Antwerp Maritime Academy

Mapping Perceived Competence in Maritime Fire Safety: An Exploratory Group-Based Study

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FOREWORD

This study stems from a strong interest in practical competence and the ongoing need to harmonize industry practices with initial training in a fast-evolving professional context.. I am convinced that maritime students have a unique and valuable role to play as intermediaries between the academic world and professional practice. By involving them meaningfully, we can contribute constructively to the continuous improvement of maritime education.

In today's evolving professional landscape, where soft skills often take center stage, it is crucial not to lose sight of hard skills—especially in critical domains such as fire safety on board ships. Practical skills in inspection, testing, and maintenance are fundamental to ensuring the safety and operational readiness of vessels.

Guiding this work has been the inspiring principle expressed by Michel de Montaigne: *"To teach is not about filling a vase, but lighting a fire."*

This idea reflects my sincere hope that this research will not only contribute with data and methods but also ignite further reflection, learning, and improvement among educators, students, and industry professionals alike.

USE OF AI TOOLS

Throughout this thesis, I have employed AI-based language tools primarily to enhance the clarity, conciseness, and academic tone of the text, as English is not my native language. Most of my prompts focused on refining and compacting longer passages I initially wrote, enabling me to extract and express the core ideas more effectively. Additionally, I used AI to critically challenge and refine my conclusions, results, and interpretations, simulating the rigorous scrutiny one might expect from a serious academic jury or professor.

Importantly, all core intellectual and technical aspects of this research—such as the creation and detailed organization of the practical skills mapping, the design and manual deployment of the survey, the processing and manual analysis of collected data, and the development of the threshold-setting method—are entirely my own work.

The Excel tools were personally built cell by cell. The original dual approach combining data-driven and section-driven analysis, the grouping of sections and subsections, as well as the conclusions drawn, reflect my individual contributions.

ABSTRACT

This exploratory study aimed to design and analyze a self-assessment instrument for evaluating fire safety competencies within the maritime sector.

The research followed a structured multi-phase approach, beginning with the development of a competency framework grounded in international regulatory references and complemented by informal insights from maritime profesionnals. This inductive mapping process provided the foundation for the creation of a structured survey instrument.

The survey collected self-assessed data from 17 early-career or in-training maritime professionals, focusing on three key dimensions: self-assessed confidence, perceived importance, and learning source for each competency. Likert-type scales were used to capture subjective perceptions in a format commonly employed in readiness assessment studies.

Descriptive statistics (mean, standard deviation) were applied to explore central tendencies and patterns across the dataset. A cross-sectional analysis revealed relationships between variables, suggesting relevant patterns. An empirical categorization scheme, based on observed trends suggested potential areas of perceived mastery as well as potential operational blind spots.

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Chapter 1 INTRODUCTION

Between 2017 and 2021, fires and explosions accounted for 18% of insurance claims worldwide in the maritime sector, with the total value of these claims reaching approximately 1.66 billion euros. As shown in Figure 1, in 2022 alone, eight vessels were declared total losses as a direct result of fire and explosion incidents, underscoring the persistent and severe risks posed by onboard fires as described in the *Safety and Shipping Review 2023* published by Allianz (2023)

Preventing such catastrophic events requires a comprehensive approach encompassing fire prevention strategies, crew certification and fitness, ongoing training and drills, and above all, operational readiness and maintenance of fire safety systems.

International regulations, notably SOLAS (International Maritime Organization, 1974), specifically Chapter II-2, Regulation 14, emphasize these responsibilities by mandating that fire protection and fire-fighting systems and appliances must be maintained in a ready-to-use condition and be subjected to regular and proper testing and inspection:

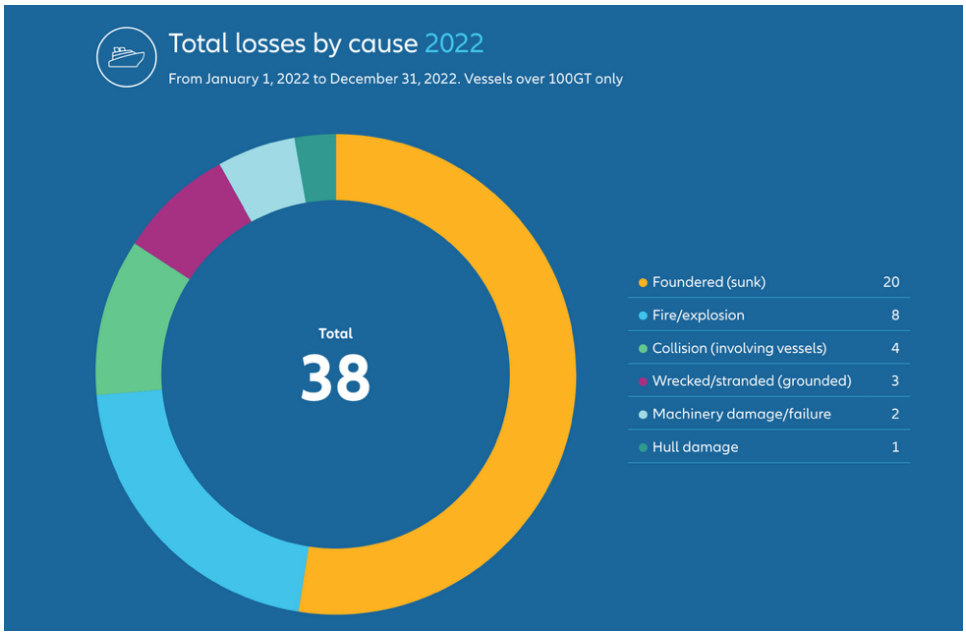


Figure 1 Total losses by cause in 2022

Source: Safety and Shipping Review 2023 (2023)

Ensuring the operational readiness of fire safety equipment hinges critically on the competences of maritime personnel in carrying out inspection, testing, and maintenance tasks.

However, previous studies tend to indicate that gaps remain between standards of training and real-world operational practices. (de Rocca Serra, 2024)

This study proposes an exploratory, perception-based approach to address these discrepancies by developing a systematic and replicable method for identifying perceived strengths, weaknesses, and blind spots in fire safety–related competencies

This research includes the building a mapping of practical skills, the designing and implementing a survey to capture self-assessed confidence and perceived importance of these skills among maritime professionals, and a dual-analysis combining data-driven and structure-based perspectives.

Chapter 2 CREATION OF A MAPPING

The objective of this chapter is to develop a detailed mapping that encompasses the practical skills required for the inspection, testing, and maintenance of fire-fighting and fire-detection systems on board merchant vessels.

The mapping aims to reflect the full range of items encountered during the routine duties of a safety officer and is not restricted to a specific type of vessel.

It must be sufficiently comprehensive to ensure exhaustive coverage of relevant topics, while remaining concise enough to be realistically completed by respondents.

2.1 Scope of the mapping

Defining what constitutes a "practical item" within the scope of this mapping posed a challenge, as the boundary between theoretical knowledge and practical application is not always clearly defined.

To ensure clarity and relevance, two guiding principles were adopted:

1) Focus on operational elements:

Priority was given to tangible, actionable items—specifically, skills, procedures, and actions that can be directly applied in the field. This approach intentionally excludes abstract or overly theoretical knowledge.

Examples include:

- Actions (e.g, lapping a leaking valve)
- Knowledge directly related to the inspection, maintenance and testing of fire-fighting and fire-detection systems and appliances
- Familiarity with components, or the physical layout of a technical systems (e.g., pump, hydrant, …)

- Understanding of distinct physical systems (difference between mist and sprinkler systems)
- Procedural knowledge (conditions for using fixed fire-extinguishing systems)
- Regulatory knowledge when directly related to physical equipment (e.g. what equipment is protected by quick closing valves? What equipment is powered by an emergency generator?)
- Awareness of physical spaces or actions that may pose a fire risk

2) Exclusion of non-pragmatic topics:

Certain subjects were deliberately excluded from the mapping due to their limited operational applicability or because they fell outside the intended scope.

The excluded topics include:

- Squad organization
- Techniques for fire attack or evacuation
- Drill organization and reporting
- Fire investigation and reporting
- Theoretical knowledge about fire behavior (e.g., fire development, fire classifications)
- Regulatory knowledge not directly related to the condition or arrangement of equipment

One notable exception is Section 4.7 (described in chapter 10.5), which assesses respondents' familiarity with the primary sources used to construct the mapping. This serves a data analysis function rather than a content evaluation purpose.

Despite these guiding principles, some ambiguity is inevitable, as certain items inherently straddle the boundary between theory and practice.

2.2 Structure of the mapping

The 123 items included in the mapping are listed in Annex 1. These items have been grouped into 34 sections, organized into four main parts.

The items themselves will be further discussed in Chapter 10 during the section-driven analysis.

2.2.1 Item Notation

The mapping is structured into Parts, Sections, and items. Each item is numbered using the P.S.N format: Part, Section, Number.

Example:

Item 1.2.2 refers to Part 1 (Firefighting), Section 2 (Fire Pumps), item 2 (Knows the difference between a fire pump and an emergency fire pump).

2.2.2 Part 1: Fire Fighting

Part 1 covers the core manual fire-fighting systems and personal protective equipment on board, including the fire main, pumps, hydrants, hoses, firefighter's outfits, and SCBAs. These components form the foundation of direct fire response operations.

Sections included:

- Section 1.1: Fire main
- Section 1.2: Fire pumps
- Section 1.3: Fire hydrants
- Section 1.4: Hoses & nozzles
- Section 1.5: Firefighter's outfits
- Section 1.6: Self-Contained Breathing Apparatus (SCBAs)
- Section 1.7: Portable fire extinguishers
- Section 1.8: International Shore Connection (ISC)

2.2.3 Part 2: Fixed Fire Extinguishing Systems

Part 2 addresses fixed fire-extinguishing installations, including gas, dry chemical, foam, water mist/spray/sprinkler, and aerosol systems. These systems provide semi-automatic or manual fire suppression capabilities.

Sections included:

- Section 2.1: Fixed fire-extinguishing systems (general)
- Section 2.2: Fixed gas extinguishing
- Section 2.3: Fixed dry chemical powder
- Section 2.4: Foam fire-extinguishing systems
- Section 2.5: Water mist, spray, sprinkler systems
- Section 2.6: Fixed aerosol extinguishing systems
- Section 2.7: Galley equipment
- Section 2.8: Paint lockers

2.2.4 Part 3 : Detection, Containment, Auxiliaries

Part 3 focuses on fire detection and containment infrastructure, including alarms, fire doors, ventilation control, quick closing valves, and emergency

generators. These systems support early response and operational continuity during fire incidents.

Sections included:

- Section 3.1: Fixed fire detection and alarm systems
- Section 3.2: Public address and general alarm systems
- Section 3.3: Fire doors and control mechanisms
- Section 3.4: Ventilation systems and fire dampers
- Section 3.5: Quick-closing valves
- Section 3.6: Emergency Diesel Generator (EDG)
- Section 3.7: SCBA compressor

2.2.5 Part 4 : Miscellaneous

Part 4-1 includes escape arrangements and supporting equipment.

Sections included:

- Section 4.1: Emergency escape routes
- Section 4.2: Emergency Escape Breathing Devices (EEBDs)
- Section 4.3: Helideck equipment
- Section 4.4: Portable foam applicators
- Section 4.5: Wheeled mobile extinguishers
- Section 4.6: Fire control station

Part 4.2 evaluates broader knowledge relevant to fire safety management, including regulatory frameworks, technological context, high-risk zones, and ship-specific fire hazards.

Sections included:

- Regulatory framework
- Technology
- Hazardous areas
- Specific risks in machinery spaces
- Fire risks associated with specific ship types

2.3 Origin of the items

For the sake of traceability and transparency, the origin of each item has been documented.

The items were drawn from a range of authoritative sources, including MSC Circulars, industry guidelines, and IMO publications such as *SOLAS* (International Maritime Organization, 1974), (*On Board Training Record Book for Officers in Charge of a Navigational Watch*, 2012) and *Course Model 2.03* (International Maritime Organization, 2001). A list of documents of reference by item is provided in Annex 1. These sources were selected for their operational relevance and regulatory authority.

The following codes are used to identify the sources of the items:

- M: Model Course 2.03 (e.g., M2 = MC 2.03 Chapter 2)
- T: Technology (describes technical components of equipment)
- C: MSC Circulars
- S: SOLAS Chapter II-2 (e.g., S10 = SOLAS II-2 Regulation 10)
- B: Cadet Record Training Book, Chapter 16
- P: Personal experience or informal feedback

Although not designed for statistical analysis, this referencing system is used in Chapter 8 for interpretive purposes.

2.3.1 Items tagged « P »

While the majority of the questionnaire items are derived from formal sources, a minority (tagged with the letter “P”) was included based on firsthand experience at sea or feedback from professionals.

Because this mapping aims at describing real-world operational needs, it was essential to include elements representing practical realities that may not be formally documented. (Eraut *, 2004), (Pilz, 2024)

As part of the item development process, initial drafts of the competency mapping were submitted to experienced navigating personnel for informal feedback. One such draft, included in Annex 5, contains handwritten annotations and comments.

Chapter 3 MAPPING BASED SURVEY

The survey is based on the mapping presented in Annex 1. A PDF version of the survey handed to respondents is presented in Annex 2. This chapter outlines the methodology used to collect data, beginning with the identification of respondents and the approach selected to assess their perceived confidence and the perceived importance of professional competencies.

3.1 Sample size

While large sample sizes are often desirable in quantitative research for statistical power, this study prioritizes depth and relevance of responses over quantity, in alignment with an exploratory approach. (DeVellis, 2017)

The objective is not to generalize findings across populations but to understand trends, perceptions, and internal consistencies within a specific, informed group.

The questionnaire requires careful introspection – such as self-assessments of confidence and perceptions of importance- and completing it demands time and cognitive effort.

In this context, collecting a smaller number of high-quality, motivated responses ensures that the data reflect sincere and thoughtful evaluations, rather than disengaged answers. (DeVellis, 2017), (Stebbins, 2001)

Furthermore, the targeted respondents – such as experienced students or recent graduates - are purposefully chosen for their relevance and familiarity with the subject.

3.2 Respondent profiles and limitations

The sample consists of 17 respondents. While this number is too small for rigorous statistical analysis, it is enough to carry out an exploratory research. (Teresi et al., 2022)

Personnal information was collected solely to identify potential limitations related to a lack of diversity in respondent profiles—not for statistical treatment.

For privacy reasons, all participants were assigned anonymous identifiers, and their names are not disclosed in this study. Recruitment was conducted on a voluntary basis, targeting students currently enrolled in maritime education programs as well as recent graduates.

Respondents provided the following information:

- Name and surname (for administrative tracking only; anonymized during analysis)
- Department: Deck, Engine, or Other
- Current academic level: Bachelor, Master, or Other
- Sea-time: Less than 3 months, 3–6 months, 6–12 months, More than 12 months
- Previous experience on RORO/ROPAX/Tanker vessels: Yes/No
- Experience participating in the inspection, maintenance, or testing of fire-fighting systems or appliances: Yes/No
- Completion of the “Advanced Fire-Fighting” course: Yes/No
- Age bracket: Under 20, 20–25, 26–30, Over 31
- Intention to work as an officer after graduation
- Willingness to be contacted for a follow-up interview

Willingness to be contacted for a follow-up interview has been integrated in the personal information, with the intent to triangulate the results, as described in

Chapter 12. Mixed approaches are more rigourous than conducting a survey or an interview only. (Creswell & Hirose, 2019)

All categories were represented across the sample, with one notable limitation: all respondents are enrolled in Nautical Science programs, and none follow an engineering track.

3.3 Subjective assessment VS formal assessment

Formal assessments—requiring a standardized curriculum, fixed testing protocols, and graded answers—are both time-consuming and prone to biases in question selection and grading criteria. Moreover, they primarily assess theoretical knowledge and often fail to capture practical, context-dependent competence shaped by personal experience and background. (Brown et al., 2015), (Eva & Regehr, 2005)

Instead, this study adopts a subjective methodology, assessing self-assessed confidence in performing professional tasks and the perceived real-world importance of those tasks. This approach facilitates the identification of perceived practical competence. (Shavelson, 2010)

While subjective assessments provide meaningful indicators of learners' readiness and comfort, they also have limitations. Self-perception does not always align with actual ability, and responses may be influenced by cultural, emotional, or contextual factors, including reference bias. (Eva & Regehr, 2005), (Lira et al., 2022).

Consequently, subjective data must be interpreted with caution: they are valuable for identifying broad trends but are not sufficient for drawing specific, actionable conclusions. These limitations were considered throughout the design and analysis of the study.

3.4 Parameters of the survey

Three metrics were included for each item in the survey:

- Self-assessed confidence, measured on a 5-point Likert scale
- Perceived importance, measured on a 3-point Likert scale
- Source of practical knowledge, selected from four options:
    - A: Maritime Academy
    - V: Sea experience onboard a vessel
    - O: Other (e.g., personal learning, informal settings)
    - N: None (no exposure or training)

The source of knowledge metric provides additional context to better interpret the potential gaps identified in the analysis.

3.5 Likert scales used

Likert scales were chosen for their ability to capture nuanced perceptions. (DeVellis, 2017)

A 5-point scale was used for confidence to allow respondents to differnetiate varying levels of self-perceived competence without introducing unnecessary complexity.

Despite the fact that scales with two, three, or four response categories are less reliable and show less consistency (Preston & Colman, 2000), a simpler 3-point scale was used to assess perceived importance—categorized as low, moderate, or high—. The intent was to facilitate decision-making and reduce cognitive load during questionnaire completion.

Fully labeled scales can increase cognitive burden because respondents must read and process each label before making a choice. (Krosnick & Fabrigar, 1997). (De Leeuw et al., 2012)

Therefore, the likert scales were only labeled with figures.

An example of the layout of the questionnaire is presented in Figure 2

	Part 1: Fire Fighting												
	Fire main	Confidence					Importance			Source			
		1	2	3	4	5	1	2	3	School	Ship	Other	No
1.1.1	Knows how to line line-up in case of fire												
1.1.2	Inspection for corrosion and watertightness												
1.1.3	Isolation valves (Inspection, requirements)												

Figure 2 Exemple of a section in the questionnaire

Source ***Own figure***

Chapter 4 METHODOLOGICAL JUSTIFICATION FOR DATASET PROCESSING

4.1 Important distinctions

4.1.1 Likert-type item and Likert scale

As explained by Boone & Boone (2012), a distinction should be made between:

- Likert-type item: A single ordinal question with ordered response options (e.g., "strongly disagree" to "strongly agree"). which is not aggregated with other items.
- Likert scale: A set of four or more Likert-type items aggregated into a composite score to measure a latent trait (e.g., motivation, confidence).

