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A Study to Determine the Awareness of Tidewater Industrial Arts Teachers of the Procedures for Proper Handling of Toxic Substances

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A STUDY TO DETERMINE THE AWARENESS
OF TIDEWATER INDUSTRIAL ARTS TEACHERS OF THE
PROCEDURES FOR PROPER HANDLING OF TOXIC SUBSTANCES

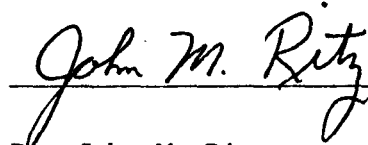
A STUDY PRESENTED TO
THE FACULTY OF THE SCHOOL OF EDUCATION
OLD DOMINION UNIVERSITY

IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE
MASTER OF SCIENCE IN EDUCATION

BY
BRIGITTE GRAUDINS VALESEY
AUGUST, 1980

This research paper was presented by Brigitte Gaudins Valesey under the direction of Dr. John Ritz in VIAE 636, Problems in Education. It was submitted to the Graduate Program as partial fulfillment of the requirements for Master of Science in Education.

Approved August 1980, by

A handwritten signature in cursive script, reading "John M. Ritz", is written over a horizontal line.

Dr. John M. Ritz

Advisor

Graduate Program Director

Vocational and Industrial Arts Education

ACKNOWLEDGEMENTS

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CHAPTER ONE

INTRODUCTION

As industrial arts teachers, we are very much aware of the dramatic consequences of neglecting to wear adequate eye protection or operating machinery without the use of appropriate guards. However, we often overlook the fact that daily exposure to toxic materials and air contaminants can not only impair us just as seriously, but in a more subtle manner and over a prolonged period of time. We spend countless numbers of hours training students to apply safe working habits and perform efficient laboratory cleanup yet, is enough time and emphasis devoted to the proper handling and storage of materials, particularly those that are toxic or suspected carcinogens in human beings? It is this disturbing question that leads to the problem of determining the extent to which industrial arts teachers are aware of the procedures for safe handling and storage of toxic materials.

STATEMENT OF THE PROBLEM

The primary purpose of this study was to determine the awareness of Tidewater industrial arts teachers of the procedures for handling toxic substances safely and the practices currently being utilized in material storage and handling.

RESEARCH OBJECTIVES

The objectives for this particular study were focused upon the knowledge of instructors as related to the proper storage and handling of toxic materials frequently found in industrial arts laboratories. More specifically, it provided answers for the

following questions:

1. What are the toxic substances used most frequently in industrial arts laboratories?
2. How are each of these substances stored and handled?
3. Who most frequently handles these substances?
4. Are both students and instructors adequately informed of potential hazards relating to the use of these substances?
5. What recommendations should be made to increase teacher awareness of the harmful side effects of toxic substances, both on them and their students?

BACKGROUND AND SIGNIFICANCE

More than any other worker, the industrial worker has been exposed to a wide variety of toxic substances, unaware of the long-term side effects that these substances may have in his or her body. When these hidden side effects, or "occupational diseases", were discovered and later publicly recognized, the worker often dismissed them as being just part of his or her occupation. It is perhaps this submissive attitude, which was recognized by legislators, that led to the passage of the Occupational Safety and Health Act of 1970. Often considered a very significant act of social legislation, its passage set health standards and regulations that were set and enforced, creating a safer work environment.

Upon examination of the educational field, it appeared that only chemistry and biology educators had developed definitive guidelines through symposiums, extensive research, and published materials; their interest and concern in the proper usage and handling of toxic chemicals and materials was evident in their written procedures, instructional materials, and laboratory management. There exists a void in the industrial arts field in relation to the proper usage, storing, and handling of toxic substances. It appears crucial that industrial arts

teachers, as transmitters of the technological society in which we live, should also be concerned about occupational health and industrial hygiene in the classroom, as well as industry. Judging from the lack of information pertaining to this problem, the results of this research study should open new avenues for additional research and and changes in curricula, instructional materials, and laboratory management.

