

*Journal of*

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# **INDUSTRIAL TECHNOLOGY**

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*Volume 25, Number 1 - January 2009 through March 2009*

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## ***Evaluation of the Safety Content in the National Association of Industrial Technology Certification Exam***

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*Peer-Refereed Paper  
Pedagogical Research*

**KEYWORD SEARCH**

**Assessment  
Certification  
NAIT  
Professional Development  
Safety**

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# Evaluation of the Safety Content in the National Association of Industrial Technology Certification Exam

By Dr. Steven A. Freeman, Dr. Dennis W. Field, Chandra W. Lott, & Dr. Charles V. Schwab

## Abstract

This study addresses the safety portion of the National Association of Industrial Technology (NAIT) Certification exam. NAIT promotes the field of industrial technology in education, business, and industry. Certification is the recognition of voluntarily achieved standards by the profession that created the proposed standards. Certification programs are used to define a required body of knowledge and skills, and establish common performance standards. The NAIT certification exam began its initial development in the 1990s. Since its development, the safety portion of the certification exam has not been reevaluated critically. A survey with an expert panel was used to determine if the safety content of the NAIT certification exam was still appropriate. Participants, made up of members of the NAIT Safety Division, identified 30 safety topics as being important enough to be represented in the safety portion of the NAIT certification exam. This study concluded that while terminology may have changed slightly, the safety topics covered on the NAIT certification exam are still relevant and current.

## Introduction

NAIT is a professional membership organization dedicated to the establishment and maintenance of professional standards for industrial technologists, and the certification program was established to acknowledge an individual's knowledge, skills, and professional development in the field of industrial technology (Field & Rowe, 2001).

The NAIT certification exam was initially developed in the 1990s under

the direction of Dr. Clois Kicklighter using a Delphi method to determine the appropriate content for the exam. The Delphi method was used to collect data from the various academic institutions across the United States that had industrial technology programs, without bringing participants to one central location. Three iterations of the Delphi process were conducted. The results of the study were reported internally to NAIT in October 1991. Eight major exam content areas were identified from that study: (1) Quality Control; (2) Production Planning and Control; (3) Industrial Supervision; (4) Industrial Finance and Accounting; (5) Industrial Safety Management; (6) Plant Layout and Materials Handling; (7) Time and Motion Study; and (8) Industrial Communications (C. Kicklighter, personal communication, October 10, 1991). These eight content areas were reduced to six by eliminating "Industrial Finance and Accounting" and "Plant Layout and Materials Handling" as stand-alone content areas during the initial developmental cycle of the exam between October 1993 and March 1995. Ultimately, the number of stand-alone content areas was reduced to four by dropping "Time and Motion Study" and "Industrial Communications" as stand-alone areas during final pretesting of the exam. The remaining areas of concentration included: (1) Production Planning and Control, (2) Quality Control, (3) Safety, and (4) Supervision/Administration.

A modified Delphi method was used by Rowe (2001) in her efforts to identify core content, subject area, and competency information needed to update

the NAIT Certification examination. Two Delphi Rounds were conducted by Rowe in which 13 panelists identified 13 core competency areas, including: Leadership Skills for Supervisors, Teamwork, Fundamentals of Management, Technical Graphics/CAD, Quality, Industrial Accounting, Electronics, Human Resource Management, Technical Writing, Written Communication, Verbal Communication, Manufacturing Technology, and Safety Management.

Additionally, Miller, Heidari, and Marsh (2004) completed a survey of Industrial Technology Department Chairs across the country, and reported that Industrial Safety received 100-percent affirmative responses when Chairs were asked: "Do you feel that industrial safety should be covered on this [certification] exam?" In fact, industrial safety was the only content area from among 27 content areas surveyed that received 100-percent affirmative responses. Based on all the aforementioned studies, safety is clearly a critical competency area for Industrial Technologists.

It is perhaps also useful to provide a brief overview of certification as it relates to this development effort. As Jaffeson (2001) indicates, certification is voluntary approval and recognition of achievements by individuals in a profession or occupation based on requirements deemed appropriate by its representative association. It should be noted that these requirements are not simply the knowledge, skills, and attributes needed to enter a profession, but can and do address life-long learning aspects needed to maintain competency and to stay current with advances in the field. Vassos and Smith (2001, p. 15) make the appropriate observation that: "Life-long learning is essential to a professional, particularly considering the rapid introduction of new technologies and the advances occurring in scientific and engineering knowledge."