Likert scales, though ordinal, are often treated as interval in social science and applied research, allowing for the use of parametric statistical markers (averages and standard deviations). This treatment is especially common in exploratory or descriptive studies, where the goal is to detect trends rather than to generalize or test hypotheses. (Boone & Boone, 2012)

4.1.2 Parametric and Non-parametric statistics

As explained by Sullivan & Artino, (2013) a distinction should be made between:

- Parametric statistics, Assuming interval/ratio-level data and normal distribution
- Non-parametric statistics, making fewer assumptions about distribution, and more suitable for ordinal data, small samples, or non-normal distributions.

4.1.3 Descriptive and Inferential statistics

As outlined in the book *Exploratory data analysis* (Tukey, 1977), descriptive statistics aim to summarize patterns observed within a sample, without attempting generalization.

In contrast, inferential statistics use formal hypothesis testing to draw conclusions about a broader population and rely on stricter assumptions. (Guthrie, 2020), (Sullivan & Artino, 2013)

4.2 Context of this study

This study is exploratory in nature. Its goal is to describe trends within responses to Likert-scale questionnaires administered to a small sample. No inferential claims or generalizations are made beyond the dataset.

4.2.1 Use of parametric markers on Likert scales

Although individual Likert-type items are ordinal, composite scores formed by averaging multiple items are widely accepted as approximating interval-level data, particularly when internal consistency is presumed or established. Therefore, the use of means and standard deviations is appropriate for describing central tendency and dispersion in this context. (Boone & Boone, 2012), (Norman, 2010)

The treatment of Likert-scale responses as interval-level data is based on the assumption that the distance between response options is perceived as roughly equal by participants. While this assumption cannot be verified directly, the scale used in this study follows a symmetric and evenly spaced format commonly accepted in psychological and educational research for descriptive analysis. (Norman, 2010), (Sullivan & Artino, 2013), (DeVellis, 2017).

4.2.2 Descriptive (non inferential) approach

The analysis does not involve significance testing or generalization. Parametric methods were used solely for descriptive purposes. The goal was to detect potential patterns worth exploring in future confirmatory work.

4.2.3 Conclusion

While non-parametric statistics could have been used as an alternative, the use of parametric methods is justified in the context of this exploratory and descriptive study. This approach, supported by the literature, offers an efficient and interpretable way to explore the structure of the dataset.

Chapter 5 DATASET PROCESSING

This chapter details the preparation of the dataset for subsequent analysis. The process includes calculating averages and standard deviations, converting raw data into percentages, and applying threshold criteria for visualization purposes. All data processing was conducted using Microsoft Excel. The detail of the Excel document composition is described in Annex 6. The excel document itself is available upon request.

The dataset comprises 123 items, each evaluated across multiple dimensions—self-assessed competence, perceived importance, and source of knowledge. Each dimension is further analyzed using statistical measures such as mean and standard deviation.

Moreover, the items are organized into thematic categories and originate from both regulatory frameworks and practical experience.

5.1 Notations and vocabulary

The following abbreviations will be used throughout the analysis:

- CON: Self-assessed Confidence
- IMP: Perceived Importance
- AV: Average
- DEV: Standard Deviation
- [A;V;O;N]: Binary matrix of sources (Academy, Vessel, Other, None)
- [%A;%V;%O;%N]: Weighted matrix of sources expressed in percentage

Examples**:**

AVCON refers to the average self-assessed confidence for a given item.

DEVIMP refers to the standard deviation in perceived importance for a given item.

Note: The term "*Source*" refers to the context in which the respondent acquired knowledge of the item (Academy, Vessel, Other, or None). The term "*Origin"* refers to the institutional or documentary justification for including the item (e.g., MSC Circular, SOLAS).

5.2 Initial dataset

The initial dataset consists of 123 items, each evaluated by 17 respondents. For each item, six data points were collected per respondent:

- CON (Confidence)
- IMP (Importance)
- [A;V;O;N]: binary matrix indicating the source(s) of knowledge

This results in a total of 12,546 data points (123 items × 6 data values × 17 respondents).

Note:

- AVCON and AVIMP reflect the average level of confidence and importance attributed to each item.
- DEVCON and DEVIMP reflect the degree of agreement (or lack thereof) among respondents. (Seltman, 2018)

5.3 Statistically processed dataset

For each of the 123 items, raw data were statistically processed as follows:

5.3.1 Confidence and Importance markers

- Confidence (CON) values were aggregated to produce:
    - AVCON: average self-assessed confidence.
    - DEVCON: Standard deviation of confidence.

- Importance (IMP) values were aggregated to produce:
    - AVIMP: Average perceived Importance.
    - DEVIMP: Standard deviation of Importance.

5.3.2 Scales used

AVCON and AVIMP represent statistical means on a 5-point Likert scale (for confidence) and a 3-point Likert scale (for importance).

DEVCON and DEVIMP are calculated as standard deviations:

$$AVCON = \frac{\sum CON}{n} \qquad DEVCON = \sqrt{\frac{\sum (CON - AVCON)^2}{n-1}}$$

Where *n* is the number of respondents (17) (Seltman, 2018)

As explained in Chapter 4, calculating averages and deviations for self-assessed confidence and perceived importance is methodologically sound, because no inferential statistics are used.

Since this study focuses on a sample and not a population, n-1 is used in the deviation formula. (Guthrie, 2020)

5.3.3 Dimensionality reduction

Each item, initially comprising 102 raw data points (6 values× 17 respondents) was condensed into 8 summary statistics:

- AVCON, DEVCON, AVIMP, DEVIMP, [%A, %V, %O, %N]

The final processed dataset thus contains:

- 123 items x 8 values = 984 data points.

5.4 Averaging the Source Matrix [A;V;O;N]

5.4.1 Initial Matrix

As explained in chapter 3.4, the source(s) of knowledge are recorded using a binary 4×1 matrix [A;V;O;N], with each position indicating whether the respondent attributes their knowledge of the item to one or more of the following contexts:

For example:

- A response of [1; 1; 1; 0] indicates the respondent attributes their knowledge to Academy, Vessel, and Other sources.
- A response of [1; 0; 1; 0] indicates only Academy and Other.

5.4.2 Conversion and Averaging

To allow meaningful averaging across respondents, these binary matrices are first converted into proportional values such that the total contribution of selected sources sums to 1. This ensures each respondent contributes equally, regardless of how many sources they selected. (De Leeuw et al., 2012).

Example of conversion:

- [1; 1; 1; 0] → [0.33; 0.33; 0.33; 0]
- [1; 0; 1; 0] → [0.5; 0; 0.5; 0]

Once converted, the matrices are averaged across all respondents for each item. The result is a weighted source matrix: [%A; %V; %O; %N]

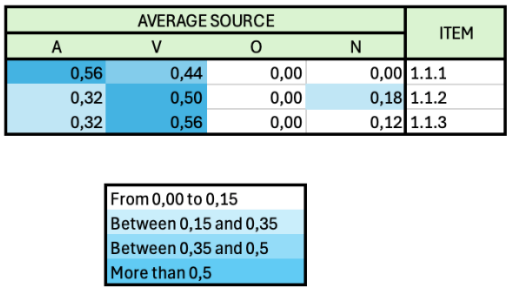
This matrix expresses, for each item, the average proportion of perceived knowledge attributed to each source.

5.4.3 Conditional Formatting

To support the interpretation of source matrices in large tables, conditional formatting was applied in Excel. This visual aid highlights dominant values through color coding.

Empirical thresholds (15%, 35%, 50%) were applied for the conditional formatting of the source tables. These visual thresholds are intended solely to enhance readability and highlight apparent trends.

They do not serve as an analytical or statistical basis. They are not used for classification purposes. Figure 3 shows an example of averaged source weighting for Section 1.1.



AVERAGE SOURCE				ITEM
A	V	O	N	
0,56	0,44	0,00	0,00	1.1.1
0,32	0,50	0,00	0,18	1.1.2
0,32	0,56	0,00	0,12	1.1.3

Figure 3 Example of an average source weighting for a section

Source ***Own figure***

Chapter 6 EXPLORATORY DATA ANALYSIS AND THRESHOLDING

To support the interpretation of Likert-scale data, this study defines specific thresholds for each statistical indicator: average self-assessed confidence (AVCON), average perceived importance (AVIMP), and their respective standard deviations (DEVCON and DEVIMP).

These thresholds allow for the classification of items and sections based on their high or low perceived average values of confidence and importance, as well as items that exhibit strong consensus or significant divergence in responses.

6.1 Characteristics of Exploratory Data Analysis

6.1.1 Difference between exploration and confirmation

Exploratory Data Analysis (EDA) is a preliminary approach to analyzing datasets to summarize their main characteristics. It aims to discover patterns, structures, and insights without requiring prior hypotheses. The goal is to experiment different approaches so to highlight patterns in the data. (Tukey, 1977)

EDA is an important step after data collection. Data is plotted and manipulated without any assumptions, in order to help assess data quality and guide model building. (Guthrie, 2020)

As explained by Seltman (2018), any statistical analysis not including formal inference falls under the term Exploratory Data Analysis.

An important distinction exists between:

- Descriptive (exploratory) statistics, which aim at understanding the data, detect structure, visualize, summarize, and discover new patterns.

- Confirmatory (inferential) statistics, which aim to test predefined hypotheses, estimate model parameters, and calculate p-values.

In the first case, no hypotheses or models are needed. The second assumes models and distributions. (Tukey, 1977)

6.1.2 Visual and intuitive tools

Different tools can be used to reveal the structure of data, including, boxplots, percentiles, and histograms. Most EDA techniques are graphical in nature, allowing for sharper insight into the data. (Guthrie, 2020), (Tukey, 1977)

6.1.3 Flexibility and iteration

In the context of EDA, multiple approaches can be applied to the same dataset to generate understanding from different angles. Although there are existing guidelines, a certain degree of looseness is commonly accepted as the goal is to formulate hypothesis and not to prove them. (Tukey, 1977), (Seltman, 2018)

6.1.4 Application to this research

This research fully aligns with the concept of Exploratory Data Analysis because:

- It aims to understand self-reported perceptions (e.g., confidence, importance) rather than to test hypotheses.
- It uses descriptive tools (e.g., averages, categorizations, distributions) to structure the data.
- It adapts thresholds and groupings based on what the data shows, in a non-prescriptive way. (Detailed in Chapter 6.3)
- It accepts multiple methods of segmentation, chosen for their interpretability, not for statistical proof.

6.2 Thresholding Strategies in EDA

6.2.1 No universal rule for thresholds in EDA:

There is no single thresholding method to follow. The choice depends on the goals of the analysis (e.g., readability, structure, insight). New ways of looking at the data may sometimes need to be invented. (Tukey, 1977).

Seltman (2018), even states that "EDA is not an exact science – it is a very important art!" (p.97)

However, the following techniques can be used:

6.2.2 Clustering Methods

Clustering methods group data points based on similarity, without requiring predefined labels. These are density-based approaches that aim to minimize variance or distance within clusters.

They are used when identifying natural groupings in the data is the goal, or when no obvious or domain-based threshold exists.

The main advantage is that clustering relies on measurable distances or densities, yielding consistent and reproducible results when using the same parameters. (Jain, 2010)

6.2.3 Distribution-Based Binning

Distribution-based binning consists of dividing a variable into bins based on its distribution — usually using equal-width bins.

This is useful for building histograms or creating categorical versions of continuous variables.

Although this method is transparent, objective, and easy to reproduce, it may lead to uneven group sizes if the data is skewed (Hastie et al., 2017)

6.2.4 Quantile Cuts

Quantile cuts involve binning data based on percentiles, so that each bin contains the same number of observations.

Examples include: Median split (2 bins), Quartiles (4 bins), or Deciles (10 bins).

This method is particularly useful when equal-sized groups are needed or when the distribution is uneven. (Tukey, 1977)

6.2.5 Domain-Based Thresholds

Domain-based thresholds are used when established cut-offs already exist in the literature, or when thresholds are applied in professional contexts such as medicine, education, or psychology.

These thresholds are anchored in real-world practice and externally validated by their use in expert fields. (Streiner et al., 2015)

6.2.6 Graphical examination

Exploratory data analysis often involves judgment-based tools, including graphical examination, which can reveal structure even when formal statistical tools are limited. (Behrens, 1997)

Visual identification of groupings or inflexion points, while not rigorous, can aid hypothesis generation in data-constrained situations. (Wilkinson & Task Force on Statistical Inference, 1999)

6.3 Thresholding strategies used

The methodological choices described below are grounded in the literature previously outlined in chapter 6.2. They are recalled here in light of the specific thresholds applied and the practical constraints of this study.

6.3.1 Thresholds for average confidence

Figure 4 shows two histograms for AVCON values: one displaying the distribution, and the other showing the number of items by category.

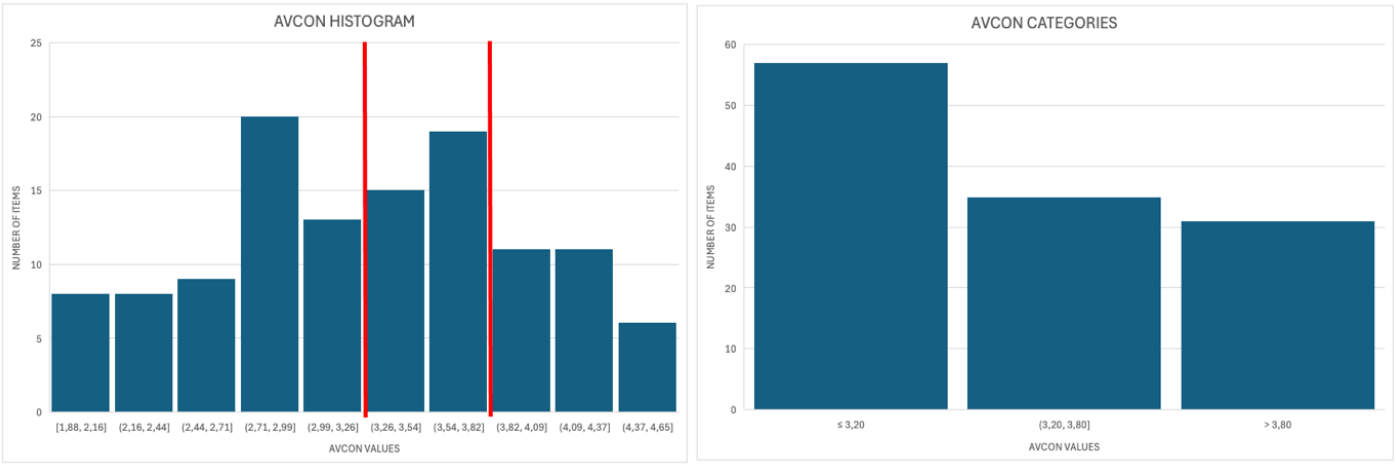


Figure 4 AVCON Threshold Calibration: Histogram and Categorized Item Counts.

Source: Own figure

Self-assessed average confidence (AVCON) was initially considered a proxy for perceived competence—an attribute routinely evaluated in pedagogical institutions such as maritime academies. To reflect this alignment, a domain-based thresholding approach was applied to interpret AVCON scores.

As outlined in *Non-Numeric scores* (Antwerp Maritime Academy, 2025), the Antwerp Maritime Academy uses qualitative grades based on numerical score ranges:

- AA for scores above 14/20
- A for scores above 12/20

- B for scores above 10/20

Whether an A or a B should be considered the minimal acceptable score was unclear. For the purposes of this exploratory study, a compromise was adopted, setting the lower threshold at 11/20, and the upper threshold for high confidence at 14/20 (AA level).

When proportionally mapped onto a 5-point Likert scale, these thresholds correspond to:

- Low: AVCON < 3.2
- Medium: 3.2 ≤ AVCON < 3.8
- High: AVCON ≥ 3.8

This domain-based approach provides an interpretive framework grounded in institutional performance standards, avoiding arbitrary or purely visual thresholding.

6.3.2 Thresholds for average importance

Figure 5 displays two histograms for AVIMP values: one showing the overall distribution, and the other presenting the number of items in each category.

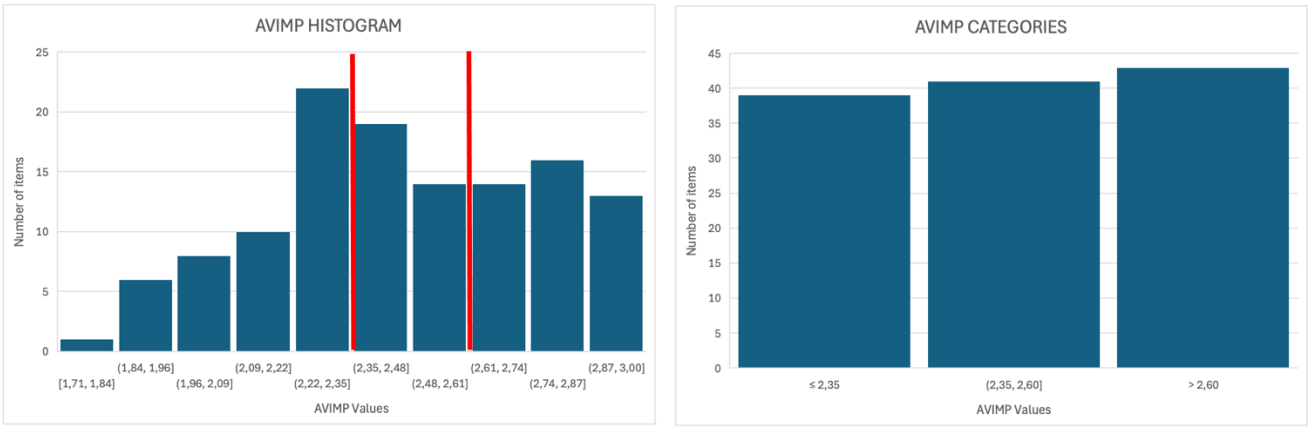


Figure 5 AVIMP Threshold Calibration: Histogram and Categorized Item Counts.

Source: Own figure

Unlike confidence, rating importance is inherently subjective and lacks external benchmarks.

Unlike confidence, perceived importance is inherently subjective and lacks external benchmarks or institutional grading systems. For this reason, a quantile cut approach was applied to AVIMP values, enabling a division into three categories of approximately equal size. (tertiles)

Based on the statistical distribution of the data, the following thresholds were applied:

- Low Importance: AVIMP < 2.35
- Medium Importance: 2.35 ≤ AVIMP < 2.60
- High Importance: AVIMP ≥ 2.60

6.3.3 Thresholds for deviations in confidence and importance

6.3.3.1 Method used

Clustering-based thresholds were initially planned for both DEVCON and DEVIMP, in order to group responses according to the shapes of their distributions.

However, due to time constraints and the limited size of the dataset (123 items), a heuristic thresholding method was applied. This involved identifying clusters visually, based on the distribution of responses, visible inflexion points, and natural groupings apparent in the graphs.

This approach aligns with the exploratory nature of the study, as explained in Chapter 6.1.4, and allowed the analysis to proceed, rather than becoming blocked at a technical stage.

While this method introduces a degree of subjectivity and lacks formal reproducibility, it is still a manual application of clustering method and it offered a pragmatic compromise between rigor and feasibility.

