control group accidents	Treatment group accidents
1	31	10
2	36	18
3	22	7
4	28	8
TOTAL	117	43

The results of Chi-Square Contingency Table analysis, Table 5, showed that the intensive safety instruction had a significant effect in reducing the number of students having accidents ($\chi^2 = 11.3$; $df = 1/224$).

Table 5
Analysis by the Chi-Square Contingency
Table for the Frequency Which
Subject had Accidents

Group	Subjects having accidents	Subjects not having accidents
Control	40	70
Treatment	18	96

$\chi^2 = 11.3$ with 3.84 being significant at the 0.05 level.

Because the Chi-Square value was larger than the table value, the null hypothesis (no significant difference in the number of students who have accidents will exist between students receiving intensive safety instruction and students receiving minimum safety instruction) was rejected and the alternate form accepted.

Analysis by the Chi-Square Test of Goodness of Fit, Table 6, showed that the treatment had a significant effect in reducing the frequency of accidents ($\chi^2 = 70$; $df = 1/224$).

Table 6

Analysis by the Chi-Square Test of Goodness
of Fit Comparing Frequency of Observed
Accidents with the Frequency of
Expected Accidents

	Observed accidents	Expected accidents
Control	117	55
Treatment	43	57

$\chi^2 = 70$ with 3.84 being significant at the 0.05 level.

Again the Chi-Square value was greater than the tabled value, hence the null hypothesis (no significant difference in the frequency of accidents will exist between students receiving intensive safety instruction and students receiving minimum safety instruction) was rejected and the alternate form accepted.

Chapter 5

CONCLUSION

The alternate hypotheses were strongly supported. First, significantly fewer students receiving intensive safety instruction had accidents than students who received minimum safety instruction. Second, classes receiving intensive safety instruction had significantly fewer accidents than classes which received minimum safety instruction.

It is apparently not enough to lecture students on the importance of safety in the ISCS laboratory, nor is it enough to rely on the built in safety features of the ISCS program. The use of the four-fronted approach to safety instruction seems worthwhile.

1. Lecture
2. Demonstration
3. Accident Simulation
4. Learning Thru Discussion, (Hill, 1969)

Personal involvement of the individual student may have been a key factor in the success of the treatment.

Some logical steps follow from this study. One may be to examine the long term effectiveness of this instruction. Another may be to determine if reinforcement throughout the school year would further reduce the frequency of accidents.

It is the sincere desire of this researcher that this study will stimulate others to research the age old problem of accidents in the science laboratory.

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The Intermediate Science Curriculum Study (ISCS) is an individualized course of study involving daily laboratory activities. Because of the chemical nature of the Level II activities, the eighth grade student finds himself in a potentially dangerous environment. The purpose of this study was to determine if intensive safety instruction would significantly reduce the frequency of laboratory accidents.

The literature reveals that safety tips to students are provided in the Level II ISCS text. Also, suggestions to improve safety conditions are made in ISCS teacher modules. The fact remains that little research has focused on this problem. One must look beyond the realm of the ISCS laboratory to find appropriate research. Doss (1965) has shown that driver education can improve driver knowledge. Fugal (1968) concluded from a study that intensive safety education significantly reduced the frequency of accidents in an industrial situation.

This study took place at New River Middle School, Fort Lauderdale, Florida and involved 224 eighth grade ISCS students. Each student received either intensive safety instruction or minimum safety instruction. Following the administration of treatment and control, a record of student accidents in the laboratory was compiled.

It was found that intensive safety education significantly reduced not only the frequency of accidents but also the number of students having accidents (at .05 level).