One can certainly find evidence that there is support for the concept of certification. For example, Pare (1996) believes that the fact that an individual

is certified may be the best indicator how qualified a potential or current employee is. Vassos and Smith (2001) report that certification of the environmental industry has been proposed in both Canada and the U.S.A. as a method of assuring the quality of work carried out. Ogolla and Cioffi (2007) cite studies from education literature linking certification of teachers with improved student performance. Additionally, Barnhardt (1994) states that professional certification helps both the individual and the organization, and reports that there are over 1,500 certification programs in the United States that represent a wide range of industries and professions. The sheer number of certification programs supports the premise that certification is viewed favorably by individuals in a wide variety of occupations regardless of the time and effort needed to achieve certification. From an individual's perspective, the perceived value of certification programs can include both intrinsic and extrinsic value items. Bekemeier (2007, p. 442) lists a few of the variables in each case, including intrinsic variables such as personal satisfaction, growth, challenge, and feelings of accomplishment and commitment; and extrinsic variables such as the potential for increased salary, employer recognition, and consumer confidence.

### **Certification Programs**

While the concept of certification is not unique, the requirements and administration of many individual programs are distinctive. Barnhardt (1994), for example, reviewed 450 certification programs and was unable to come up with a comprehensive classification that would apply to every program. Many certification programs use education and experience as certification criteria, while others may require only one or the other, and in some cases neither. The designators used for certification differ in meaning as well as the criteria established to define them. For example, in some cases, the term "Certified" actually refers to a state issued license. In point of fact, the terms certification, licensure, and accreditation all have different meanings and should not

be confused. Certification provides assurances about an individual, while accreditation provides assurances about institutions. Licensure programs are managed by a state or government agency, and restrict a profession to individuals who meet minimum state requirements.

### **Purpose of the Study**

The purpose of this study is twofold: (1) To determine if the safety portion of the NAIT certification exam is addressing the appropriate safety topics; and (2) To make recommendations based on the findings of this study to the NAIT Board of Certification.

### **Methods**

A survey, patterned in some respects after the Delphi method, was proposed to determine if the safety portion of the NAIT certification exam is addressing the appropriate content. After identifying the participants, the first survey was created to determine the safety topics participants believe are important to technology students. The Round I survey was distributed to participants via e-mail. After participants had provided feedback on the Round I survey and the information was analyzed, the Round II survey was created and distributed to participants. The Round II survey consisted of the safety topics listed from the Round I survey. The information from Round II was analyzed to establish if consensus has been reached. If consensus had not been reached a new survey would be created from the new safety topics identified by participants and the process would repeat itself until consensus is reached.

### **Population and Sample**

The participants selected for this study were all members of the Safety Division of NAIT. NAIT is a professional organization responsible for promoting industrial technology in business, industry, education, and government (NAIT, 2006b). The Safety Division of NAIT is a special interest division that contributes to the overall success of the association's programs and activities (NAIT, 2006a). Its mission is to carry out the purposes and objectives

of NAIT as they apply to personnel employed in safety positions in education, industry, business, and government (NAIT, 2006a). Membership in the Safety Division of NAIT is not mandatory; one has to choose to serve NAIT in this manner. NAIT membership demonstrates a personal interest in the development of NAIT as an organization and voluntary membership in the safety division shows the participant's personal interest in safety as it relates to NAIT.

The president of the Safety Division of NAIT was contacted concerning the purpose of this study and the importance of the division's participation in this study. The president of the Safety Division was asked for an updated e-mail list of all the current members, permission to distribute the survey to the Division, and permission to use his influence to communicate the importance of this study to the Divisions' members. After obtaining a current e-mail list, all safety division members were informed about the study via e-mail. The first survey, Round I, was attached to an e-mail describing the intent and purpose of the study, the importance of participants' feedback to this study, and the NAIT certification exam. The Round II survey was attached to an e-mail that reminded participants of the importance of their expertise to this study and thanked them for their participation.