It enabled the identification of coherent trends and interpretive categories. However, applying a formal clustering algorithm in the future would significantly improve the methodological robustness and objectivity of the findings.

6.3.3.1 DEVCON

Figure 6 presents two histograms for DEVCON values: one illustrating the overall distribution, and the other showing the number of items per deviation category.

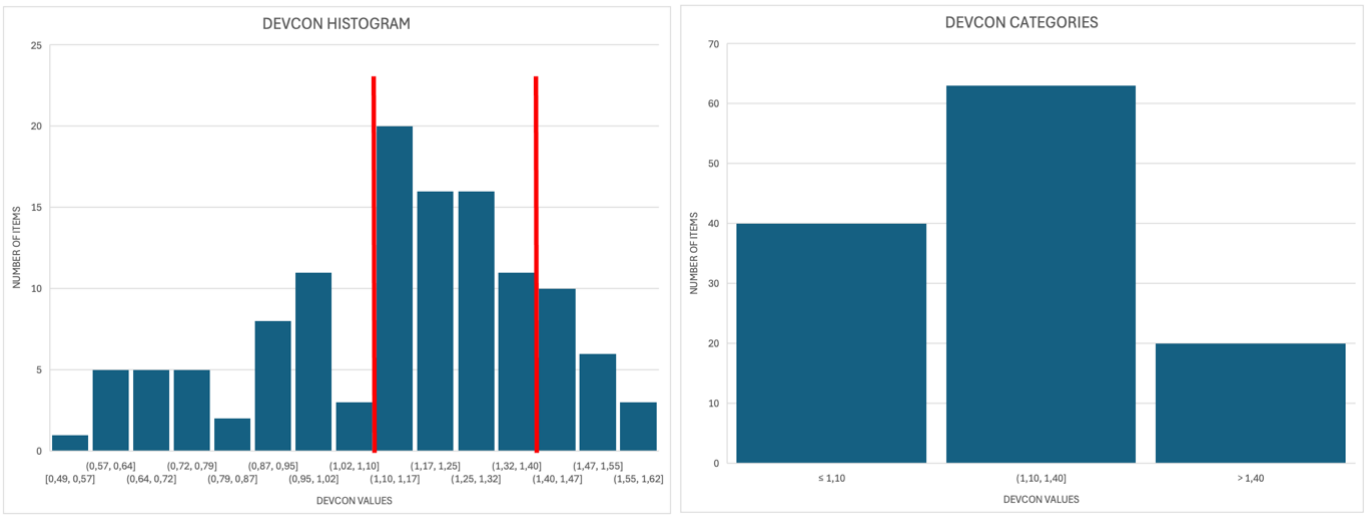


Figure 6 DEVCON Threshold Calibration: Histogram and Categorized Item Counts

Source: Own figure

A visual inspection of the distribution of DEVCON values across all 123 items revealed a clear inflection point at 1.10, which was determined to be the most appropriate location to set the lower threshold.

DEVCON measures respondent consensus regarding confidence. Thresholds were established based on the distribution:

- Low Deviation: DEVCON < 1.10
- Medium Deviation: 1.10 ≤ DEVCON < 1.40
- High Deviation: DEVCON ≥ 1.40

The lower threshold isolates items with strong consensus, under the inflexion point located at 1.10. The upper threshold, was set at 1.40

6.3.3.2 DEVIMP

Figure 7 presents two histograms for DEVIMP values: one illustrating the overall distribution, and the other showing the number of items per deviation category.

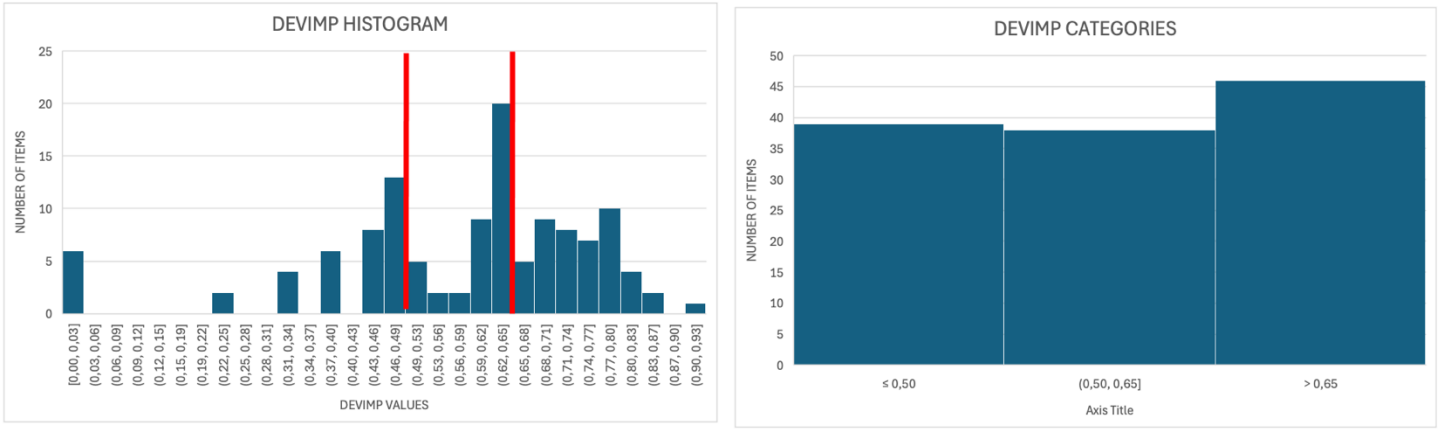


Figure 7 DEVIMP Threshold Calibration: Histogram and Categorized Item Counts

Source: Own figure

- Low Deviation: DEVIMP < 0.50
- Medium Deviation: 0.50 ≤ DEVIMP < 0.65
- High Deviation: DEVIMP ≥ 0.65

An analysis of the distribution of DEVIMP values across all 123 items revealed a noticeable inflexion point around 0.50, which was selected as the lower threshold. Items below this point reflect strong agreement among respondents on the importance of the competency.

6.4 Limitations and Improvements

6.4.1 Distribution of the Data

The values for AVCON, AVIMP, DEVCON, and DEVIMP do not follow a normal distribution.

As a result, standard parametric thresholds could not be applied. This outcome may change in future studies if the number of respondents increases or if the survey design is modified.

6.4.2 AVCON

Although domain-based thresholding is a recognized method, it remains heuristic in nature. These thresholds are context-specific, and caution should be exercised if results are to be generalized in subsequent studies.

6.4.3 AVIMP

For AVIMP, the bins used were not of rigorously equal size. While this had limited impact on interpretation, it may have introduced minor bias in group size distribution and should be corrected in future implementations.

6.4.4 DEVCON and DEVIMP

A clustering algorithm could be applied to DEVCON and DEVIMP in future studies.

Alternatively, a simpler and more robust solution could be to apply quantile thresholding (e.g., tertiles) to the deviations. While this was not done in the present study, it would increase reproducibility and statistical clarity.

6.5 Interpretative Function of the Thresholds

The use of thresholds in this study supports an exploratory analysis aimed at identifying meaningful trends, without any attempt to generalize the findings beyond the specific context of the research.

In particular, thresholds are used to classify sections and support visual interpretation, but item-level scores remain the primary basis for interpretation.

No statistical tests or inferences are based on these groupings; instead, they serve to organize the structure of the analysis, apply color-coding for readability, and facilitate a coherent reading of the item-by-item results.

The thresholds do not affect the underlying data or the core logic of interpretation, which remains grounded in the actual numerical values. Therefore, a degree of flexibility in their definition is acceptable, given the exploratory and non-inferential nature of this stage of the study. A more formal classification approach could be implemented in future confirmatory research.

Chapter 7 METHODOLOGY

This chapter outlines the methodology employed to analyze the responses collected through the evaluation framework.

The primary objective of the analysis is to offer insights into the patterns revealed by the data gathered.

For that purpose, two strategies were combined: a data-driven approach based on the actual distribution of responses, and a section-driven approach grounded in the conceptual structure of the questionnaire.

This diversity is consistent with the spirit of EDA, which emphasizes the value of looking at the same dataset from multiple perspectives to uncover unexpected patterns and make the data more meaningful. (Tukey, 1977)

7.1 Analytical Approaches Overview

The dataset was analysed using two complementary methods, each offering distinct but interconnected perspectives:

- A section-driven approach
- A data-driven approach.

Rather than treating them as separate strategies, these methods were designed to inform one another and enable a comprehensive interpretation of the evaluation data. (Miles et al., 2014)

The section-driven approach groups items according to their original structural divisions (i.e., sections), with further subdivision into thematically homogeneous subsections where necessary.

This refinement preserves the overarching structure while introducing the granularity needed to detect local variations. It enables the identification of large-

scale trends—such as consolidated knowledge areas, training gaps, or blind spots—while also supporting item-level insight within specific thematic clusters. (Miles et al., 2014)

The data-driven approach relies on correlation analysis between key response indicators—such as average confidence (AVCON), average importance (AVIMP), and percentage of "No" responses (%N)—to uncover underlying statistical patterns. This method highlights potential response biases, and serves to contextualize and reinforce findings from the section-based analysis.

Together, these two perspectives allow for both structured and exploratory analysis, yielding a deeper understanding of how respondents perceive, value, and assess operational competencies.

7.2 Classification and Categories

To facilitate interpretation and structure the discussion, each section of the dataset was classified into analytical categories derived from statistical patterns observed across its constituent items. This classification provides a clear overview of respondent perceptions while maintaining the granularity needed for detailed item-level insights.

Three primary classification criteria were applied: variability-based, average-based, and structural heterogeneity. Each criterion is described in detail below.

Note: As explained in chapter 6.5, the groupings serve to organize the structure of the analysis, apply color-coding for readability, and facilitate a coherent reading of the results. It does not affect the underlying data and the interpretation remains grounded in the actual numerical values.

7.2.1 Classification Based on Variability

7.2.1.1 Aligned-perception sections

Sections in this category exhibit a high degree of consensus among respondents regarding the importance of their items. Specifically, these sections meet the following criteria:

- The average DEVIMP (deviation of perceived importance) is below 0.50.
- Fewer than one-third of their items individually exceed this threshold.

Such low variability in deviation suggests a shared frame of reference concerning the relevance of the section's content, thereby strengthening the interpretive value of other indicators (e.g., confidence, response patterns) within these areas. (Miles et al., 2014)

7.2.1.2 Consistency gap sections

These sections display high variability in confidence (DEVCON) and low variability in importance (DEVIMP), while other indicators (AVIMP and AVCON) remain mild or high. This profile suggests that respondents are uneven in their familiarity or comfort with the content, potentially reflecting heterogeneous exposure.

7.2.1.3 Perception gap sections

Perception gap sections are characterised by high variability in perceived importance (DEVIMP). This indicates that respondents diverge significantly in how important they consider the items within the section. Such variability may reflect differing roles, contexts, or experiences among respondents, and suggests a lack of shared understanding about the section's relevance. These sections warrant closer analysis to explore the roots of these perceptual differences. (Miles et al., 2014)

7.2.2 Classification Based on Averages

7.2.2.1 Consolidated sections

Consolidated sections are defined by high average confidence (AVCON) and medium to high average importance (AVIMP)**.** This profile reflects areas where respondents not only perceive the content as relevant but also feel well-prepared to engage with it. An example of a consolidated section is presented in Figure 8.

1.6	**Self Contained Breathing Apparatus (SCBA)**	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	SRC
1.6.1	Inspection BA Bottle (Body, connection, pressure, when to replace)	4,65	3,00	0,61	0,00	0,68	0,26	0,06	0,00	M3+B
1.6.2	Inspection SCBA (Good state, storage, whistle, leaks)	4,65	3,00	0,61	0,00	0,65	0,29	0,06	0,00	M3+B
1.6.3	Test SCBA masks (void, overpressure, cleanliness, straps)	4,59	3,00	0,71	0,00	0,71	0,24	0,06	0,00	M3+B
	AVERAGES	4,63	3,00	0,64	0,00	0,68	0,26	0,06	0,00	

Figure 8 An example of a consolidated section: Section 1.6

Source Own Figure

7.2.2.2 Training gap sections

These sections are marked by low AVCON despite medium to high AVIMP, indicating that respondents recognize the importance of the content but feel underprepared. Such sections highlight training needs and are particularly actionable in development planning. An exemple of a Training Gap is presented in Figure 9.

3.5	**Quick Closing Valves**	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	SRC
3.5.1	Knows the technology of a QCV (Spring, Pneumatic, ...)	3,06	2,41	1,30	0,62	0,50	0,22	0,00	0,29	T
3.5.2	Knows which equipment are protected by a QCV	2,76	2,47	1,30	0,62	0,50	0,22	0,00	0,25	R4
3.5.3	Knows how to reset a QCV	2,00	2,29	1,22	0,69	0,24	0,25	0,00	0,50	B
3.5.4	Knows in which situation to use a QCV	2,71	2,65	1,49	0,49	0,38	0,22	0,00	0,38	M1
	AVERAGES	2,63	2,46	1,33	0,61	0,40	0,23	0,00	0,35	

Figure 9 An example of a Training Gap: Section 3.5

Source Own figure

Section 3.5 is a good example of aligned-perception section, representing a training gap as a section. Average importance AVIMP is medium and average confidence AVCON is low.

7.2.2.3 Low importance sections

Sections in which all items consistently show low AVIMP are grouped under this label. They represent content areas perceived as low in relevance by the respondent population. This classification does not imply that the content lacks value altogether but signals that it may currently hold limited significance to respondents.

7.2.3 High Focus Sections

High focus sections are characterized by consistent:

- Low AVCON (average confidence) and low AVIMP (average importance)
- High DEVCON (deviation in confidence) and high DEVIMP (deviation in importance)

This uniformly negative profile highlights areas where respondents express both low perceived relevance and low self-assessed confidence, accompanied by high variability. Such sections warrant focused, in-depth examination to understand the reasons of these divergences. An example of High Focus Section is presented in Figure 10 (Section 3.7).

3.7	SCBA Compressor	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	SRC
3.7.1	Knows the different part of a SCBA compressor	2,82	2,00	1,29	0,79	0,26	0,32	0,12	0,29	T
3.7.2	Knows the safe procedure for starting a SCBA compressor and filling a bottle	2,88	2,41	1,50	0,80	0,18	0,47	0,06	0,29	P
3.7.3	Knows the common maintenance of a SCBA compressor	2,06	1,94	1,09	0,75	0,12	0,38	0,00	0,50	P
3.7.4	Knows the importance of draining condensate traps	2,53	2,18	1,62	0,73	0,12	0,38	0,06	0,44	P
3.7.5	Is aware of the dangers of high pressure systems	3,65	2,71	1,37	0,47	0,26	0,28	0,12	0,31	P
3.7.6	Know how to change oil and filters	2,29	1,88	1,53	0,93	0,06	0,25	0,12	0,53	P
3.7.7	Prepared to fill air bottles alone in safety?	2,71	2,35	1,49	0,79	0,00	0,44	0,06	0,47	S15
	AVERAGES	2,71	2,21	1,41	0,75	0,14	0,36	0,08	0,41	

Figure 10 An exemple of a High Focus section: Section 3.7

Source Own Figure

7.2.4 Composite sections

Some sections in the dataset—referred to here as composite sections—show internal heterogeneity, where subsets of items show markedly different statistical patterns.

This diversity prevents the application of a single, coherent classification to the section as a whole and suggests the presence of distinct response logics within the same thematic area.

1.5	Firefighter's Outfits	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	SRC
1.5.1	Knows how to inspect FF outfits and equipments	4,24	3,00	0,66	0,00	0,62	0,31	0,03	0,06	M3+B
1.5.2	Knows good practices for operational readiness	4,06	2,88	0,66	0,33	0,71	0,19	0,06	0,06	P+B
1.5.3	Inspection / Test of Radios (Working, charging arrangement state, not overcharging)	3,88	2,76	0,78	0,44	0,26	0,68	0,00	0,06	M3
1.5.4	Knows the standard signals for steel-cored lifeline	2,29	2,06	1,40	0,83	0,24	0,18	0,00	0,59	M3
1.5.5	Knows in which situation to use the fire axe	3,00	2,06	1,46	0,83	0,35	0,24	0,12	0,29	M3
		3,49	2,55	0,99	0,48	0,44	0,32	0,04	0,21	

Figure 11 An exemple of a Composite section: Section 1.5

Source ***Own figure***

For example, Figure 11 presents Section 1.5, where item-level variation clearly indicates divergent trends that prevents a unified interpretation of the section.

To address this, composite sections were subdivided into smaller, thematically coherent subsections. This strategy preserves the integrity of the overall section-based structure while integrating the granularity needed for accurate interpretation**.**

The approach aligns with the meta-matrix logic (Miles et al., 2014), in which preserving case structure is compatible with zooming in within-case variation. This method enhances the identification of knowledge gaps, confidence shifts, and consensus patterns, thus improving both interpretive precision and the clarity of the final analysis.

7.2.5 Visualization matrix

7.2.5.1 Justification for Section Typology via Matrix Design

Categorizing sections by type using two-dimensional visual matrices serves both a descriptive and interpretive function. As explained by Miles et al. (2014), structured displays such as conceptually clustered matrices are essential tools in qualitative data analysis, helping researchers to make sense of complex, multidimensional information.

By plotting sections across meaningful participant-defined constructs—confidence and importance—the analysis remains grounded in local perceptions, enhancing credibility and contextual validity. (Miles et al., 2014)

These matrices function as tools of data condensation allowing the researcher to selectively simplify and visually organize key dimensions of variation. This supports pattern recognition, and the identification of meaningful contrasts—all central goals of qualitative inquiry. (Miles et al., 2014)

7.2.5.2 Detail of the Matrices

To enhance interpretation and ensure transparency in classification, a visual framework was developed using two-dimensional scatter plots, including:

- AVCON versus AVIMP plots, which delineate areas such as Consolidated, Training Gap, and Marginal-Perception.
- DEVCON versus DEVIMP plots, which identify regions corresponding to Shared-Perception and Consistency Gap.

This visual framework is shown in Figure 12.

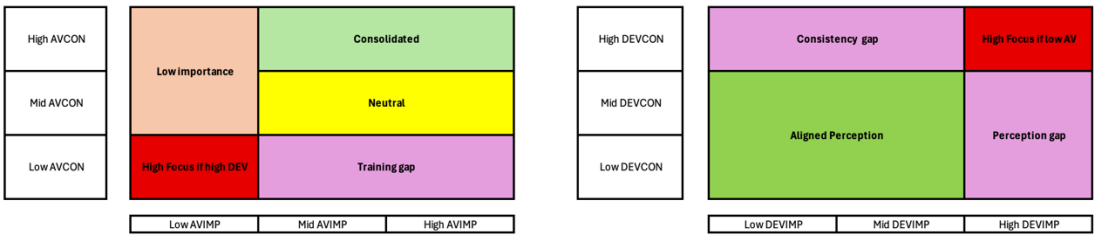


Figure 12 Visualization Matrix

Source Own figure

Category boundaries in each plot are represented by contour zones and labeled according to their respective classifications. These graphical tools provide an intuitive overview of the clustering patterns of sections and items across key

statistical dimensions. This framework can be applied both at the section level and at the individual item level.