LIMITATIONS

The study was limited to the Tidewater area of Virginia, and the population consisted solely of teachers who were employed in industrial arts programs in this area.

ASSUMPTIONS

In this research paper, the following statements were assumed to be true:

1. The Tidewater area of Virginia consisted of Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, and Virginia Beach.
2. Industrial arts teachers do utilize toxic substances and materials in the laboratories in which they teach.
3. Storage was provided for toxic materials and substances in the industrial arts laboratories.

PROCEDURES

The subjects chosen were certified industrial arts teachers from the Tidewater area of Virginia, who were selected at random to complete a survey pertaining to the handling of toxic materials in the industrial arts facility. One-third of the population was surveyed, with the results of the survey listed in a series of tables, along with general findings, conclusions drawn from the results, and recommendations made for follow-up studies and revised teacher training programs.

DEFINITION OF TERMS

1. Toxic Material : Any substance whose vapors, liquid, or solid causes a harmful reaction in humans as a result of inhalation or direct contact with the substance.
2. Industrial Arts Teacher: A teacher certified to teach the tools, materials, processes, and occupations of industry as they relate to the technological society and general education as a whole.
3. Carcinogen: A substance which is known or believed to cause cancer in animals and/or humans.
4. Air contaminant: A substance which sends harmful vapors into the air.
5. Local Irritant: A toxic substance which irritates the human skin upon contact.
6. OSHA: The Occupational Safety and Health Administration.

OVERVIEW OF CHAPTERS

Because of the lack of information , the literature pertaining to the usage and handling of toxic materials in the chemistry and biology education areas, as well as industrial safety guidelines, were reviewed and related to the industrial arts field. Following the review of literature in Chapter Two, treatment was given to the selection of the population, collection of data, and tabulation of results in Chapter Three. Subsequent findings were enumerated upon in the next chapter , and summarized in Chapter Five, which contained conclusions drawn from the survey results and recommendations vital to the safety and well being of both the teachers and students of industrial arts.

CHAPTER TWO

REVIEW OF LITERATURE

In the industrial arts education field, scant information was found relating to the correct storage and handling of toxic materials. The information that had been gathered was often vague, with no guidelines for reinforcement. In the Washington State Industrial Arts Safety Guide, a checklist included the item, "All flammable and combustible liquids, toxics and caustics are stored securely, in proper containers, identified by name and degree of hazard" (Washington State Education Department, p.27) with no mention of what the toxic materials were specifically, what the proper containers were, nor what the degree of hazard was for various materials. Neither was any reference made of how this item was to be enforced.

In the New York State guide on safety, "Industrial Arts Safety: A Management Plan", only one reference was cited regarding the storage of toxic materials, in which it was stated that metal cabinets were required for storing paint and other flammable substances (University of the State of New York, 1977, p.11). Again, flammable materials were not identified and the method of enforcement was not mentioned in the guide. Other state guides for safety and facility planning did not include procedures for storing and handling toxic substances, perhaps assuming that teachers were already well informed and knowledgeable in this area. However, by assuming that teachers were aware of the toxicity of materials, the degree of hazard that exists, and the need for proper storage and handling of these materials, many states were leaving a serious void in their safety guidelines. The states should not assume that the teacher training programs cover this needed information in their preparatory programs.

In the fields of chemistry and biology education, there had been a substantial amount of research accumulated and specific guidelines set

forth in the proper handling and storage of chemicals. Seminars, in-service programs and symposia had been implemented to instruct potential and current science teachers in the handling of laboratory chemicals, as well as provided specific information relating to the potential hazards that exist in the usage of these chemicals. One state in particular, Delaware, had instituted statewide action through the Delaware Department of Instruction, sending inspectors to schools to inspect science labs upon the requests of teachers or administrators. These inspectors also provided a written set of recommendations, and removed outdated, hazardous or carcinogenic materials (Chemical & Engineering News, October 1978, p. 15). Other state education departments are just beginning initiate similar programs and exhibit greater concern over science laboratory safety.