### **Survey Development and Design**

The purpose of the Round I survey was to identify the safety topics that each participant believed to be important to all technology students and collect demographic information about each participant and their respective programs. From the Round I survey, participant's responses to the question of which safety topics are important to all technology students were compiled together into a single list. The listed safety topics then were grouped into categories. The safety topics collected and categorized from the Round I results were used to construct the Round II survey, where these safety topics were listed in alphabetical order. Figure 1 contains the list

**Figure 1. Round I survey questions.**

What is your current academic position?  
In what areas are your primary teaching responsibilities?  
What degrees and/or options are offered in your program?  
Which of these degrees are NAIT accredited?  
How many safety courses are required for your technology students?  
What are the titles of these courses?  
Please list and/or describe the core occupational safety content areas that you feel are important to all technology students in your program.

of questions participants were asked on the Round I survey.

The purpose of the Round II survey is to identify the safety topics that participants believe should be represented in the safety section of the NAIT certification exam. The Round II survey gave participants the opportunity to see the safety topics identified by participants from the Round I survey. Space was provided for participants to rank the safety topics they agreed should be represented on the NAIT certification exam and add any safety topics they felt were not represented in the Round I results. The participants also were instructed to rank all safety topics on the survey by importance, including any safety topics added to the original list of Round I results. For example, if one person felt only 25 of the safety topics were of importance, his/her rankings should be from 1 to 25, with 1 indicating the topic of highest importance.

### **Data Collection and Analysis**

The safety topics identified from the Round I survey were compiled into a single list. The listed safety topics then were analyzed and potentially combined into categories based on key terms found in each safety topic. For example, if the key term was "OSHA," then the safety topics containing "OSHA" were examined and potentially combined into one category. The list of combined safety topics then was used to develop the Round II survey. The Round II survey was e-mailed to the participant's who responded to the Round I survey. Upon receiving and analyzing the Round II results, participants were contacted via e-mail and

asked to provide their credentials in the form of vitas.

The participants' individual rankings were placed next to the appropriate safety topic in the Round II survey and the following descriptive statistics were calculated in order to obtain a sense of the group's opinion of each safety topic: mean, sample standard deviation, median, and number of responses. Given that lower numbers are indicative of higher importance in the minds of the participants, topics with lower mean (or median) values are deemed more important than topics with higher mean (or median) values. Additionally, the value of the standard deviation provides some insight into the consistency of the rankings among participants, and large differences between the mean and median values can be an indication of outliers in the data. Finally, the number of participants ranking a topic, regardless of the positional value on the list, can be used as a rough measure of importance. One can argue about what should be the weights assigned to each category, however, ideally, topics of highest perceived importance would be those with the lowest mean and median values, small discrepancies between the mean and median values, low standard deviations, and high response counts. These statistics can then be used to assign a priority order to each safety topic on the Round II survey.

## **Results and Discussion**

### **Description of Participant Sample**

The participants for this study were the 53 members of the NAIT Safety Division at the time of the survey. The participants in this study hold certifications



with nationally known organizations, such as the Board of Certified Safety Professionals (BCSP), the National Association of Industrial Technology (NAIT), the Department of Labor, and the Occupational Health and Safety Administration. Aside from being active members of NAIT, participants also hold memberships in other professional safety organizations, such as the American Society of Safety Engineers (ASSE) and the National Safety Council (NSC). On average, each participant is involved in two or more professional organizations and holds two current certifications. Participants also have published and/or presented research in the areas of safety, health, and technology in peer-reviewed journals or books, or at professional conferences. Barnhardt (1994) states that obtaining a certification in one's field shows commitment and motivation to that profession, and those individuals who are certified are more involved in their profession and more aware of the constant changes in the profession.

### **Round I Survey**

The Round I survey was e-mailed to the 53 members of the NAIT Safety Division. The response rate was 25%, for a total of 13 responses—ten from academia and three from industry. Participants in educational positions teach in the following areas: occupational safety and health, fire safety, aviation safety, agricultural safety, manufacturing, industrial management, facility planning, industrial safety, manufacturing technology, environmental health, hazardous materials, and manufacturing technology. Industry participants had training experience in OSHA requirements and plant safety, and hold specialized positions in areas related to safety.

From the Round I survey, participants identified 22 degrees, eight options, and three minors as undergraduate programs offered at their institutions. Of the undergraduate programs represented, 14 held accreditations from NAIT. Additionally, 14 degree programs required students to take one or more safety courses.