It should be noted that, in theory—based on predictive considerations prior to empirical application—the AVCON/AVIMP matrix is most meaningfully interpreted within the "aligned perception" region defined by the DEVCON/DEVIMP matrix.

Indeed, data points with low variability and high frequency near the centre are typically regarded as stable patterns worthy of further analysis. (Tukey, 1977)

7.3 Types of Analysis

7.3.1 Section-Driven Analysis

7.3.1.1 Original sections

The section-driven approach relies on the aggregation of item-level markers to uncover overarching trends and structural regularities within content areas. Its primary objectives are:

(1) to assign sections to predefined typological categories when their internal marker profiles demonstrate sufficient consistency, and

(2) to identify sections requiring specific attention due to atypical or heterogeneous statistical behaviour.

Sections were sorted into the following categories, as defined in Chapter 7.2:

- Consolidated Sections
- Training Gap Sections
- Consistency Gap Sections
- Perception Gap Sections
- Low-Importance Sections
- High Focus Sections

- Composite Sections

Sections identified as composite—due to internal divergence in item-level trends or inconsistent marker profiles—are subsequently analysed through a *subsection split*, whereby the section is divided into thematically homogeneous subsections. This procedure is detailed and illustrated in a dedicated chapter.

7.3.1.2 Post split units

Following the initial classification, a second sorting phase was conducted to address internal heterogeneity within certain sections.

Composite sections—identified by divergent item-level statistical profiles—were subdivided into smaller, thematically homogeneous subsections. This process, referred to as a subsection split, was applied to enhance interpretability by aligning internal item patterns with the broader typological framework. (Miles et al., 2014)

In some cases, sections were classified as mixed due to ambiguous or inconsistent statistical trends that did not fit any existing category. For these, items were first reorganized to reveal latent structure or coherence. Once a consistent internal pattern was established, the section was then subdivided into meaningful subsections.

After this restructuring, all resulting subsections—whether derived from composite or mixed sections—were treated as independent analytical units. They were reintegrated into the main typological framework established during the first sorting phase and classified accordingly. This ensured that the section-driven analysis remained both coherent and sufficiently granular.

Figure 13 illustrates a typical case of a mixed section. Section 1.4 was reorganized to reveal underlying patterns and subsequently divided into four thematically homogeneous subsections.

1.4	Hoses & Nozzles	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.1	Knows the mandatory length of the hoses	2,94	1,71	1,56	0,85	0,65	0,13	0,06	0,07	S10
1.4.2	Knows how to inspect a hose (couplings, gaskets, wire binding, leaks, sediments, ...)	4,12	2,47	0,93	0,51	0,50	0,41	0,03	0,00	M3+B
1.4.3	Knows the different kinds of couplings / nozzles	3,88	1,94	1,11	0,75	0,71	0,25	0,00	0,00	T
1.4.4	Knows how to perform a pressure test	3,35	2,41	1,58	0,62	0,38	0,34	0,06	0,19	M3
1.4.5	Knows how to wire bind	3,35	2,47	1,54	0,62	0,35	0,31	0,00	0,31	P
1.4.6	Knows how to maintain storing boxes (grease for nozzles, gasket for boxes)	3,41	2,12	1,18	0,49	0,35	0,41	0,03	0,19	M3
1.4.7	Knows how to store a hose (Common roll, O-shaped, S-Shaped)	4,47	2,12	0,87	0,78	0,62	0,41	0,00	0,00	P

1.4-A	Hoses & Nozzles (Inspection)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.2	Knows how to inspect a hose (couplings, gaskets, wire binding, leaks, sediments, ...)	4,12	2,47	0,93	0,51	0,50	0,41	0,03	0,00	M3+B
1.4-B	**Hoses & Nozzles (test and binding)**	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.4	Knows how to perform a pressure test	3,35	2,41	1,58	0,62	0,38	0,34	0,06	0,19	M3
1.4.5	Knows how to wire bind	3,35	2,47	1,54	0,62	0,35	0,31	0,00	0,31	P
1.4-C	**Hoses & Nozzles (Coupling, nozzles, storage)**	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.3	Knows the different kinds of couplings / nozzles	3,88	1,94	1,11	0,75	0,71	0,25	0,00	0,00	T
1.4.6	Knows how to maintain storing boxes (grease for nozzles, gasket for boxes)	3,41	2,12	1,18	0,49	0,35	0,41	0,03	0,19	M3
1.4.7	Knows how to store a hose (Common roll, O-shaped, S-Shaped)	4,47	2,12	0,87	0,78	0,62	0,41	0,00	0,00	P
1.4-D	**Hoses & Nozzles (length of hoses)**	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.1	Knows the mandatory length of the hoses	2,94	1,71	1,56	0,85	0,65	0,13	0,06	0,07	S10

Figure 13 Section 1.4 was re-arranged and divided into 4 subsections

Source ***Own figure***

7.3.2 Data-Driven Analysis

The data-driven analysis uses statistical correlation techniques to uncover patterns and relationships among quantitative markers across items and sections. This approach helps reveal underlying structures that may not be visible through isolated marker examination or aggregated section profiles.

It is presented early in the Results chapter to frame subsequent interpretations and to guide focused discussion on critical content areas. The goal is to enrich the dataset's meaning by exploring hidden patterns and systemic dynamics.

7.3.2.1 Justification of correlation analysis in a non-inferential research

Conducting a correlational analysis in an exploratory, non-inferential context is methodologically sound. Such analyses aim to identify patterns within the data rather than generalize to a population, and therefore do not require strict assumptions like normality (Tukey, 1980)

7.3.2.2 Choice of correlation

The choice between Pearson and Spearman correlation coefficients depends largely on the nature of the data and the objectives of the analysis.

Pearson's correlation coefficient (r) measures the strength and direction of a linear relationship between two continuous, interval-level variables, whereas Spearman's correlation assesses monotonic relationships based on ranked data, making it more appropriate for ordinal variables or when the relationship is non-linear. (Sullivan & Artino, 2013)(Guthrie, 2020)

In this study, correlation was used for exploratory and descriptive purposes rather than inferential generalization. While normality of the variables is a requirement for inferential testing with Pearson's r, this assumption is not required in a purely descriptive context. (Sullivan & Artino, 2013) (Norman, 2010)

Additionally, the variables were derived from Likert-type scales averaged across multiple items, and were therefore treated as approximately continuous — a common and accepted practice. (Boone & Boone, 2012)

In conclusion, using Pearson's correlation is valid, although probably not optimal. Future studies might consider using Spearman's correlation, which may offer increased robustness when working with small samples or non-normal distributions.

7.3.2.3 Correlation Analysis

Correlations between average confidence (AVCON), average importance (AVIMP), their respective deviations (DEVCON, DEVIMP), and response patterns (e.g., percentage of "No" answers) were analyzed to identify clusters of related items, consistent trends, or inverse associations that could support deeper interpretation.

7.3.2.4 Partial Correlations

In selected cases, partial correlation techniques were used to assess whether the observed relationship between two markers persisted when controlling for the influence of a third variable. This was done by performing linear regressions of each of the two markers on the third variable separately, extracting the residuals, and then computing the correlation between those residuals. This method isolates the unique contribution of each variable and clarifies the structure of the relationships.

7.3.2.5 Partial Correlation Steps

To examine whether the correlation between average confidence (AVCON) and average importance (AVIMP) was influenced by a third factor—specifically, the percentage of "No" responses (%N)—a partial correlation was performed. This allowed us to isolate the direct relationship between AVCON and AVIMP while removing the effect of %N. (Guthrie, 2020)

The process was conducted as follows:

Regression using LINEST: The LINEST function in Excel was used to perform a linear regression of AVCON on %N. This provided the slope and intercept of the best-fit line predicting AVCON from %N.

Residuals: For each item, the predicted AVCON value was calculated using the regression formula (slope × %N + intercept). This predicted value was subtracted from the actual AVCON to obtain the residual, which reflects the variation unexplained by %N. The same steps were repeated for AVIMP.

Correlation of residuals: The two sets of residuals (for AVCON and AVIMP) were then correlated. This resulting value represents the partial correlation between AVCON and AVIMP, with %N controlled for.

7.3.2.6 Origin Patterns in %N

An exploratory analysis was conducted to assess whether the source of items (e.g., MSC Circulars, Cadet Record Training Book, etc.) correlates with the percentage of "No" responses (%N), which reflects informational exposure.

Items were grouped by origin, and the proportion of each origin in high-%N and low-%N categories was compared to its distribution in the overall dataset.

It is important to note that origin attributions were originally collected for transparency and contextualization, not as formal analytical categories. These attributions were often non-exclusive, loosely defined, and not standardized during the item development phase.

Consequently, this analysis does not meet the methodological rigor required for definitive conclusions.

Chapter 8 DATA-DRIVEN ANALYSIS

8.1 Data-Driven Results: Correlation Trends

8.1.1 Correlation Matrix

	AVCON	AVIMP	DEVCON	DEVIMP	%A	%V	%O	%N
AVCON	1,00	**0,70**	-0,61	-0,64	0,49	0,43	0,03	**-0,84**
AVIMP	**0,70**	1,00	-0,51	**-0,77**	0,30	0,39	-0,05	-0,59
DEVCON	-0,61	-0,51	1,00	0,59	-0,45	-0,13	0,14	0,51
DEVIMP	-0,64	**-0,77**	0,59	1,00	-0,40	-0,13	-0,06	0,51
%A	0,49	0,30	-0,45	-0,40	1,00			
%V	0,43	0,39	-0,13	-0,13		1,00		
%O	0,03	-0,05	0,14	-0,06			1,00	
%N	**-0,84**	-0,59	0,51	0,51				1,00

Figure 14 Correlation Matrix

Source ***Own figure***

The correlation matrix presented in Figure 14 summarizes linear relationships between key quantitative markers in the item analysis using correlation coefficients.

Many metrics—especially averages and deviations from the same response distributions—show strong intercorrelations due to their mathematical linkage. The 3-point Likert scale's limited granularity may inflate these correlations.

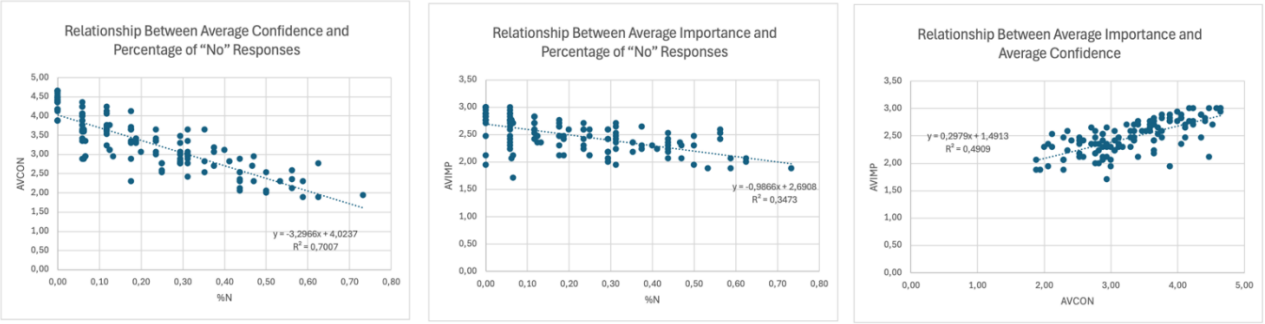


Figure 15 Scatter plots of different metrics

(a) [Relationship between Average Confidence and Percentage of "No" Reponses].
(b) [Relationship between Average Importance and Percentage of "No" Reponses].
(c) [Relationship between Average Importance and Average Confidence].
Source Own source

Figure 15 presents scatter plots of the main metrics assessed.

Given the overall high correlations, the analysis focuses on the most conspicuous patterns:

- A strong negative correlation (R = -0.84) exists between average confidence (AVCON) and the percentage of "No" responses (%N).
- A positive correlation (R = 0.70) is observed between average confidence (AVCON) and average perceived importance (AVIMP).
- A negative correlation (R = -0.77) is found between average perceived importance (AVIMP) and its standard deviation (DEVIMP).

Because AVIMP and %N are moderately negatively correlated (R = -0.58), a partial correlation controlling for %N was performed to clarify the directness of the AVCON–AVIMP relationship.

8.1.2 Residual correlation between AVCON and AVIMP

To assess whether the observed correlation between average confidence (AVCON) and average perceived importance (AVIMP) was driven by informational exposure, a partial correlation analysis was conducted controlling for the percentage of "No" responses (%N).

This was done by regressing each variable on %N and then correlating the resulting residuals.

The initial correlation of R = 0.70 between AVCON and AVIMP decreased to R = 0.47 after accounting for %N.

This reduction suggests that while informational exposure partially explains the association, a positive relationship remains, indicating that confidence and perceived importance may still be linked beyond the effect of content unfamiliarity.

8.1.3 Analysis by origin

An exploratory analysis was conducted to examine the distribution of item sources across different levels of informational exposure, as measured by the percentage of "No" responses (%N). Items were grouped based on their indicative source (e.g., IMO Codes, Circulars, Training Guides), and their representation in high-%N and low-%N categories was compared to their distribution in the full dataset.

8.1.3.1 Item Origin by Level of Informational Exposure

Figure 16 illustrates how item origins (e.g., MSC Circulars, SOLAS) are distributed across two informational exposure categories, defined by the proportion of respondents selecting “None” as a source. Items were categorized as “high %N” or “low %N” using a threshold of 30%. The distribution of item origins within the entire dataset is also shown for reference.

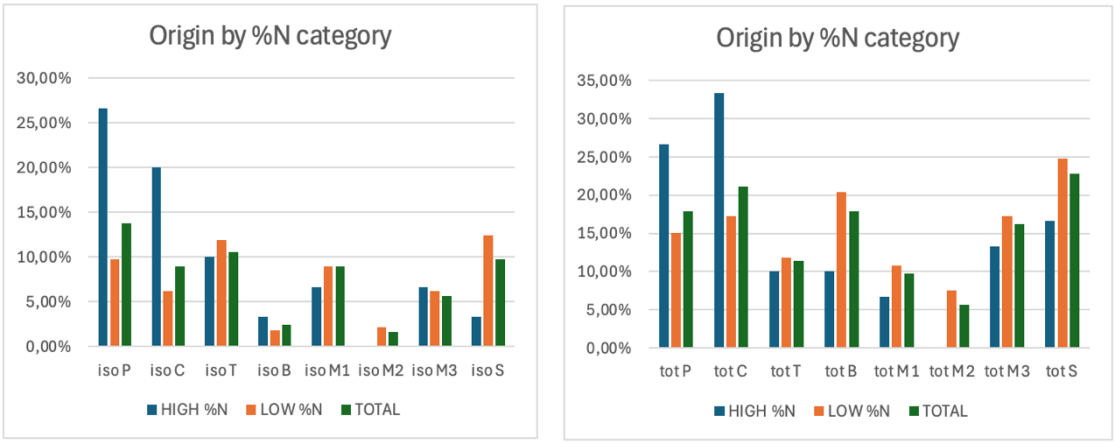


Figure 16 Origin of items by level of informational exposure

Source Own Figure

Because items may be linked to multiple origins, and precise attribution statistics are unavailable, two graphs are provided. The first includes only items with a single, clearly identified origin ("isolated origins"), while the second accounts for all items mentioning a given origin, regardless of whether it appears alone or in combination. This two-pronged approach offers a more balanced perspective, avoiding potential overrepresentation biases caused by grouped origin data.

As shown in Figure 16, items originating from MSC Circulars (C) and Informal Feedback (P) are markedly overrepresented among those with a high percentage of "None" responses (i.e., %N > 30%). This suggests that respondents may have limited access to or awareness of these sources.

This is in line with the representation of "C" and "P" items amongst items with a low average confidence. "C" and "P" account for 24% and 19%, respectively.

Conversely, items associated with the CRTB are frequently linked to multiple sources and are predominantly found in the low %N category, indicating higher levels of informational exposure.

While these observations are not conclusive due to limitations in source attribution, they offer valuable contextual insight into how the origin of content may influence patterns of respondent familiarity and perceived information availability.

Since the origin data were initially collected for transparency and informational purposes rather than systematic analysis, no further quantitative treatment was conducted beyond the identification of general trends

8.1.3.2 Proportion of single-origin and multi-origin items by N% category

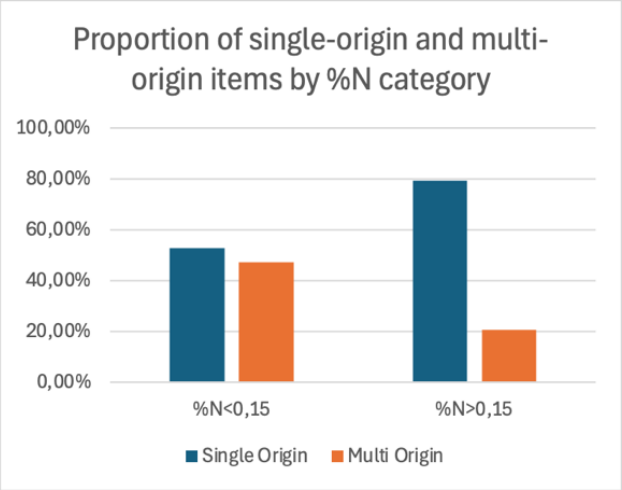


Figure 17 Proportion of single-Origin and Multi-Origin items by %N category

Source ***Own figure***

An additional pattern emerges when comparing the number of origins associated with items across %N categories. As shown in Figure 17, items with %N below 15% (i.e., those with higher exposure) are evenly divided between single-origin and multiple-origin attributions. However, for items with %N above 15%, the distribution shifts markedly: approximately 80% of these items are associated with a single origin, while only 20% have multiple origins.

Although this analysis remains exploratory, the results suggest that items linked to a single source may be more vulnerable to limited informational exposure—an intuitively reasonable assumption. Furthermore, the presence of multiple sources covering a single item appears to be strongly correlated with higher levels of respondent confidence.

8.2 Data Driven discussion

8.2.1 Correlation between Average Confidence and Informational Exposure

A strong negative correlation between average confidence (AVCON) and the percentage of "None" responses (%N) indicates that limited informational exposure may be associated with lower confidence.

As pointed out in chapter 7.3.2.2, results should be taken with caution due to the use of Pearson's correlation and the limited size of the sample.

This relationship may reflect a complex interplay—low confidence might stem from lack of information, or both could be influenced by other factors like item complexity or relevance.

It may be assumed that confidence is more tied to information exposure than to competence. This assumption will be kept in the following chapters of interpretative purposes.