What had provided the impetus for the safety movement in science education? Many science educators felt that the core of the problem related to the inadequate training of teachers; Douglas Macbeth, the supervisor of science for the Delaware Department of Public Instruction feels, "The big thing is that teachers often are not aware of what constitutes a safety hazard" (Chemical and Engineering News, 1978, p.15). Educators attributed this lack of awareness to ignorance, administrative neglect, lack of concern, lack of money to obtain appropriate storage facilities and new supplies, and lack of knowledge in the proper disposal of chemicals. This lack of awareness was not necessarily limited to science teachers, but could possibly apply to industrial arts teachers as well, since they also utilize toxic substances.

Industry appeared to offer the greatest protection of and most literature pertaining to chemical handling, storage, toxicity, and related safety measures in the form of OSHA standards. OSHA requires that employers must provide work environments that are free from safety hazards and has set provisions for the enforcement of OSHA standards, as well as strict penalties for noncompliance (Strong, 1975, p.242). Both employers and their workers are aware of the standardized procedures for the safe and proper storage of toxic materials, and are thus protected from most potential hazards that may result from ignorance or negligence. When it is considered that teachers are

twice as likely to be injured in classroom teaching than if employed in a steel mill (Strong, 1975, p359), and that too many students and instructors are unnecessarily injured in vocational and industrial arts laboratories, the need for safety standards and means of enforcement cannot be overemphasized.

SUMMARY

It was the author's contention that the initial step in developing awareness of the proper storage and handling of toxic materials was to determine the degree of awareness that teachers presently possessed. To accomplish this, teachers from the Tidewater area of Virginia were selected and randomly surveyed. The methods utilized in conducting the survey and the procedures for tabulation of the results were elaborated upon in Chapter Three. The survey results determined what actions, if any, were needed to be taken to develop greater awareness.

CHAPTER THREE

METHODS AND PROCEDURES

SELECTING THE POPULATION

The subjects chosen for this research study were Tidewater industrial arts teachers selected at random from the Virginia Industrial Arts Directory 1980. A random numbers table was used to select the population to be surveyed. Twenty-five per cent, or seventy of the 278 industrial arts teachers in Tidewater were selected.

DATA COLLECTION

The instrument used in the collection of data was a survey, in which the degree of awareness of proper handling and storage of toxic materials was measured. The survey consisted of ten questions, in the form of checklists or short answers questions, pertaining to the safety devices utilized in the industrial arts facilities, where materials were stored and what type of storage facilities existed, who handled the materials, and the extent of awareness. Appendix B contains a sample of the survey instrument.

The survey was administered as a mail questionnaire, in which respondents were asked to mark the most appropriate response or set of responses for each question. The responses were categorized and tabulated for analysis in Chapter Four. The surveys were sent on June 1, 1980, with a requested deadline of June 10, 1980. Since seventy-five per cent of the population responded, a follow-up letter was not sent to those who did not respond.

DATA ANALYSIS

The data was compiled in a series of tables, which indicated the number of respondents for each answer and what percentage of the population they represented. Each table was accompanied by further explanations.

From the survey results, the findings determined what knowledge existed toward the safe use of toxic materials and what recommendations were developed to increase teacher awareness of the safe and proper usage of toxic materials. The findings of the survey instrument were elaborated upon in Chapter Four and summarized along with conclusions and appropriate recommendations for further action in Chapter Five.

CHAPTER FOUR

The purpose of this study was to determine the awareness of Tidewater industrial arts teachers of the procedures for the proper handling procedures of toxic substances.

This chapter contained the selected responses of the toxic substance survey and the tabulation of the survey results. The population consisted of the Tidewater industrial arts teachers, approximately twenty-five percent of whom were selected at random to participate in the survey. Of the participants, fifty-three or seventy-five percent of the teachers responded to the survey. Nine of the surveys were discounted because less than two-thirds of the questions were answered. The survey results were tabulated and summarized in the following sections.

Table I

Question I. Circle which of the following material areas you utilize in Industrial Arts:

	Responses
Automotives.....	5
Drafting.....	12
Metals.....	19
Graphic Arts.....	3
Plastics.....	9
Woodworking.....	22
Other.....	10

The woodworking and metals areas were most utilized and the graphic arts area was the least used. Under the category of "other", such areas as Crafts, Small Engines, Electronics, Leather, and Surveying were listed.