**Figure 2. Safety categories and topics identified in Round I.**

- Accident investigation
- Causes for injuries and/or incidents
- Construction safety
- Development of safety policies and programs
- Emergency action plans
- Emergency response
- Employee involvement in safety programs
- Engineering controls for hazards
- Ergonomics
- Fire safety
- Hazard communications
- Hazard identification, analysis, and assessment
- Hazardous materials
- Industrial hygiene
- Injury prevention
- Job safety analysis
- Lifting techniques/back safety
- Lockout/tag out
- Machine guarding
- Noise and vibration
- OSHA rules and regulations
- Personal safety
- Process safety management
- Record keeping
- Safety attitudes
- Safety inspection/audits
- Safety program management
- Safety training
- Selection of PPE
- Workers' compensation

The Round I survey also contained a list of safety topics each participant believed was important to all technology students. First, the safety topics identified in the Round I survey were combined by grouping them into categories based on key terms found in each safety topic listed by participants. For example, if the key term was "construction," then all safety topics containing "construction" (e.g., construction safety, construction safety fundamentals, excavations, etc.) were examined and potentially combined into that category. After the categories were formed based on key terms, the entire list of safety topics was analyzed to see if any other safety topics could be listed under the categories identified by this process. This process resulted in some safety topics being listed under multiple categories. After each safety topic had been placed in the appropriate

categories, the category was evaluated to determine if the title represented each list of safety topics. The final list of safety topics/categories from Round I are listed in Figure 2.

### **Round II Survey**

Items in the Round II survey were the participants' opinions from the Round I survey. After analyzing the listed safety topics from the Round I survey, 30 safety topics were identified. The safety topics then were listed in alphabetical order in the Round II survey and e-mailed to participants. The participants then acknowledged and ranked the safety topics that they felt should be represented on the NAIT certification exam. They also were given the opportunity to add any safety topic(s) they believed should be included but were not represented on the Round II survey.

The Round II survey was sent to the 13 participants who had responded to the Round I survey. Ten participants, a 77% rate of return, responded to the Round II survey. Two participants ranked all of the safety topics, indicating they believed all of the items should be represented in the safety portion of the NAIT certification exam. The other eight participants felt that one or more of the safety topics on the Round II survey were not important enough to be represented on the safety portion of the NAIT certification exam. One of these participants ranked some of the safety topics as tied, indicating they were seen as equal to one another. No safety topics were added to the Round II survey, indicating that participants believed all relevant safety topics were addressed in the original list.

**Analysis of Consensus**

After analyzing the responses of the Round II survey, all safety topics identified were assigned a ranking by participants in the study. Since all safety topics were ranked by two or more participants, all were seen as important and were not removed from the list. It was concluded that participants had reached consensus that the safety topics on the Round II survey all were important enough to be represented on the NAIT certification exam. This list was compared to the safety topics currently being addressed on the NAIT certification exam to determine if the appropriate safety topics are being addressed. It was determined that the safety topics on the current NAIT certification exam corresponds with the 30 safety topics identified in this study, indicating that the NAIT certification exam is addressing appropriate safety topics.

Some safety topics identified in this study are identical to the safety topics on the certification exam, such as noise and vibration, safety attitudes, industrial hygiene, and personal safety. Other safety topics can be categorized similar to those topics currently being addressed on the certification exam; for example, safety program management was identified in this study and developing safety policies and programs is a