8.2.2 Correlation between Average Importance and Deviation in importance

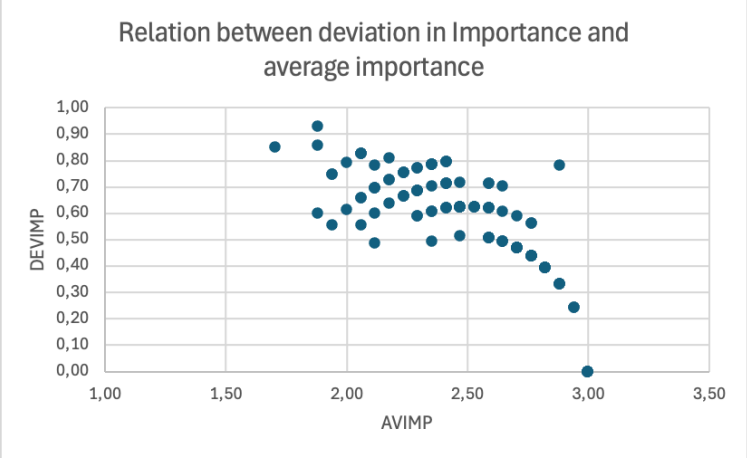


Figure 18 Relation between deviation in Importance and average Importance

Source ***Own figure***

The negative correlation between average perceived importance (AVIMP) and its standard deviation (DEVIMP) is best understood as a mathematical artifact.

This effect stems from two factors:

(1) AVIMP and DEVIMP are calculated from the same response distribution and are thus statistically dependent, and

(2) the limited 3-point Likert scale reduces variability, producing clusters of identical response patterns.

The scatterplot presented in Figure 18 confirms this with a curved trend: when AVIMP is near the extremes, DEVIMP decreases—an expected outcome when most responses converge on one value. This correlation therefore reflects structural constraints of the data, not an underlying behavioral or psychological phenomenon.

8.2.3 Correlation between Average Confidence and Average Importance

The positive correlation observed between average importance (AVIMP) and average confidence (AVCON) tends to indicate a cognitive bias in respondent evaluations.

This relationship suggests that respondents tend to rate as important the items they feel confident about, reflecting a classic confirmation bias. Analysis of residuals further tends to support this interpretation, suggesting that items with low confidence but potentially high importance may be under-recognized.

This bias may imply that the perceived importance is partially influenced by self-assessed competence, which risks overlooking areas requiring attention.

Consequently, this finding highlights the need for caution when interpreting importance ratings and suggests complementing them with other sources of information, as explained in Chapter 12.

8.2.4 Implications for the analysis of High Focus Sections

These assumptions may have important implications for interpreting sections flagged as high focus (all red).

Since AVCON seems to reflect informational exposure, and given the potential confirmation bias where respondents undervalue items they lack confidence in, a lack of information across an entire topic can trigger a cascade effect.

Low informational exposure may lead to low confidence, which may bias respondents toward assigning low importance, accompanied by high disagreement (high deviation).

This pattern may explain sections being uniformly flagged as problematic. Therefore, it is reasonable to interpret these high focus sections not simply as gaps, but as structural blind spots within the competence framework of respondents.

8.2.5 Analysis by Origin

The exploratory analysis of item origins in relation to informational exposure (%N) suggests several meaningful trends.

First, MSC Circulars (C) and Informal Feedback (P) are notably overrepresented among items with high %N (>30%), suggesting that respondents have limited access to or awareness of these sources.

Since these two origins also account for a significant portion (25%) of low AVCON items, improving the accessibility and visibility of such information could meaningfully enhance informational exposure and self-assessed confidence.

Interestingly, the prominence of Informal Feedback among high %N items also highlights its relevance, suggesting that while informal sources contribute valuable insights, they may not be systematically disseminated or recognized.

In contrast, items linked to the CRTB appear predominantly in the low %N category and are nearly always associated with multiple sources.

This supports the idea that mandatory, centralized, and cross-referenced documentation (like the CRTB) effectively boosts both exposure and confidence. The additional observation that multi-origin items are more common among low %N categories further suggests that when multiple sources converge on the same content, familiarity and access improve.

These insights reinforce the potential value of consolidating and clarifying reference material, particularly for domains currently relying on fragmented or obscure sources.

8.2.6 Recommandations and limitations

Although the analysis of item origins is exploratory in nature and not based on rigorously standardized source data, the observed overrepresentation of MSC Circulars among high-%N items constitutes a strong enough pattern to warrant attention.

Given the assumption that %N reflects a lack of informational exposure, and considering the operational relevance of MSC Circulars, providing structured and accessible information on these documents represents a low-cost intervention with potentially high returns in terms of user familiarity and confidence.

While definitive causal conclusions cannot be drawn from the current data, the alignment of this trend with practical considerations justifies recommending targeted informational support for MSC Circulars as a pragmatic and actionable improvement.

8.3 Data Driven Conclusions

This exploratory data-driven analysis suggests several cognitive and structural patterns in respondent evaluations that may carry practical implications.

First, self-assessed confidence seems to be closely tied to informational exposure rather than actual competence, suggesting that familiarity—not readiness—drives confidence scores.

Second, a moderate correlation between confidence and perceived importance suggests a confirmation bias: respondents tend to value what they feel confident about, potentially underestimating unfamiliar but critical topics.

Sections flagged as high focus (all red) seem to reflect this reinforcing loop of low exposure, low confidence, and undervalued importance—indicating possible blind spots in training coverage.

These trends do not constitue results, but would be good hypothesis for further works. Even in small samples, high correlations can be interpreted as strong signals within an exploratory study.(Bazeley, 2013)

Source analysis shows that MSC Circulars and Informal Feedback are linked to low levels of informational exposure, whereas centralized tools like the CRTB correlate with higher confidence.

Chapter 9 REORGANIZATION OF SECTIONS

9.1 Introduction

This chapter outlines the process used to sort sections by type as explained in chapter 7.2.5. The steps for transforming composite section into homogeneous subsection, are also described.

Annex 3 shows the initial list of sections with statistical markers, and Annex 4 shows the final list of sections, with statistical markers

9.2 Identification of Composite Sections

The following sections are identified as composite sections:

- Section 1.4: Hoses & Nozzles
- Section 1.5: Firefighter's Outfits
- Section 1.7: Portable Fire Extinguishers
- Section 2.2: Fixed gas Extinguishing
- Section 2.5: Water Mist, Spray, Sprinklers
- Section 3.1: Fixed Fire Detection and Fire Alarm
- Section 3.4: Ventilation Systems and Fire Dampers

Figure 19 presents each Composite section with the detail of their items and statistical markers.

1.4	Hoses & Nozzles	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.1	Knows the mandatory length of the hoses	2,94	1,71	1,56	0,85	0,65	0,13	0,06	0,07	S10
1.4.2	Knows how to inspect a hose (couplings, gaskets, wire binding, leaks, sediments, ...)	4,12	2,47	0,93	0,51	0,50	0,41	0,03	0,00	M3+B
1.4.3	Knows the different kinds of couplings / nozzles	3,88	1,94	1,11	0,75	0,71	0,25	0,00	0,00	T
1.4.4	Knows how to perform a pressure test	3,35	2,41	1,58	0,62	0,38	0,34	0,06	0,19	M3
1.4.5	Knows how to wire bind	3,35	2,47	1,54	0,62	0,35	0,31	0,00	0,31	P
1.4.6	Knows how to maintain storing boxes (grease for nozzles, gasket for boxes)	3,41	2,12	1,18	0,49	0,35	0,41	0,03	0,19	M3
1.4.7	Knows how to store a hose (Common roll, O-shaped, S-Shaped)	4,47	2,12	0,87	0,78	0,62	0,41	0,00	0,00	P

1.5	Firefighter's outfits	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.5.1	Knows how to inspect FF outfits and equipment	4,24	3,00	0,66	0,00	0,62	0,31	0,03	0,06	M3+B
1.5.2	Knows good practices for operational readiness	4,06	2,88	0,66	0,33	0,71	0,19	0,06	0,06	P+B
1.5.3	Familiar with Inspection / Test of Radios and charging arrangements	3,88	2,76	0,78	0,44	0,26	0,68	0,00	0,06	M3
1.5.4	Knows the standard signals for steel-cored lifeline	2,29	2,06	1,40	0,83	0,24	0,18	0,00	0,59	M3
1.5.5	Knows in which situation to use the fire axe	3,00	2,06	1,46	0,83	0,35	0,24	0,12	0,29	M3

1.7	Portable fire extinguishers	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.7.1	Familiar with: types of extinguishers, and their use (Fire category, Distance, Method)	4,35	2,88	0,61	0,33	0,79	0,15	0,06	0,00	M
1.7.2	Familiar with: extinguishers inspection (Body, connection, pin, seal, tags and marks, ...)	4,24	2,71	0,83	0,47	0,44	0,38	0,06	0,12	C+B
1.7.3	knows how to avoid powder caking (shaking)	3,06	2,24	1,52	0,75	0,32	0,24	0,03	0,38	P
1.7.4	Knows how to check emptiness (weighting)	3,65	2,18	1,22	0,81	0,29	0,26	0,09	0,35	P
1.7.5	Knows how to re-fill an empty extinguisher	1,88	1,88	1,17	0,86	0,21	0,18	0,03	0,59	M3+S14

2.2	Fixed gas-extinguishing	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.2.1	Knows how to inspect an installation (hose cracks, pressure, leakages, ...)	3,29	2,59	1,10	0,71	0,32	0,41	0,00	0,29	C + S14
2.2.2	Aware of the risk of explosion in flammable atmospheres	4,18	3,00	0,88	0,00	0,74	0,28	0,00	0,00	P
2.2.3	Aware of the importance of headcount and the master's orders before use	4,47	3,00	0,72	0,00	0,62	0,34	0,00	0,00	P
2.2.4	Aware of the importance of closing flaps and shutting ventilation before use	4,65	2,94	0,49	0,24	0,65	0,38	0,00	0,00	P
2.2.5	Knows the importance of draining the lines for condensation	3,47	2,59	1,28	0,62	0,32	0,38	0,03	0,29	P
2.2.6	Knows the different parts of an installation and the different modes of activation	3,76	2,82	1,20	0,39	0,41	0,47	0,03	0,12	T + P

2.5	Water mist spray, sprinkler	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.5.1	Knows: the difference between dry pipe and wet pipe systems	3,06	2,24	1,39	0,66	0,38	0,28	0,00	0,31	C
2.5.2	Knows: the difference between mist, spray, and sprinkler	4,06	2,35	0,75	0,79	0,59	0,38	0,00	0,06	C
2.5.3	Knows: how to check nozzles integrity and prevent clogging	3,35	2,59	0,86	0,51	0,38	0,38	0,00	0,24	M3
2.5.4	Knows: common requirements and different kind of arrangements	2,82	2,24	1,24	0,75	0,21	0,38	0,00	0,41	T
2.5.5	Aware that pressure tanks must have a correct level of water	2,88	2,53	1,32	0,62	0,24	0,31	0,00	0,44	M3
2.5.6	Familiar with: right position of valves for pump units	2,94	2,65	1,20	0,70	0,26	0,41	0,00	0,31	M3 + C
2.5.7	Knows: how to test automatic start	2,53	2,41	1,37	0,71	0,21	0,34	0,00	0,44	C
2.5.8	Familiar with: standby pressure air/gas gauges inspection	2,94	2,29	1,25	0,77	0,18	0,38	0,00	0,47	M3 + C

3.1	Fixed fire detection system and fire alarm	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.1.1	Knows: how to use a manual call point	4,12	2,65	1,17	0,61	0,26	0,59	0,00	0,18	M2 + B
3.1.2	Familiar with: types of sensors, their locations, testing methods	3,88	2,76	0,99	0,44	0,50	0,47	0,00	0,06	M3 + B + S7 + S14
3.1.3	Familiar with: main functions and use of fire alarm control pannel	3,65	2,82	1,11	0,39	0,18	0,75	0,00	0,12	B
3.1.4	Knows: the difference between pre-alarm and alarm	3,12	2,29	1,62	0,59	0,12	0,44	0,00	0,40	P
3.1.5	Knows: when fire rounds should take place, what are the important items to be inspected?	4,12	2,71	0,99	0,47	0,15	0,78	0,00	0,12	M2 + B

3.4	Ventilation systems and fire dampers	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.4.1	Familiar with: the operation and the layout of fans and A/C units	3,00	2,29	1,12	0,69	0,26	0,47	0,06	0,24	T
3.4.2	Understands: the difference between a flap, a fire damper, a smoke damper	3,06	2,24	1,25	0,75	0,44	0,34	0,00	0,24	M1 + B + S9 + C
3.4.3	Familiar with: ventilation mushrooms	2,59	2,12	1,23	0,70	0,41	0,31	0,00	0,25	T
3.4.4	Aware that: there are remote and manual activation for dampers	3,59	2,65	1,06	0,49	0,47	0,50	0,00	0,06	B + C
3.4.5	Familiar with: smoke extraction	3,53	2,59	1,01	0,62	0,56	0,34	0,00	0,12	M1

Figure 19 Detailed list of Composite Sections and Items

Source ***Own figure***

9.3 Treatment of composite sections

9.3.1 Split Section

The split sections were directly divided into subsections. This concerns Sections 1.5 and 1.7, as shown in Figure 19.

9.3.2 Mixed Sections

For mixed sections, items were visually examined and reordered to identify meaningful sub-patterns before subdivision.They were then divided into 2 to 4 subsections each. The results are shown in Figure 20 and Figure 21.

2.5-A	Water mist spray, sprinkler (definition)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.5.2	Knows: the difference between mist, spray, and sprinkler	4,06	2,35	0,75	0,79	0,59	0,38	0,00	0,06	C
2.5.3	Knows: how to check nozzles integrity and prevent clogging	3,35	2,59	0,86	0,51	0,38	0,38	0,00	0,24	M3
2.5-B	**Water mist spray, sprinkler (Inspection, Test, Types of systems, requirements)**	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.5.5	Aware that pressure tanks must have a correct level of water	2,88	2,53	1,32	0,62	0,24	0,31	0,00	0,44	M3
2.5.6	Familiar with: right position of valves for pump units	2,94	2,65	1,20	0,70	0,26	0,41	0,00	0,31	M3 + C
2.5.7	Knows: how to test automatic start	2,53	2,41	1,37	0,71	0,21	0,34	0,00	0,44	C
2.5.1	Knows: the difference between dry pipe and wet pipe systems	3,06	2,24	1,39	0,66	0,38	0,28	0,00	0,31	C
2.5.4	Knows: common requirements and different kind of arrangements	2,82	2,24	1,24	0,75	0,21	0,38	0,00	0,41	T
2.5.8	Familiar with: standby pressure air/gas gauges inspection	2,94	2,29	1,25	0,77	0,18	0,38	0,00	0,47	M3 + C

3.1	Fixed fire detection system and fire alarm (Detection)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.1.1	Knows: how to use a manual call point	4,12	2,65	1,17	0,61	0,26	0,59	0,00	0,18	M2 + B
3.1.2	Familiar with: types of sensors, their locations, testing methods	3,88	2,76	0,99	0,44	0,50	0,47	0,00	0,06	M3 + B + S7 + S14
3.1.5	Knows: when fire rounds should take place, what are the important items to be inspected?	4,12	2,71	0,99	0,47	0,15	0,78	0,00	0,12	M2 + B
3.1	**Fixed fire detection system and fire alarm (alarm)**	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.1.3	Familiar with: main functions and use of fire alarm control pannel	3,65	2,82	1,11	0,39	0,18	0,75	0,00	0,12	B
3.1.4	Knows: the difference between pre-alarm and alarm	3,12	2,29	1,62	0,59	0,12	0,44	0,00	0,40	P

3.4-A	Ventilation systems and fire dampers (Physical elements)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.4.1	Familiar with: the operation and the layout of fans and A/C units	3,00	2,29	1,12	0,69	0,26	0,47	0,06	0,24	T
3.4.2	Understands: the difference between a flap, a fire damper, a smoke damper	3,06	2,24	1,25	0,75	0,44	0,34	0,00	0,24	M1 + B + S9 + C
3.4.3	Familiar with: ventilation mushrooms	2,59	2,12	1,23	0,70	0,41	0,31	0,00	0,25	T
3.4-B	**Ventilation systems and fire dampers (Theory)**	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.4.4	Aware that: there are remote and manual activation for dampers	3,59	2,65	1,06	0,49	0,47	0,50	0,00	0,06	B + C
3.4.5	Familiar with: smoke extraction	3,53	2,59	1,01	0,62	0,56	0,34	0,00	0,12	M1

Figure 20 List of new Subsections – Part 1

Source ***Own figure***

1.4-A	Hoses & Nozzles (inspection)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.2	Knows how to inspect a hose (couplings, gaskets, wire binding, leaks, sediments, ...)	4,12	2,47	0,93	0,51	0,50	0,41	0,03	0,00	M3+B
1.4-B	**Hoses & Nozzles (test and binding)**	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.4	Knows how to perform a pressure test	3,35	2,41	1,58	0,62	0,38	0,34	0,06	0,19	M3
1.4.5	Knows how to wire bind	3,35	2,47	1,54	0,62	0,35	0,31	0,00	0,31	P
1.4-C	**Hoses & Nozzles (Coupling, nozzles, storage)**	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.3	Knows the different kinds of couplings / nozzles	3,88	1,94	1,11	0,75	0,71	0,25	0,00	0,00	T
1.4.6	Knows how to maintain storing boxes (grease for nozzles, gasket for boxes)	3,41	2,12	1,18	0,49	0,35	0,41	0,03	0,19	M3
1.4.7	Knows how to store a hose (Common roll, O-shaped, S-Shaped)	4,47	2,12	0,87	0,78	0,62	0,41	0,00	0,00	P
1.4-D	**Hoses & Nozzles (length of hoses)**	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.1	Knows the mandatory length of the hoses	2,94	1,71	1,56	0,85	0,65	0,13	0,06	0,07	S10

1.5-A	Firefighter's outfits (Outfits)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.5.1	Knows how to inspect FF outfits and equipment	4,24	3,00	0,66	0,00	0,62	0,31	0,03	0,06	M3+B
1.5.2	Knows good practices for operational readiness	4,06	2,88	0,66	0,33	0,71	0,19	0,06	0,06	P+B
1.5.3	Familiar with Inspection / Test of Radios and charging arrangements	3,88	2,76	0,78	0,44	0,26	0,68	0,00	0,06	M3
1.5-B	**Firefighter's outfits (Tools)**	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.5.4	Knows the standard signals for steel-cored lifeline	2,29	2,06	1,40	0,83	0,24	0,18	0,00	0,59	M3
1.5.5	Knows in which situation to use the fire axe	3,00	2,06	1,46	0,83	0,35	0,24	0,12	0,29	M3

1.7-A	Portable fire extinguishers (type and inspection)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.7.1	Familiar with: types of extinguishers, and their use (Fire category, Distance, Method)	4,35	2,88	0,61	0,33	0,79	0,15	0,06	0,00	M
1.7.2	Familiar with: extinguishers inspection (Body, connection, pin, seal, tags and marks, ...	4,24	2,71	0,83	0,47	0,44	0,38	0,06	0,12	C+B
1.7-B	**Portable fire extinguishers (Maintenance, Re-fill)**	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.7.3	knows how to avoid powder caking (shaking)	3,06	2,24	1,52	0,75	0,32	0,24	0,03	0,38	P
1.7.4	Knows how to check emptiness (weighting)	3,65	2,18	1,22	0,81	0,29	0,26	0,09	0,35	P
1.7.5	Knows how to re-fill an empty extinguisher	1,88	1,88	1,17	0,86	0,21	0,18	0,03	0,59	M3+S14

2.2-A	Fixed gas-extinguishing (Procedure)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.2.2	Aware of the risk of explosion in flammable atmospheres	4,18	3,00	0,88	0,00	0,74	0,28	0,00	0,00	P
2.2.3	Aware of the importance of headcount and the master's orders before use	4,47	3,00	0,72	0,00	0,62	0,34	0,00	0,00	P
2.2.4	Aware of the importance of closing flaps and shutting ventilation before use	4,65	2,94	0,49	0,24	0,65	0,38	0,00	0,00	P
2.2-B	**Fixed gas-extinguishing (Inspection)**	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.2.1	Knows how to inspect an installation (hose cracks, pressure, leakages, ...)	3,29	2,59	1,10	0,71	0,32	0,41	0,00	0,29	C + S14
2.2.5	Knows the importance of draining the lines for condensation	3,47	2,59	1,28	0,62	0,32	0,38	0,03	0,29	P
2.2.6	Knows the different parts of an installation and the different modes of activation	3,76	2,82	1,20	0,39	0,41	0,47	0,03	0,12	T + P

Figure 21 List of new Subsections – Part 2

Source ***Own figure***

9.4 Final Classification

Figure 22 presents the final grouping of all sections and subsections into 5 new groups of items. These groups are be the interpretation basis for the section-driven analysis.