Table II

Question 2. Check the following materials stored or utilized
in your shop which you know to be toxic and have
harmful side effects:

Group A 35 Responses

Benzene

Paint Thinner

Lacquer Thinner

Alcohol

Group B 2 Responses

Plate Developers

Offset Chemicals

Fixative

Film Developers

Group C 15 Responses

Ammonia

Bleach

Parts Cleaner

Group D 39 Responses

Paint Stripper

Paint

Lacquer

Enamel Paints

Linseed Oil

Group E 15 Responses

Gas Welding Materials

Arc Welding Materials

Metals

Acids

Table II. continued

Group F	23 Responses
Glazes	
Plastics	
Cohesives	
Adhesives	

The toxic materials most frequently utilized were in Group D, which included paints, paint stripper, lacquer, enamel paints, and linseed oil. The materials in Group A were also frequently utilized. The materials least utilized were in Group B, those materials related to the graphic arts area.

Table III

Question 3. Are all supplies and materials you utilize labeled with regard to potential hazards?

Yes.....	23	or	53%
No.....	18	or	42%
Unsure.....	2	or	5%

A total of forty-three respondents answered the above question, with the majority of responses indicating that supplies and materials were adequately labeled with regard to potential hazards.

Table IV

Question 4. Who informs you of the potential hazards in the storing and handling of materials?

	Responses
Administrator.....	4
Supervisor.....	9
Department Chairman.....	7
Sales/Technical Representative.....	6
No one.....	20
Other.....	6

Most of the instructors were informed by one or more sources of potential hazards. In 9 cases, it was the supervisor who informed the instructors, followed by the department chairman with 7 cases. In twenty instances, no one informed the instructor of potential hazards. In the category of "other", the fire marshall, nurse, or personal experience served to inform the instructor. At total of forty-four persons responded to this question.

Table V

Question 5. Who stores and handles materials in your shop?

	Responses	Percentage
Instructor Only.....	16.....	36%
Student Ass't and Instructor...6.....	6.....	13%
Instructor and All Students....19.....	19.....	43%
Students Only.....	1.....	2%
Not Responding.....	2.....	4%

In almost half, or forty-three per cent of the responses the instructor and all students utilized materials in the shop. In twenty-two cases, the instructor alone, or with the student assistant, utilized the materials. In only one instance were the

students the sole users of the materials. Two of the survey participants did not respond to this question.

Table VI

Question 6. Do your facilities include metal shelves or cabinets in which to store toxic materials?

	Responses	Percentage
Yes.....	38.....	86%
No.....	6.....	14%

44 Responses

Eighty-six per cent of the respondents stated that their facilities did provide metal shelves or cabinets in which to store toxic materials. In only six cases, were they not provided.

Table VII

Question 7. Which of the following are present in your shop facilities?

	Responses
Adequate Ventilation and Air Exchange	24
Face Masks.....	8
Respirators/Dust Masks.....	9
Closed Metal Containers.....	24
Spray Booth.....	15
Safety Glasses.....	34
Safety Aprons.....	20

Each of the safety devices were present in the different industrial arts facilities. The safety features found most frequently were safety glasses, closed metal containers, and safety aprons.

Table VIII

Question 8. Do you feel that you possess adequate knowledge of the hazards and harmful side effects of storing and handling toxic materials improperly?

	Responses	Percentage
Yes.....	26.....	59%
No.....	15.....	34%
No Response.....	3.....	7%

44 Responses

The majority of teachers, fifty-nine per cent, felt they possessed adequate knowledge in the use and storage of toxic materials. Thirty-four per cent however, did not feel confident in their knowledge. Of a total of forty-four responses, seven per cent of the respondents did not respond to this question.

Table IX

Question 9. Would you like to have a safety instructor visit your facilities and recommend proper procedures for handling and storing materials?