**Table 1. Participants' priority order of safety topics.**

Safety Topic	Mean	Median	Delta*	Standard Deviation	Count
Causes for injuries and/ or incidents	3.4	3.0	0.4	2.88	9
Hazard identification, analysis and assessment	5.6	3.0	2.6	5.66	8
Engineering controls for hazards	7.9	3.0	4.9	9.49	7
Injury prevention	8.2	5.0	3.2	5.97	9
Employee involvement in safety programs	7.5	6.0	1.5	5.10	8
Job safety analysis	9.9	7.0	2.9	6.41	7
OSHA rules and regulations	9.7	7.5	2.2	5.74	10
Safety attitudes	11.2	8.0	3.2	7.98	5
Safety training	9.6	9.0	0.6	6.00	7
Process safety management	9.8	9.5	0.3	2.75	4
Safety inspections/audits	9.9	9.5	0.4	5.49	8
Safety program management	10.2	10.0	0.2	5.17	9
Accident investigation	10.8	10.5	0.3	6.88	8
Emergency response	13.2	11.0	2.2	6.34	5
Hazard communications	12.2	13.0	-0.8	6.21	10
Construction safety	15.6	13.0	2.6	8.77	7
Lockout/ tag out	14.3	13.5	0.8	6.86	10
Noise and vibration	14.6	14.0	0.6	4.03	9
Selection of PPE	15.8	15.0	0.8	4.74	9
Industrial hygiene	14.4	15.5	-1.1	8.58	8
Hazardous materials	15.8	15.5	0.3	8.33	8
Emergency action plans	14.8	16.0	-1.2	6.83	9
Personal safety	17.7	16.0	1.7	7.36	7
Lifting techniques/back safety	19.0	16.5	2.5	7.38	6
Development of safety policies and programs	13.6	17.0	-3.4	9.84	8
Ergonomics	15.3	17.5	-2.2	5.81	10
Fire safety	15.4	18.0	-2.6	6.57	10
Record keeping	18.5	20.0	-1.5	8.67	8
Machine guarding	19.3	21.0	-1.8	6.18	8
Workers compensation	21.6	24.0	-2.4	7.68	7

\* Mean - Median

topic currently being addressed. Injury prevention in this study corresponds to the accident prevention topic on the current exam. This change represents an update in terminology. Similarities like these exist between the content on

the NAIT certification exam and the safety topics identified by this study. There also were safety topics on the NAIT certification exam that were not listed by participants in this study, such as electrical hazards and appraising

safety practices; however, these safety topics are embedded in the safety topics identified by this study.

### ***Analysis of Participants' Rankings***

As previously mentioned, means, medians, standard deviations, and number of times the topics were ranked (the count) were used to assign a priority order to each safety topic.

Participants' opinions on the safety topics identified in Round II varied. Participants' opinions varied on the inclusion of safety topics, as well as, the importance of safety topics. Because participants did not assign individual rankings to all safety topics in Round II, safety topics were placed in order of importance based first on the median value, next on the mean value, thirdly on the value of the standard deviation, and finally on the count, as shown in Table 1. Although the safety topics are placed in priority order based on the above mentioned criteria, obtaining consensus on the order of importance was beyond the goals of this study. Table 1 includes the safety topics listed in general priority order.

The five safety topics that received the lowest median ranks (indicating the highest priority by those who ranked them) were: Causes of injuries and/or incidents; Hazard identification, analysis, and assessment; Engineering controls for hazards; Injury prevention; and Employee involvement in safety programs.

### ***Conclusions***

This study analyzed the safety topics of the NAIT certification exam and offers some insight into the significance of safety topics at the forefront of industry and academia. The findings of this study have determined that the 30 safety topics identified by this study are represented currently on the NAIT certification exam. These topics represent the current safety topics being addressed in academia and industry. This study has determined that the safety

portion of the NAIT certification exam is addressing the appropriate content.

### ***Recommendations***

The NAIT Board of Certification should consider conducting more in-depth research on the importance of safety topics. This research would help NAIT identify the safety topics that are most important to the discipline. Research in this area would help NAIT determine questions to add to and/or remove from the certification exam. Research in this area would also assist in evaluating the safety questions on the current exam and developing new questions for the next generation exam. While it has been determined that the safety topics represented on the NAIT certification exam are both current and relevant, research can be conducted to further define the content, and allocation of content (number of questions) with respect to each safety topic identified in this study. This would allow NAIT to target an appropriate number of safety content related questions and develop additional safety questions relevant to the certification exam for an exam item bank. From this research, the Board of Certification could achieve its goal of increasing the item bank for its exam.

NAIT also should look to other professional organizations with similar interests to participate in current research to develop new exam questions or specialized certification exams. Students who graduate from industrial technology programs are employed in various technological careers, and seeking input from other technology-oriented professions could help NAIT identify other topics that may be of interest to its future examinees. Finally, NAIT should also look at the current content of other portions of certification exam to ensure the validity and current relevancy of all content included in the exam.

### ***Further Suggestions to the NAIT Board of Certification***

Based on this study, the authors recommend that the NAIT Board of Certification review and update individual

questions currently included in the certification exam to ensure that the questions are appropriate and reflect the current body of knowledge. Additionally, while not one of the original goals of this research, it became clear that the terminology used on the safety portion in the current NAIT certification exam needs to be updated to reflect changes in the profession.

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