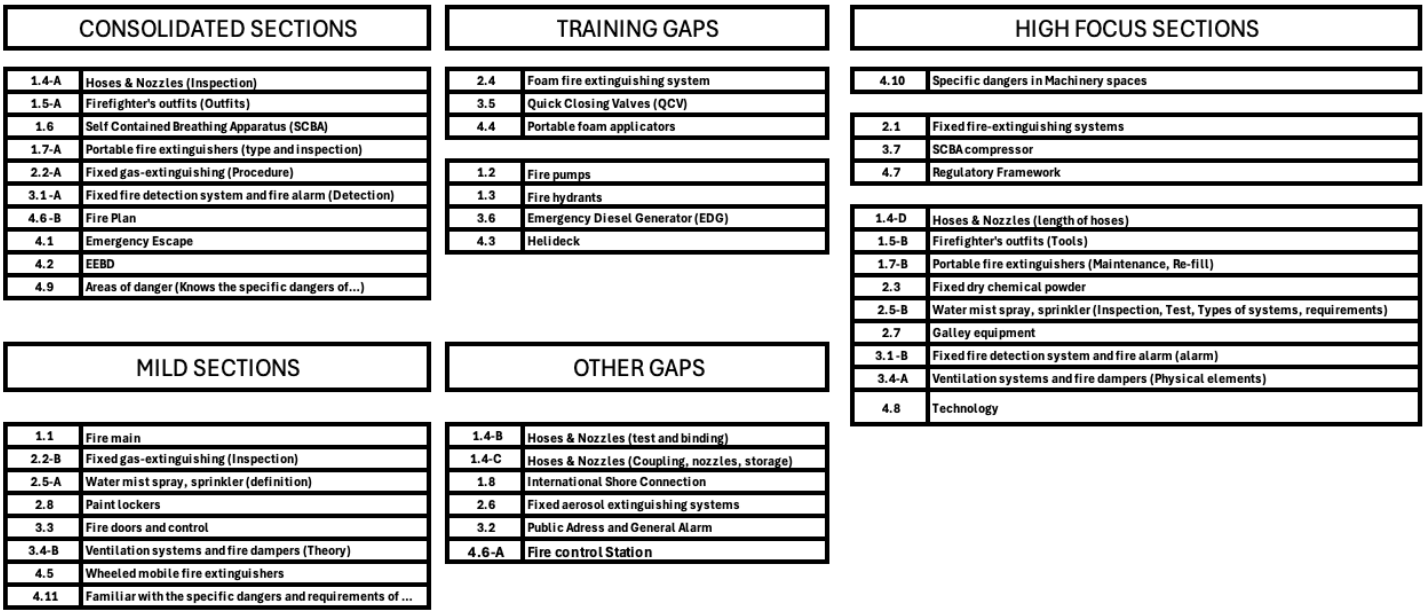


Figure 22 Final grouping of all Sections and Subsections

Source Own figure

Chapter 10 SECTION DRIVEN ANALYSIS

This chapter presents the detailed analysis of each section (and, where applicable, its subsections) and then examines individual items within those groupings.

The complete list of sections and subsections, organized by analytical group, can be found in Annex 4.

10.1 Group 1: Consolidated Sections.

Figure 23 and Figure 24 show the sections and subsections comprising Group 1, along with the statistical markers for each item within them.

1.4-A	Hoses & Nozzles (Inspection)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.2	Knows how to inspect a hose (couplings, gaskets, wire binding, leaks, sediments, ...)	4,12	2,47	0,93	0,51	0,50	0,41	0,03	0,00	M3+B

1.5-A	Firefighter's outfits (Outfits)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.5.1	Knows how to inspect FF outfits and equipment	4,24	3,00	0,66	0,00	0,62	0,31	0,03	0,06	M3+B
1.5.2	Knows good practices for operational readiness	4,06	2,88	0,66	0,33	0,71	0,19	0,06	0,06	P+B
1.5.3	Familiar with Inspection / Test of Radios and charging arrangements	3,88	2,76	0,78	0,44	0,26	0,68	0,00	0,06	M3
	AVERAGE VALUES	4,06	2,88	0,70	0,26	0,53	0,39	0,03	0,06	

1.6	Self Contained Breathing Apparatus (SCBA)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.6.1	Familiar with: Inspection of BA Bottles (Body, connection, pressure) (+ When to replace	4,65	3,00	0,61	0,00	0,68	0,26	0,06	0,00	M3+B
1.6.2	Familiar with: Inspection of SCBA (Good state, storage, whistle, leaks)	4,65	3,00	0,61	0,00	0,65	0,29	0,06	0,00	M3+B
1.6.3	Familiar with: Test of SCBA masks (void, overpressure, cleanliness, straps)	4,59	3,00	0,71	0,00	0,71	0,24	0,06	0,00	M3+B
	AVERAGE VALUES	4,63	3,00	0,64	0,00	0,68	0,26	0,06	0,00	

1.7-A	Portable fire extinguishers (type and inspection)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.7.1	Familiar with: types of extinguishers, and their use (Fire category, Distance, Method)	4,35	2,88	0,61	0,33	0,79	0,15	0,06	0,00	M
1.7.2	Familiar with: extinguishers inspection (Body, connection, pin, seal, tags and marks, ..	4,24	2,71	0,83	0,47	0,44	0,38	0,06	0,12	C+B

2.2-A	Fixed gas-extinguishing (Procedure)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.2.2	Aware of the risk of explosion in flammable atmospheres	4,18	3,00	0,88	0,00	0,74	0,28	0,00	0,00	P
2.2.3	Aware of the importance of headcount and the master's orders before use	4,47	3,00	0,72	0,00	0,62	0,34	0,00	0,00	P
2.2.4	Aware of the importance of closing flaps and shutting ventilation before use	4,65	2,94	0,49	0,24	0,65	0,38	0,00	0,00	P
	AVERAGE VALUES	4,43	2,98	0,70	0,08	0,67	0,33	0,00	0,00	

Figure 23 Group 1: Detailed list of Sections and Subsections – Part 1

Source Own figure

3.1-A	Fixed fire detection system and fire alarm (Detection)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.1.1	Knows: how to use a manual call point	4,12	2,65	1,17	0,61	0,26	0,59	0,00	0,18	M2+B
3.1.2	Familiar with: types of sensors, their locations, testing methods	3,88	2,76	0,99	0,44	0,50	0,47	0,00	0,06	M3+B+S7+S14
3.1.5	Knows: when fire rounds should take place, what are the important items to be inspecte	4,12	2,71	0,99	0,47	0,15	0,78	0,00	0,12	M2+B
	AVERAGE VALUES	4,04	2,71	1,05	0,50	0,30	0,61	0,00	0,12	

4.6-B	Fire Plan	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.6.2	Able to: read a Fire Control Plan	4,00	2,94	1,00	0,24	0,38	0,53	0,03	0,06	M2+S15

4.1	Emergency Escape	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.1.1	Knows: what spaces must have an emergency escape	4,24	2,76	0,75	0,44	0,34	0,56	0,00	0,06	S13+B
4.1.2	Aware of: the conflict between safety and security (locking of emergency escapes)	4,35	2,47	0,79	0,62	0,50	0,44	0,00	0,06	S13+B

4.2	EEBD	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.2.1	Knows: how to inspect an EEBD	4,06	2,82	0,90	0,39	0,47	0,41	0,00	0,12	B

4.9	Areas of danger (Knows the specific dangers of...)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.9.1	Machinery spaces (oil leak, defect, in lagging, hot work, ...)	4,41	2,82	0,71	0,39	0,53	0,44	0,03	0,00	M1
4.9.2	Accomodation spaces (cigaret, electrical defect, laundry)	4,41	2,76	0,87	0,44	0,47	0,50	0,03	0,00	M1
4.9.3	Galley (hot surfaces, deep fat frying)	4,53	2,71	0,62	0,47	0,44	0,53	0,03	0,00	M1
4.9.4	Radio/Battery rooms (hydrogen build-up, loose connections, short-circuit)	3,65	2,76	1,32	0,44	0,35	0,50	0,03	0,06	M1
4.9.5	Holds and containers (Dangerous cargo in bulk, DG, electric cars, ...)	3,59	2,76	1,28	0,44	0,53	0,26	0,09	0,06	M1
4.9.6	Storage of material (L.O barrels, thinners, paints, oxygen and acethylen cylinders)	4,18	2,76	0,95	0,44	0,53	0,35	0,06	0,00	M1
	AVERAGE VALUES	4,13	2,76	0,96	0,44	0,48	0,43	0,04	0,02	

Figure 24 Group 1: Detailed list of Sections and Subsections – Part 2

Source Own figure

Consolidated sections are those for which respondents reported high perceived importance, high confidence, and low variability. Examples include Self-Contained Breathing Apparatus (Section 1.6), Emergency Escapes (4.1), and Emergency Escape Breathing Devices (4.2).

Two observations merit mention:

Fixed Fire Detection Systems (3.1-1) are learned predominantly at sea (61 %) rather than through academic courses (30 %), yet confidence and importance remain high, confirming this topic as operationally well understood.

Although respondents show strong consensus overall, familiarity with fire risks related to battery rooms and dangerous goods (including electric vehicles) is slightly lower—an indication that even consolidated sections may contain specific outlier items.

10.2 Group 2: Mild Sections.

Figure 25 and Figure 26 show the sections and subsections in Group 2, along with the statistical markers for each item within them.

Mild sections are characterized by medium or high perceived importance, average self-assessed confidence, and low deviations—indicating stable yet non-exceptional confidence.

This group includes, among others: Fire Main (1.1), Paint Lockers (2.8), Fire Doors and Controls (3.3), Wheeled Mobile Fire Extinguishers (4.5), and Specific Dangers of Certain Vessel Types (4.11).

1.1	Fire main	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.1.1	Knows: how to line line-up in case of fire	3,88	2,82	0,78	0,39	0,56	0,47	0,00	0,00	M2
1.1.2	Inspection for corrosion and watertightness	3,35	2,47	1,00	0,62	0,32	0,50	0,00	0,18	M2
1.1.3	Isolation valves (Inspection, requirements)	3,24	2,71	1,15	0,47	0,32	0,59	0,00	0,12	M3+S10
	AVERAGE VALUES	3,49	2,67	0,97	0,50	0,40	0,52	0,00	0,10	

2.2-B	Fixed gas-extinguishing (inspection)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.2.1	Knows how to inspect an installation (hose cracks, pressure, leakages, ...)	3,29	2,59	1,10	0,71	0,32	0,41	0,00	0,29	C + S14
2.2.5	Knows the importance of draining the lines for condensation	3,47	2,59	1,28	0,62	0,32	0,38	0,03	0,29	P
2.2.6	Knows the different parts of an installation and the different modes of activ	3,76	2,82	1,20	0,39	0,41	0,47	0,03	0,12	T + P
	AVERAGE VALUES	3,51	2,67	1,20	0,57	0,35	0,42	0,02	0,24	

2.5-A	Water mist spray, sprinkler (definition)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.5.2	Knows: the difference between mist, spray, and sprinkler	4,06	2,35	0,75	0,79	0,59	0,38	0,00	0,06	C
2.5.3	Knows: how to check nozzles integrity and prevent clogging	3,35	2,59	0,86	0,51	0,38	0,38	0,00	0,24	M3

2.8	Paint lockers	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.8.1	Familiar with: the extinguishing systems required for a paint locker?	3,41	2,71	1,12	0,47	0,32	0,44	0,00	0,24	S10
2.8.2	Knows: the good practices for the housekeeping of a paint locker?	3,65	2,71	1,06	0,47	0,44	0,38	0,00	0,18	M1

Figure 25 Group 2: Detailed list of Sections and Subsections – Part 1

Source ***Own figure***

3.3	Fire doors and control	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.3.1	Knows: how to automatically and manually close a door	4,35	2,88	0,61	0,33	0,24	0,71	0,06	0,00	C + B
3.3.2	Knows: how to inspect a fire door and a release mechanism	3,76	2,47	1,20	0,62	0,12	0,65	0,06	0,13	C + B
3.3.3	Familiar with: adjusting the closing device	3,29	2,47	1,40	0,72	0,12	0,59	0,06	0,19	C
3.3.4	Familiar with: A, B, and C class divisions	3,71	2,53	1,21	0,62	0,62	0,28	0,00	0,12	S3 + C
3.3.5	Familiar with: the division of the ship into vertical zones by structural / therr	3,59	2,59	1,46	0,62	0,44	0,44	0,00	0,12	M1
	AVERAGE VALUES	3,74	2,59	1,18	0,58	0,31	0,53	0,04	0,11	

3.4-B	Ventilation systems and fire dampers (Theory)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.4.4	Aware that: there are remote and manual activation for dampers	3,59	2,65	1,06	0,49	0,47	0,50	0,00	0,06	B + C
3.4.5	Familiar with: smoke extraction	3,53	2,59	1,01	0,62	0,56	0,34	0,00	0,12	M1

4.5	Wheeled mobile fire extinguishers	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.5.1	Familiar with: location and use	3,65	2,41	1,17	0,62	0,26	0,50	0,00	0,24	C

4.11	Familiar with the specific dangers and requirements of ...	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N
4.11.1	Passenger ships	4,00	2,76	1,32	0,56	0,41	0,50	0,03	0,06
4.11.2	Tankers	3,76	2,88	1,20	0,33	0,79	0,15	0,00	0,06
4.11.3	Car carriers	4,06	2,82	0,97	0,39	0,68	0,24	0,03	0,06
4.11.4	Cargo Ships	3,59	2,71	1,00	0,47	0,85	0,06	0,03	0,06
4.11.5	Ships carrying DG	3,41	2,76	1,23	0,44	0,76	0,15	0,03	0,06
	AVERAGE VALUES	3,76	2,79	1,14	0,44	0,70	0,22	0,02	0,06

Figure 26 Group 2: Detailed list of Sections and Subsections – Part 2

Source ***Own figure***

Three observations are worth noting:

In section 1.1 (Fire Main), confidence is lower for inspection tasks compared to operational tasks like lining-up.

In section 2.5-A (Water Mist, Sprays, and Sprinklers – Definitions), while respondents show familiarity with terminology, opinions vary on the importance of this knowledge. Confidence is again lower when it comes to inspection, specifically of nozzles.

In section 3.3 (Fire Doors and Controls), both confidence and importance display higher deviations when it comes to adjusting the closing device (Maintenance skill). It is to be noted that learning for the whole section occurs predominantly on board (53%) rather than through academic training (31%).

10.3 Group 3: Training Gaps

Figure 27 and Figure 28 show the sections and subsections comprising Group 3, along with the statistical markers for each item within them.

Training gaps were defined as full sections where respondents reported low confidence (low AVCON) despite rating the topic as important (average/high AVIMP).

2.4	Foam fire extinguishing system	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.4.1	Familiar with the layout of a system	2,82	2,35	1,38	0,49	0,41	0,16	0,09	0,35	T
2.4.2	Familiar with: Inspection of control and section valves, and pressure gauges	2,53	2,35	1,18	0,61	0,35	0,25	0,06	0,35	C+B
2.4.3	Knows: how to verify the quantity of foam concentrate in a storage tank	2,12	2,53	1,11	0,62	0,18	0,19	0,06	0,56	C+B
	AVERAGE VALUES	2,49	2,41	1,22	0,57	0,31	0,20	0,07	0,42	

3.5	Quick Closing Valves (QCV)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.5.1	Knows: the technology of a QCV (Spring, Pneumatic, ...)	3,06	2,41	1,30	0,62	0,50	0,22	0,00	0,29	T
3.5.2	Knows: which parts are protected by a QCV	2,76	2,47	1,30	0,62	0,50	0,22	0,00	0,25	R4
3.5.3	Knows: how to reset a QCV	2,00	2,29	1,22	0,69	0,24	0,25	0,00	0,50	B
3.5.4	Knows: when to use a QCV	2,71	2,65	1,49	0,49	0,38	0,22	0,00	0,38	M1
	AVERAGE VALUES	2,63	2,46	1,33	0,61	0,40	0,23	0,00	0,35	

4.4	Portable foam applicators	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.4.1	Knows: where foam applicators should be placed	2,53	2,47	1,18	0,62	0,26	0,21	0,00	0,50	S10+C
4.4.2	Knows: how to inspect foam applicators	2,59	2,41	1,37	0,71	0,26	0,15	0,00	0,56	C

Figure 27 Group 3: Detailed list of Sections and Subsections – Part 1

Source Own figure

1.2	Fire pumps	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.2.1	Knows: main parts of a centrifugal pump, normal flow and pressures, starting sequenc	2,88	2,29	1,36	0,59	0,68	0,28	0,00	0,06	T
1.2.2	Knows: difference between a fire pump and an emergency fire pump	3,65	2,41	1,41	0,80	0,35	0,56	0,00	0,12	M2+S10
1.2.3	Knows: maintenance of a pump and the mandatory monthly tests	2,29	2,47	1,16	0,62	0,26	0,59	0,00	0,18	C
	AVERAGE VALUES	2,94	2,39	1,31	0,67	0,43	0,48	0,00	0,12	

1.3	Fire hydrants	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.3.1	Knows the main parts of a hydrant (spindle, seat, stuffing box, nuts, gaskets, flanges)	3,65	2,24	1,32	0,66	0,59	0,38	0,00	0,06	T
1.3.2	Knows how to perform pressure test for watertightness	2,88	2,12	1,45	0,60	0,47	0,38	0,00	0,18	M3+P
1.3.3	Knows how to react if leaking: rectify the surface of the seat (lapping), or change the gas	3,12	2,47	1,17	0,62	0,29	0,56	0,00	0,13	M3+P
1.3.4	Knows how to react if the wheel is blocked (open, clean, grease, adjust stuffing box ten	2,76	2,59	1,44	0,51	0,24	0,38	0,12	0,25	M3+P
	AVERAGE VALUES	3,10	2,35	1,34	0,60	0,40	0,42	0,03	0,15	

3.6	Emergency Diesel Generator (EDG)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.6.1	Knows: the requirements for an EDG (start, time running)	2,94	2,35	1,25	0,70	0,47	0,31	0,00	0,13	SOLAS II-1 42+43
3.6.2	Knows: which equipment is powered by an EDG	3,35	2,71	1,32	0,59	0,38	0,41	0,06	0,07	SOLAS II-1 42+43
3.6.3	Knows: the different modes for starting an EDG (local, remote, automatic)	3,06	2,59	1,34	0,51	0,29	0,44	0,00	0,20	M2+SOLAS II-1 44
	AVERAGE VALUES	3,12	2,55	1,30	0,60	0,38	0,39	0,02	0,13	

Figure 28 Group 3: Detailed list of Sections and Subsections – Part 2

Source Own figure

The group can be divided into two subsets based on AVCON levels:

- Low confidence (AVCON < 2.8):
    - Section 2.4: Foam Fire Extinguishing Systems
    - Section 4.4: Foam Applicators
    - Section 3.5: Quick Closing Valves
- Moderate confidence (AVCON between 2.8 and 3.2):
    - Section 1.2: Fire Pumps
    - Section 1.3: Fire Hydrants
    - Section 3.6: Emergency Generator

Three observations are worth highlighting:

In section 1.2, gaps appear in technical knowledge and maintenance procedures, particularly regarding distinctions between fire pumps and emergency fire pumps. Confidence and importance ratings show high variability.