	Responses	Percentage
Yes.....	24.....	54%
No.....	18.....	41%
No Response.....	2.....	5%

44 Responses

Slightly more than half of the respondents, or fifty-four per cent stated that they were willing to have a safety inspector visit their facilities and make recommendations for safety improvements. Eighteen of the total forty-four respondents were not willing and two survey participants did not respond to this question.

Table X

Question 10. Would you attend an inservice program on the proper labeling, storage, and use of toxic materials?

	Responses	Percentage
Yes.....	31.....	70%
No.....	11.....	20%
Unsure.....	2.....	5%

Seventy per cent of the total forty-four respondents stated that they would attend an inservice program on the use, storage,

and handling of toxic materials, while only twenty-five per cent stated they were interested in an inservice program. Two respondents wrote in a third category, "Unsure", in answer to the question.

SUMMARY

Forty-four respondents participated in the toxic materials survey, which consisted of ten short answer questions. The results were tabulated and listed in a series of tables. The following chapter will summarize the research conducted, draw conclusions from the survey results, and make recommendations for improvements.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter was a summary of the problem researched, the background pertaining to the problem, the selection of the population, the survey instrument, results, and the conclusions drawn from the study. Recommendations for further action follow the research study conclusions.

SUMMARY

The purpose of the study was to determine the awareness of Tidewater industrial arts teachers of the procedures for proper handling of toxic materials. The need for this study stemmed from a lack of information on occupational health guidelines for use of toxic materials in industrial arts laboratories. The study was limited to the Tidewater area of Virginia and the industrial arts teachers working in this locale.

Twenty-five per cent of the Tidewater industrial arts teachers were selected at random to complete the toxic materials and handling survey. The closed-form questionnaire was the instrument used for the survey. Seventy-five per cent of the surveys were returned and used in tabulating results. The results were listed in a series of tables which showed the percentage of respondents for each selection and the total number of respondents.

CONCLUSIONS

In this particular research study, the findings showed the following:

1. The woodworking and metals areas were the most utilized in Tidewater industrial arts facilities. Since both of these areas include many processes utilizing toxic substances, the instructors working in these areas should possess sufficient knowledge of the safe use and storage of toxic materials.

2. The toxic materials most frequently used were those associated with finishing processes.

3. Almost half, or forty-two per cent, of all Tidewater industrial arts teachers stated that their materials and supplies were not properly labeled. This indicates a potential for great misuse and abuse of the supplies, as well as a potential hazard.

4. Most of the instructors were informed of potential hazards by their supervisors. Almost half, or forty-seven per cent, were not informed of any hazards, either by their supervisors, department chairmen, or other informed persons. Since the department chairmen informed the teacher teachers in only fourteen per cent of the cases, greater efforts must be made to ensure that the department chairmen disseminate such such information.

5. Most industrial arts facilities were equipped with metal storage cabinets or shelves, safety attire, and adequate ventilation.

6. Thirty-six per cent of the teachers did not feel that they possessed adequate knowledge of the harmful side effects of improper use and storage of toxic materials, yet the same percentage of teachers gave a negative response toward shop visitations by a safety inspector; it is surmised that the individuals were either disinterested in safety conditions or they did not wish to have their facilities inspected by outside agencies.

7. Though sixty-nine per cent of the teachers felt they possessed adequate knowledge of the hazards associated with the use of toxic materials, the majority of the teachers surveyed, or sixty-three per cent, were interested in attending an in-service program on this topic. This indicates not only concern on the part of the teachers, but also an interest in increasing their awareness.

8. Thirty-eight per cent of the respondents indicated that they were the only individuals in the laboratory who utilized or handled toxic materials; either these respondents misinterpreted the question, or the students performed few tasks utilizing materials in these facilities.

RECOMMENDATIONS

Though the study was limited in scope, it did generate some important issues. Based upon the findings and conclusions, the following recommendations were submitted:

1. Further investigative research must be conducted to determine what substances are most commonly found in each of the material areas in industrial arts, and what the potential hazards are in their utilization.

2. Objectives and program goals pertaining to the safe handling and storage of toxic materials should be incorporated and implemented in teacher preparatory programs.

3. Specific guidelines should be established at the state and local levels for the safe storage and use of toxic materials in industrial arts facilities. Means of enforcement should also be established.