In section 1.3, actions related to in-depth maintenance (lapping, replacing internal parts) show the lowest AVCON, while respondents are more confident in identifying hydrant components.

For section 3.6, there is strong consensus (low deviation) and high perceived importance regarding knowledge of the systems powered by the emergency generator.

Notably, sections with the lowest AVCON scores (2.4, 3.5, 4.4) also display a high proportion of "%N" responses, indicating low informational exposure.

Additionally, in this low-confidence subset, 4 out of 9 items are directly linked to content from MSC Circulars (“C”), tending to indicate a need for more exposure of regulatory content.

10.4 Group 4: Other Gaps

This group gathers sections that display distinctive or inconsistent response patterns not fitting the previous categories. Figure 29 and Figure 30 show the sections and subsections comprising Group 4, along with the statistical markers for each item within them.

Subsection 1.4-B (*Hoses and Nozzles – Test and Binding*) and section 3.2 (*Public Address and General Alarm*) both show high deviations in confidence, while average importance and confidence remain moderate. This reflects a consistency gap: respondents demonstrate highly variable exposure and understanding, likely depending on individual operational experience.

Skill 1.8 (*International Shore Connection – Use and Location*) reveals a pure perception gap: while confidence is uniformly high, deviation in importance is significant. This suggests respondents agree on how to use the equipment but differ in how critical they believe it is.

A similar perception gap is seen in subsection 1.4-C (*Hoses and Nozzles – Coupling, Nozzles, Storage*), where average importance is low and deviation high. Opinions diverge on the relevance of storage and box maintenance, likely reflecting variability in onboard practices.

Finally, section 2.6 (*Fixed Aerosol Extinguishing Systems*) represents a consensus gap of omission. Respondents uniformly rate both confidence and importance low, with an exceptionally high percentage (63% to 73%) declaring no source of information at all for these items.

1.4-B	Hoses & Nozzles (test and binding)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.4	Knows how to perform a pressure test	3,35	2,41	1,58	0,62	0,38	0,34	0,06	0,19	M3
1.4.5	Knows how to wire bind	3,35	2,47	1,54	0,62	0,35	0,31	0,00	0,31	P

1.4-C	Hoses & Nozzles (Coupling, nozzles, storage)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.3	Knows the different kinds of couplings / nozzles	3,88	1,94	1,11	0,75	0,71	0,25	0,00	0,00	T
1.4.6	Knows how to maintain storing boxes (grease for nozzles, gasket for boxes)	3,41	2,12	1,18	0,49	0,35	0,41	0,03	0,19	M3
1.4.7	Knows how to store a hose (Common roll, O-shaped, S-Shaped)	4,47	2,12	0,87	0,78	0,62	0,41	0,00	0,00	P
	AVERAGE VALUES	3,92	2,06	1,05	0,67	0,56	0,35	0,01	0,06	

Figure 29 Group 4: Detailed list of Sections and Subsections – Part 1

Source ***Own figure***

1.8	International Shore Connection	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.8.1	Knows the use and locations of ISCs	3,88	2,88	0,93	0,78	0,68	0,34	0,00	0,00	S14+C

2.6	Fixed aerosol extinguishing systems	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.6.1	Knows: what an aerosol system is	2,76	2,00	1,39	0,61	0,24	0,06	0,06	0,63	C
2.6.2	Knows: the difference between condensed and dispersed aerosols	1,94	1,88	0,90	0,60	0,18	0,06	0,00	0,73	C

3.2	Public Adress and General Alarm	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.2.1	Familiar with: the use of P.A and of G.A	3,65	2,76	1,46	0,56	0,26	0,59	0,00	0,18	C+S12
3.2.2	Familiar with: specificities of passenger ships for muster organization (crowd manage	3,35	2,59	1,41	0,62	0,21	0,59	0,00	0,24	C+B

Figure 30 Group 4: Detailed list of Sections and Subsections – Part 2

Source ***Own figure***

10.5 Group 5: High Focus Sections

Figure 31 and Figure 24 show the sections and subsections comprising Group 1, along with the statistical markers for each item within them.

High Focus Sections are defined as those for which more than half the statistical markers are coded red, yet no clear thematic or structural pattern could be identified.

In chapter 8.2.4, the hypothesis was made that high-focus sections may represent blind spots for respondents. This perspective will be further explored in the discussion.

4.10	Specific dangers in Machinery spaces	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.10.1	Familiar with: boiler uptake fires and exhaust fires (cause, dangers, procedur	2,41	2,41	1,00	0,80	0,41	0,24	0,00	0,31	M1
4.10.2	Familiar with: iron-in-steam fires in water-tubes boilers? (cause, dangers, pro	2,06	2,35	1,14	0,79	0,29	0,24	0,00	0,44	M1
4.10.3	Know: what is a machinery space of category A?	1,88	2,06	1,11	0,66	0,24	0,12	0,00	0,63	S3
4.10.4	Familiar with: the mandatory measure for category A spaces ?	2,12	2,29	1,11	0,77	0,32	0,21	0,00	0,44	S10
	AVERAGE VALUES	2,12	2,28	1,09	0,75	0,32	0,20	0,00	0,45	

2.1	Fixed fire-extinguishing systems	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.1.1	Knows the different types of fixed FFS allowed by SOLAS	3,29	2,29	0,99	0,69	0,59	0,25	0,00	0,18	S10
2.1.2	Knows the regulatory requirements for the different types of vessels / Parts	2,76	2,18	1,20	0,73	0,44	0,28	0,00	0,29	S10

3.7	SCBA compressor	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.7.1	Knows: the different parts of a SCBA compressor	2,82	2,00	1,29	0,79	0,26	0,32	0,12	0,29	T
3.7.2	Knows: safe procedure for starting a SCBA compressor and filling a bottle	2,88	2,41	1,50	0,80	0,18	0,47	0,06	0,29	P
3.7.3	Familiar with: the common maintenance of a SCBA compressor	2,06	1,94	1,09	0,75	0,12	0,38	0,00	0,50	P
3.7.4	Aware of: the importance of draining condensate traps	2,53	2,18	1,62	0,73	0,12	0,38	0,06	0,44	P
3.7.5	Aware of: the dangers of high pressure systems	3,65	2,71	1,37	0,47	0,26	0,28	0,12	0,31	P
3.7.6	Knows: how to change oil and filters	2,29	1,88	1,53	0,93	0,06	0,25	0,12	0,53	P
3.7.7	Prepared to fill air bottles alone in safety?	2,71	2,35	1,49	0,79	0,00	0,44	0,06	0,47	S15
	AVERAGE VALUES	2,71	2,21	1,41	0,75	0,14	0,36	0,08	0,41	

4.7	Regulatory Framework	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.7.1	Familiar with: the content of SOLAS II-2?	2,88	2,06	1,17	0,83	0,79	0,03	0,06	0,06	S
4.7.2	Familiar with: the content of the model course 2.03 Advanced Fire Fighting	2,94	2,12	1,20	0,70	0,76	0,06	0,00	0,07	M
4.7.3	Familiar with: the content of FSS?	3,12	2,35	1,17	0,61	0,71	0,13	0,00	0,13	FFS
4.7.4	Familiar with: the content of the important MSC Circulars (1432, ...)	2,29	2,06	1,16	0,66	0,41	0,13	0,00	0,44	C
4.7.5	Familiar with: the mandatory content of a Planned Management System?	2,53	2,12	1,18	0,70	0,47	0,25	0,00	0,25	S14
	AVERAGE VALUES	2,75	2,14	1,17	0,70	0,63	0,12	0,01	0,19	

1.4-D	Hoses & Nozzles (length of hoses)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.1	Knows the mandatory length of the hoses	2,94	1,71	1,56	0,85	0,65	0,13	0,06	0,07	S10

1.5-B	Firefighter's outfits (Tools)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.5.4	Knows the standard signals for steel-cored lifeline	2,29	2,06	1,40	0,83	0,24	0,18	0,00	0,59	M3
1.5.5	Knows in which situation to use the fire axe	3,00	2,06	1,46	0,83	0,35	0,24	0,12	0,29	M3

1.7-B	Portable fire extinguishers (Maintenance, Re-fill)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.7.3	knows how to avoid powder caking (shaking)	3,06	2,24	1,52	0,75	0,32	0,24	0,03	0,38	P
1.7.4	Knows how to check emptiness (weighting)	3,65	2,18	1,22	0,81	0,29	0,26	0,09	0,35	P
1.7.5	Knows how to re-fill an empty extinguisher	1,88	1,88	1,17	0,86	0,21	0,18	0,03	0,59	M3+S14
	AVERAGE VALUES	2,86	2,10	1,30	0,81	0,27	0,23	0,05	0,44	

Figure 31 Group 1: Detailed list of Sections and Subsections – Part 1

Source ***Own figure***

2.3	Fixed dry chemical powder	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.3.1	Familiar with the following terms: Cacking, Packing, Gas point, Monitor	2,29	2,06	0,99	0,56	0,41	0,13	0,00	0,47	C
2.3.2	Knows when to chose between using DCP versus shutting gas supply during	2,35	2,59	1,41	0,51	0,26	0,09	0,06	0,56	p
2.3.3	Familiar with the layout of a DCP system and its different activation procedu	2,35	2,24	1,37	0,66	0,29	0,19	0,06	0,44	T
	AVERAGE VALUES	2,33	2,29	1,25	0,58	0,32	0,14	0,04	0,49	

2.5-B	Water mist spray, sprinkler (inspection, Test, Types of systems, requireme	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.5.5	Aware that pressure tanks must have a correct level of water	2,88	2,53	1,32	0,62	0,24	0,31	0,00	0,44	M3
2.5.6	Familiar with: right position of valves for pump units	2,94	2,65	1,20	0,70	0,26	0,41	0,00	0,31	M3 + C
2.5.7	Knows: how to test automatic start	2,53	2,41	1,37	0,71	0,21	0,34	0,00	0,44	C
2.5.1	Knows: the difference between dry pipe and wet pipe systems	3,06	2,24	1,39	0,66	0,38	0,28	0,00	0,31	C
2.5.4	Knows: common requirements and different kind of arrangements	2,82	2,24	1,24	0,75	0,21	0,38	0,00	0,41	T
2.5.8	Familiar with: standby pressure air/gas gauges inspection	2,94	2,29	1,25	0,77	0,18	0,38	0,00	0,47	M3 + C
	AVERAGE VALUES	2,86	2,39	1,29	0,70	0,25	0,35	0,00	0,40	

2.7	Galley equipment	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.7.1	Familiar with: the mandatory extinguishing mediums for galley fire	3,71	2,65	1,10	0,49	0,35	0,50	0,00	0,18	S10
2.7.2	Knows: the difference between dry chemical and wet chemical extinguishing	3,18	2,29	1,29	0,69	0,32	0,28	0,00	0,38	P

3.1 -B	Fixed fire detection system and fire alarm (alarm)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.1.3	Familiar with: main functions and use of fire alarm control pannel	3,65	2,82	1,11	0,39	0,18	0,75	0,00	0,12	B
3.1.4	Knows: the difference between pre-alarm and alarm	3,12	2,29	1,62	0,59	0,12	0,44	0,00	0,40	P

3.4-A	Ventilation systems and fire dampers (Physical elements)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.4.1	Familiar with: the operation and the layout of fans and A/C units	3,00	2,29	1,12	0,69	0,26	0,47	0,06	0,24	T
3.4.2	Understands: the difference between a flap, a fire damper, a smoke damper	3,06	2,24	1,25	0,75	0,44	0,34	0,00	0,24	M1 + B + S9 +C
3.4.3	Familiar with: ventilation mushrooms	2,59	2,12	1,23	0,70	0,41	0,31	0,00	0,25	T
	AVERAGE VALUES	2,88	2,22	1,20	0,71	0,37	0,38	0,02	0,24	

4.8	Technology	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.8.1	Knows: what essential equipment should be found in a safety locker?	3,35	2,41	1,17	0,71	0,56	0,41	0,00	0,06	P
4.8.2	Knows: the difference between grease/vaseline/silicon grease?	3,00	1,94	1,27	0,56	0,21	0,35	0,09	0,31	T
4.8.3	Familiar with: valves and pumps maintenance	2,76	2,35	1,35	0,79	0,29	0,35	0,00	0,31	T
4.8.4	Familiar with: gate/butterfly valves(different parts+how to fix a leak)	2,76	2,18	1,30	0,64	0,53	0,18	0,00	0,29	T
	AVERAGE VALUES	2,97	2,22	1,27	0,67	0,40	0,32	0,02	0,24	

Figure 32 Group 5: Detailed list of Sections and Subsections – Part 2

Source ***Own figure***

Section 4.10 (Specific Dangers in Machinery Spaces) stands out of the others. With the lowest average AVCON in the dataset and 45% of respondents reporting no source of information, this section includes risks such as boiler fires and hazards in Category A machinery spaces. High deviation in importance suggests inconsistent understanding of its relevance.

A second trend emerges across several fixed fire extinguishing systems, including Sections 2.1, 2.5-B, and 2.7. These sections display both low AVCON and

high deviation. The predominant informational source marked “C” (MSC Circulars) indicates that knowledge of these systems may rely on dense regulatory documents, which not all respondents seem to access or understand effectively.

Several items relate to practical aspects appear to be particularly affected by blind spots:

- Section 1.5-B, which focuses on the tools used with fire-fighting equipment.
- Section 1.7-B, which addresses maintenance and refilling of portable fire extinguishers.
- Section 3.4-A, which involves the technical details of ventilation systems.
- Section 4.8 , which covers specialized content such as grease types and the content of a safety locker.

These items have in common to be highly practical and related to tools and knowledge of technical parts.

Another revealing case is Section 3.7 (SCBA Compressor), where 41% of respondents report no source of information at all. Learning is primarily on board (36%) and only marginally from academic instruction (14%). The item *3.7.7 (Prepared to fill air bottles alone in safety)* illustrates the point with a notably low AVCON of 2.71.

10.6 Composite Section separations.

This chapter offers an identification of intra-sectional divergences that reveal the physical or procedural limits of respondents' knowledge.

The detailed list of subsections is presented in Figure 20 and Figure 21.

Composite sections were further subdivided into separate patterns—highlighting clear distinctions between conceptual understanding, practical handling, and regulatory familiarity.

Hoses and Nozzles: Respondents report strong familiarity with inspection procedures. However, a consistency gap appears regarding testing and maintenance, where confidence is highly variable. A perception gap is observed concerning storage practices and maintenance of hose boxes and nozzles. Finally, a blind spot emerges around regulatory requirements, such as the mandatory lengths of hoses.

Firefighter Outfits: Respondents expressed high confidence regarding the outfit itself. However, a potential blind spot seems to exist for associated tools and accessories, including the fire axe and lifeline.

Portable Fire Extinguishers: Respondents expressed high confidence for the use and inspection of portable fire extinguishers, but potential blind spots seem to appear in procedures related to testing and maintenance, and refill.

CO_2 Systems: The procedural aspects (activation, operation, emergency response) form a consolidated pattern with high confidence. In contrast, inspection and maintenance aspects seem to fall fall into a mild pattern.

Ventilation Systems: Respondents expressed medium confidence for items related to theoretical knowledge of ventilation elements, and expressed low confidence for knowledge of physical elements such as airflow controls and damper systems.

Fire Detection and Alarm: Respondents expressed confidence in understanding fire detection systems. However, they expressed low confidence regarding fire alarm systems.

Water Sprinklers and Mist Systems: Respondents expressed high confidence regarding their conceptual knowledge (Knowing the different types of systems).

However, a potential blind spot seems to exist regarding the installation itself—its layout, components, and inspection procedures.

These findings tend to indicate that even when sections are conceptually unified, practical experience and technical detail often vary across their components.

Chapter 11 DISCUSSION

The analysis of the five groups suggests interesting patterns in respondent self-assessed confidence and the way they perceive the importance of items regarding onboard fire safety competencies.

11.1 Groups 1 & 2: Consolidated and Mild Sections

Groups 1 and 2 are composed of items for which respondents express high confidence, suggesting a feeling of overall mastery. Most represented sections are firefighting equipment such as SCBAs and firefighter's outfits. This high level of confidence may suggests that these topics are well-covered. The origin of knowledge is mostly shared between maritime academies and on-board training environments, at the exception of Fire detection, covered at sea mainly.

A trend seems to emerge emerge when transitioning from theoretical or procedural understanding to technical and maintenance-related tasks**.** Items involving inspection, testing, and maintenance are often categorized in the Mild or Training Gap groups.

11.2 Group 3: Training Gaps

Group 3 captures the medium to high importance items for which respondents expressed a low confidence. These items often include a low informational exposure.

Foam Systems: Both fixed foam systems and mobile foam applicators stand out as sections for which respondents expressed a lower confidence. This phenomenon will be explored interpreted in Chapter 11.6.1.