4. In-service programs and workshops should be conducted to properly inform teachers of specific safety guidelines to follow and of the proper procedures for working with toxic materials.

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Appendix A

Dear Fellow Industrial Arts Educator:

Because of the dramatic increase in the discoveries of cancer-causing agents and substances which cause skin irritations, lung inflammations, and other physical disturbances, I feel it necessary to determine the awareness of industrial arts teachers of the proper handling and storage of toxic materials.

Improper handling and storage of materials often is not due to neglect, but to a lack of knowledge of each particular material and its possible hazards. It is the intent of this survey to determine what knowledge exists as well as what safety precautions are presently being taken in shop facilities. Survey results will be used in recommendations for further education, written materials and guidelines, and possible in-service programs.

Please fill out the enclosed survey and return it in the stamped, self-addressed envelope no later than June 10, 1980. The survey will be used to gather information and determine what recommendations need to be made. Thank you for your time and consideration in this matter. Your participation will make a difference, for you and your students.

Sincerely,

Brigitte Graudins
Brigitte Graudins

Appendix B

Materials Handling and Storage Survey

Purpose: To determine the awareness of Industrial Arts teachers of the procedures for proper handling and storage of toxic materials.

Instructions: Select the answer(s) which most pertain to your current classroom situation. All answers will be kept confidential and will be used solely for gathering information.

1. Circle which of the following material areas you utilize in

Industrial Arts:

Automotives Drafting Graphic Arts, Metals Plastics

Woods Other _____

2. Check the following materials stored or utilized in your shop which you know are toxic and may have harmful side effects:

<input type="checkbox"/> Benzene	<input type="checkbox"/> Plate Developers	<input type="checkbox"/> Ammonia
<input type="checkbox"/> Paint Thinner	<input type="checkbox"/> Offset Chemicals	<input type="checkbox"/> Bleach
<input type="checkbox"/> Lacquer Thinner	<input type="checkbox"/> Fixative	<input type="checkbox"/> Parts Cleaner
<input type="checkbox"/> Alcohol	<input type="checkbox"/> Film Developers	
 <input type="checkbox"/> Paint Stripper	 <input type="checkbox"/> Gas Welding Materials	 <input type="checkbox"/> Glazes
<input type="checkbox"/> Paint	<input type="checkbox"/> Arc Welding Materials	<input type="checkbox"/> Plastics
<input type="checkbox"/> Lacquer	<input type="checkbox"/> Metals	<input type="checkbox"/> Cohesives
<input type="checkbox"/> Enamel Paints	<input type="checkbox"/> Acids	<input type="checkbox"/> Adhesives
<input type="checkbox"/> Linseed Oil		

3. Are all supplies and material you utilize labeled with regard to potential hazards?

☐ Yes. ☐ No

4. Who informs you of the potential hazards in the storing and handling of materials?

☐ Administrator
☐ Supervisor
☐ Department Chairman
☐ Sales/Technical Representative
☐ No one
☐ Other (Please Specify)

5. Who stores and handles materials in your shop?
- ☐ Instructor Only
 - ☐ Student Assistant and Instructor Only
 - ☐ Instructor and All Students
 - ☐ Students Only
6. Do your facilities include metal shelves or cabinets in which to store toxic materials?
- ☐ Yes ☐ No
7. Which of the following are present in your shop facilities?
- ☐ Adequate Ventilation and Air Exchange
 - ☐ Face Masks
 - ☐ Respirators/Dust Masks
 - ☐ Closed Metal Containers for Rags
 - ☐ Spray Booth
 - ☐ Safety Glasses or Goggles
 - ☐ Safety Aprons
8. Do you feel that you possess adequate knowledge of the hazards and harmful side effects of storing and handling toxic materials improperly?
- ☐ Yes ☐ No
9. Would you like to have a safety inspector visit your facilities and recommend proper procedures for handling and storing materials?
- ☐ Yes ☐ No
10. Would you attend an inservice program on the proper labeling, storage, and use of toxic materials?
- ☐ Yes ☐ No