Quick Closing Valves (QCVs)**:** This section is conspicuous amongst training gaps, because -like foam systems- respondents expressed a consistent lower confidence amongst the items composing the section.

In particular, respondents expressed low confidence regarding the principal aspects of Quick Closing Valves, including:

- Their components
- The knowledge of what equipment is protected by them
- The knowledge of when they should be activated

Link Between Emergency Systems: An interesting connection arose between item 1.2.2 (distinguishing between fire pumps and emergency fire pumps) and item 3.6.2 (equipment powered by Emergency Diesel Generator). The patterns suggest that respondents may not have fully established the relationship between emergency fire pumps and emergency power systems. This may reflects a fragmented understanding.

Respondents also expressed a low confidence regarding the maintenance of fire hydrants (lapping, changing parts).

11.3 Group 4: Other Gaps

Group 4 includes consistency and perception gaps**,** where high deviations are obtained for either self-assessed confidence or perceived importance.

11.3.1 Consistency Gaps

Items 1.4-B (Hoses – testing and binding) and 3.2 (Public Address and General Alarm) show high variability in self-assessed confidence.

For example, 63% of respondents learned about Public Address and General Alarm systems onboard, and 23% of respondents report having no source of

information at all. These figures suggest that self-assessed confidence is driven by exposure at during sea-experience training, and less by mandatory training.

It raises the pedagogical question: could confidence be raised before boarding through low-cost interventions? Examples might include: annotated photos, short technical videos, or simplified user manuals. These tools might provide a baseline familiarity even without physical access.

11.3.2 Perception Gaps

Item 1.8.1 (International Shore Connection) tends to indicate a divergence in perceived importance. While respondents express confidence in their knowledge, the high deviation in perceived importance suggests conceptual uncertainty about its operational relevance.

Similar patterns exist for pressure testing and wire binding. Notably, some respondents informally admitted not knowing what "wire binding" entailed—underscoring the need for triangulated assessments , this topic will be elaborated on chapter 12.3.

11.4 Group 5: high focus areas

Group 5 includes items where multiple types of gaps intersect—low confidence, low importance, high deviations, and unclear patterns of exposure. These may represent blind spots that do not fall neatly into perception, consistency, or training categories.

An interesting example is Section 3.7 (SCBA Compressor), where 41% of respondents report no source of information at all. Learning is primarily on board (36%) and only marginally from academic instruction (14%). The item *3.7.7 (Prepared to fill air bottles alone in safety)* illustrates the point with a notably low AVCON of 2.71.

This potential blind spot, if confirmed by a triangulation, could be resolved by approaching this system from a technical perspective in a maritime curriculum, providing respondents with the safe procedure to use high pressure systems, and train them to use academic facilities to refill bottles used during drills.

Ventilation Control**:** Item 3.4.2 suggests that respondents do not feel confident in distinguishing flaps, fire dampers, and smoke dampers. Item 3.4.3 also suggests that respondents are not confident in their understanding of "mushroom" systems. The implication is that although procedural knowledge seems to be present present (e.g., isolate the space before CO_2 release), the physical systems enabling that procedure seems not to be clearly visualized.

11.5 Composite Section

The Composite Sections suggest valuable insight into the physical and practical limits of the respondents' knowledge.

While respondents expressed high confidence in core elements like firefighting outfits and hose use, potential blind spots could exist in areas requiring maintenance, testing, or physical system identification.

For instance, while fire extinguishers seem to be well understood in terms of use, their testing and servicing seem to remain remain unclear. Similarly, although CO_2 system procedures seem to be known, respondents expressed lower confidence regarding the inspection and maintenance aspects.

Lastly, respondents expressed a high confidence regarding their knowledge of the differences between water-based fixed extinguishing systems (spray, sprinklers, mist). However, they expressed low confidence regarding the knowledge of the physical layout or installation related to these water-based systems.

This reinforce the idea that there may be a disconnect between procedural knowledge and real-world equipment.

11.6 Potential cross-section blind spots

11.6.1 Foam and Applicators

An potential insight relates to foam systems and applicators, which appear repeatedly across training gaps and high-focus areas. While respondents seem to have identified foam applicators as tools used in firefighting, a cross-section analysis suggest a potential lack of understanding regarding their specific context of application.

Most notably, respondents expressed low confidence with:

- Category A machinery spaces
- Boiler fires
- Location of foam equipment on board.

This suggests that although respondents may conceptually associate foam with fire response, they may not clearly visualize when, where, or how it should be used operationally.

The potential disconnect between the tool and its intended scenario suggests the existence of a potential cognitive gap in situational awareness. This hypothesis would benefit from confirmation through targeted interviews, to explore how respondents frame the use of foam in their mental models of shipboard firefighting.

These possible triangulation methods will be developed in Chapter 12.

11.6.2 From detection to action

Another potential blind spot seems to exist regarding the functioning of the fire alarm control panel. In particular, the distinction between “alarm” and “pre-alarm” (Item 3.1-B), suggests a potential gap in the understanding of how detection signals are processed and transmitted to the bridge.

Respondents expressed high self-assessed confidences regarding the detection systems (input) and procedural response to an alarm (output). However, their mental mapping seems to have a blind spot between the point of detection and the reaction, with a potential limited knowledge of how alerts are relayed or managed via the fire control panel.

11.7 Conclusion

Different homogeneous groups were identified. Consolidated and mild sections, training gaps, other gaps, and high focus sections.

Some topics stood out as important gaps, requesting confirmation and possible corrective action: including Quick Closing Valves, Specific dangers in machinery spaces, or the use of SCBA compressor.

The study suggested that structural gaps in respondent's mental model of fire-fighting may exist. These potential structural gaps refer to the items mentioned in chapter 11.6, like between emergency power generation and emergency equipment, or the link between machinery space of category A, boilers fire and foam fire fighting.

Chapter 12 LIMITATIONS, IMPROVEMENTS, AND NEED FOR TRIANGULATION

12.1 Limitations

This exploratory study aimed to design, and analyze a self-assessment tool for evaluating fire safety competencies within the maritime sector, with a clear focus on obtaining results. Apart from the non-inferential nature of this study and the fact that findings are only hypothesis, several limitations have been identified.

12.1.1 Methodological Limitations

Potential gaps may have been overlooked due to due to an incomplete mapping. Also, bias created by the design of the survey has not be measured. Ambiguous questions or lack of clarity of the items may have mislead the respondents. Finally, a self-assessment approach is ambiguous by nature.

12.1.2 Analytical Limitations

Several obstacles were met during the dataset processing. Although methodologically justified, the choice of parametric statistical markers and the use of Pearson's correlation may not be the most efficient.

Although inspired by recognized thresholding methods, deviation thresholds have been heuristically defined, limiting the reproductability of the study. The impact of this choice has not been measured.

12.1.3 Conceptual Limitations

Although the concept of competence is well described in the litterature, it has not be rigourously defined in this study.

Note: My understanding of the concept of competence evolved throughout the development of this study. Initially framed with a strictly practical and operational focus, the notion gradually expanded to integrate more cognitive and judgment-based dimensions.

In particular, the perceived importance of each item — which was at first introduced intuitively — emerged as a key aspect of competence itself.

12.2 Improvements

Several improvement could be added in a future work, including:

- Reviewing more extensvely the litterature on competence, and include a more rigorous definition of this concept.
- Revising the mapping with new items, cut useless items, better referencing of the origins, assessment of the mapping by respondents
- Improving the survey (Wording of questions should be reviewed to limit potential bias, The size of the likert scales should be re-assessed)
- Processing of data (Trying non-parametric markers, comparing Pearson and Spearman correlation results)
- Thresholding (Improved process, algorythm for cluster thresholding, trying a quartile-based thresholding for deviation and observing the influence on the classification
- Reviewing the Excel file and the way answers are registered.

12.3 Need for triangulation

12.3.1 Methods for triangulation

Although the survey suggested valuable insights, such results remain vulnerable to bias, error, or misinterpretation if not supported by converging evidence.

Miles et al. (2014) explain that different methods are available to help confirming trends observed in an exploratory analysis, a concept called triangulation. These methods include:

- Changing the method of assessment (observation, survey, interview)
- Changing the researcher
- Changing the data type (Qualitative texts, audio recordings, quantitative data)

12.3.2 Respondent's post-survey interview

In the context of this exploratory analysis, targeted interviews amongst respondents stand out as a relevant way to confirm suspected trends, so to formulate more robust hypotheses.

These interviews could serve multiple purposes:

- The interviews could help confirming or challenging the trends observed and the classification of the sections.
- The interviews could allow feedback to be expressed, so to help refining the mapping.
- The interviews could help understand the potential biases created by the survey's wording.

- Interviews on high-focus sections could help understand the reasons for deviation and confirm the hypothesis of high focus sections being blind spots.

Chapter 13 CONCLUSION

This exploratory study developed a mapping of practical competencies required for the inspection, testing, maintenance, and operation of fire-fighting systems onboard ships. A survey was conducted to assess a small group of seafarers' self-reported confidence and perceived importance for each competency item.

The analysis combined exploratory data analysis and section-based interpretation. Trends suggested that higher confidence levels tended to align with broader informational exposure, and that areas with limited exposure to references—particularly from MSC Circulars—were more frequently associated with low confidence.

Section-level patterns highlighted areas of perceived mastery as well as potential blind spots, especially regarding quick-closing valves and SCBA compressors. Some evidence pointed to fragmented understanding of complex systems, raising the possibility of cognitive disconnects in emergency preparedness.

These findings primarily support further instrument refinement and deeper investigation into competence mapping in maritime safety context.

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LIST OF ANNEXES

Annex 1 MAPPING OF ITEMS WITH SOURCES

1.1	**Fire main**	
1.1.1	Knows: how to line line-up in case of fire	M2
1.1.2	Inspection for corrosion and watertightness	M2
1.1.3	Isolation valves (Inspection, requirements)	M3+S10
1.2	**Fire pumps**	
1.2.1	Knows: main parts of a centrifugal pump, normal flow and pressures, starting sequence	T
1.2.2	Knows: difference between a fire pump and an emergency fire pump	M2+S10
1.2.3	Knows: maintenance of a pump and the mandatory monthly tests	C
1.3	**Fire hydrants**	
1.3.1	Knows the main parts of a hydrant (spindle, seat, stuffing box, nuts, gaskets, flanges)	T
1.3.2	Knows how to perform pressure test for watertightness	M3+P
1.3.3	Knows how to react if leaking: rectify the surface of the seat (lapping), or change the gasket	M3+P
1.3.4	Knows how to react if the wheel is blocked (open, clean, grease, adjust stuffing box tension, ...)	M3+P
1.4	**Hoses & Nozzles**	
1.4.1	Knows the mandatory length of the hoses	S10
1.4.2	Knows how to inspect a hose (couplings, gaskets, wire binding, leaks, sediments, ...)	M3+B
1.4.3	Knows the different kinds of couplings / nozzles	T
1.4.4	Knows how to perform a pressure test	M3
1.4.5	Knows how to wire bind	P
1.4.6	Knows how to maintain storing boxes (grease for nozzles, gasket for boxes)	M3
1.4.7	Knows how to store a hose (Common roll, O-shaped, S-Shaped)	P
1.5	**Firefighter's outfits**	
1.5.1	Knows how to inspect FF outfits and equipment	M3+B
1.5.2	Knows good practices for operational readiness	P+B
1.5.3	Familiar with Inspection / Test of Radios and charging arrangements	M3
1.5.4	Knows the standard signals for steel-cored lifeline	M3
1.5.5	Knows in which situation to use the fire axe	M3
1.6	**Self Contained Breathing Apparatus (SCBA)**	
1.6.1	Familiar with: Inspection of BA Bottles (Body, connection, pressure) (+ When to replace)	M3+B
1.6.2	Familiar with: Inspection of SCBA (Good state, storage, whistle, leaks)	M3+B
1.6.3	Familiar with: Test of SCBA masks (void, overpressure, cleanliness, straps)	M3+B
1.7	**Portable fire extinguishers**	
1.7.1	Familiar with: types of extinguishers, and their use (Fire category, Distance, Method)	M
1.7.2	Familiar with: extinguishers inspection (Body, connection, pin, seal, tags and marks, ...)	C+B
1.7.3	knows how to avoid powder caking (shaking)	P
1.7.4	Knows how to check emptiness (weighting)	P
1.7.5	Knows how to re-fill an empty extinguisher	M3+S14
1.8	**International Shore Connection**	
1.8.1	Knows the use and locations of ISCs	S14 +C

2.1	**Fixed fire-extinguishing systems**	
2.1.1	Knows the different types of fixed FFS allowed by SOLAS	S10
2.1.2	Knows the regulatory requirements for the different types of vessels / Parts of a vessel	S10
2.2	**Fixed gas-extinguishing**	
2.2.1	Knows how to inspect an installation (hose cracks, pressure, leakages, ...)	C + S14
2.2.2	Aware of the risk of explosion in flammable atmospheres	P
2.2.3	Aware of the importance of headcount and the master's orders before use	P
2.2.4	Aware of the importance of closing flaps and shutting ventilation before use	P
2.2.5	Knows the importance of draining the lines for condensation	P
2.2.6	Knows the different parts of an installation and the different modes of activation	T + P
2.3	**Fixed dry chemical powder**	
2.3.1	Familiar with the following terms: Cacking, Packing, Gas point, Monitor	C
2.3.2	Knows when to chose between using DCP versus shutting gas supply during a gas fire	p
2.3.3	Familiar with the layout of a DCP system and its different activation procedures	T
2.4	**Foam fire extinguishing system**	
2.4.1	Familiar with the layout of a system	T
2.4.2	Familiar with: Inspection of control and section valves, and pressure gauges	C + B
2.4.3	Knows: how to verify the quantity of foam concentrate in a storage tank	C + B
2.5	**Water mist spray, sprinkler**	
2.5.1	Knows: the difference between dry pipe and wet pipe systems	C
2.5.2	Knows: the difference between mist, spray, and sprinkler	C
2.5.3	Knows: how to check nozzles integrity and prevent clogging	M3
2.5.4	Knows: common requirements and different kind of arrangements	T
2.5.5	Aware that pressure tanks must have a correct level of water	M3
2.5.6	Familiar with: right position of valves for pump units	M3 + C
2.5.7	Knows: how to test automatic start	C
2.5.8	Familiar with: standby pressure air/gas gauges inspection	M3 + C
2.6	**Fixed aerosol extinguishing systems**	
2.6.1	Knows: what an aerosol system is	C
2.6.2	Knows: the difference between condensed and dispersed aerosols	C
2.7	**Galley equipment**	
2.7.1	Familiar with: the mandatory extinguishing mediums for galley fire	S10
2.7.2	Knows: the difference between dry chemical and wet chemical extinguishing systems	P
2.8	**Paint lockers**	
2.8.1	Familiar with: the extinguishing systems required for a paint locker?	S10
2.8.2	Knows: the good practices for the housekeeping of a paint locker?	M1

3.1	**Fixed fire detection system and fire alarm**	
3.1.1	Knows: how to use a manual call point	M2 + B
3.1.2	Familiar with: types of sensors, their locations, testing methods	M3 + B + S7 + S14
3.1.3	Familiar with: main functions and use of fire alarm control pannel	B
3.1.4	Knows: the difference between pre-alarm and alarm	P
3.1.5	Knows: when fire rounds should take place, what are the important items to be inspected?	M2 + B
3.2	**Public Adress and General Alarm**	
3.2.1	Familiar with: the use of P.A and of G.A	C + S12
3.2.2	Familiar with: specificities of passenger ships for muster organization (crowd management)	C + B
3.3	**Fire doors and control**	
3.3.1	Knows: how to automatically and manually close a door	C + B
3.3.2	Knows: how to inspect a fire door and a release mechanism	C + B
3.3.3	Familiar with: adjusting the closing device	C
3.3.4	Familiar with: A, B, and C class divisions	S3 + C
3.3.5	Familiar with: the division of the ship into vertical zones by structural / thermal boundaries	M1
3.4	**Ventilation systems and fire dampers**	
3.4.1	Familiar with: the operation and the layout of fans and A/C units	T
3.4.2	Understands: the difference between a flap, a fire damper, a smoke damper	M1 + B + S9 +C
3.4.3	Familiar with: ventilation mushrooms	T
3.4.4	Aware that: there are remote and manual activation for dampers	B + C
3.4.5	Familiar with: smoke extraction	M1
3.5	**Quick Closing Valves (QCV)**	
3.5.1	Knows: the technology of a QCV (Spring, Pneumatic, ...)	T
3.5.2	Knows: which parts are protected by a QCV	R4
3.5.3	Knows: how to reset a QCV	B
3.5.4	Knows: when to use a QCV	M1
3.6	**Emergency Diesel Generator (EDG)**	
3.6.1	Knows: the requirements for an EDG (start, time running)	SOLAS II-1 42+43
3.6.2	Knows: which equipment is powered by an EDG	SOLAS II-1 42+43
3.6.3	Knows: the different modes for starting an EDG (local, remote, automatic)	M2 + SOLAS II-1 44
3.7	**SCBA compressor**	
3.7.1	Knows: the different parts of a SCBA compressor	T
3.7.2	Knows: safe procedure for starting a SCBA compressor and filling a bottle	P
3.7.3	Familiar with: the common maintenance of a SCBA compressor	P
3.7.4	Aware of: the importance of draining condensate traps	P
3.7.5	Aware of: the dangers of high pressure systems	P
3.7.6	Knows: how to change oil and filters	P
3.7.7	Prepared to fill air bottles alone in safety?	S15

4.1	**Emergency Escape**	
4.1.1	Knows: what spaces must have an emergency escape	S13 + B
4.1.2	Aware of: the conflict between safety and security (locking of emergency escapes)	S13 + B
4.2	**EEBD**	
4.2.1	Knows: how to inspect an EEBD	B
4.3	**Helideck**	
4.3.1	Familiar with: helideck fire fighting equipment?	S18
4.4	**Portable foam applicators**	
4.4.1	Knows: where foam applicators should be placed	S10 + C
4.4.2	Knows: how to inspect foam applicators	C
4.5	**Wheeled mobile fire extinguishers**	
4.5.1	Familiar with: location and use	C
4.6	**Fire control Station**	
4.6.1	Knows: what equipment must be located in the Fire Control Station?	S9
4.6.2	Able to: read a Fire Control Plan	M2 + S15
4.7	**Regulatory Framework**	
4.7.1	Familiar with: the content of SOLAS II-2?	S
4.7.2	Familiar with: the content of the model course 2.03 Advanced Fire Fighting	M
4.7.3	Familiar with: the content of FSS?	FFS
4.7.4	Familiar with: the content of the important MSC Circulars (1432, ...)	C
4.7.5	Familiar with: the mandatory content of a Planned Management System?	S14
4.8	**Technology**	
4.8.1	Knows: what essential equipment should be found in a safety locker?	P
4.8.2	Knows: the difference between grease/vaseline/silicon grease?	T
4.8.3	Familiar with: valves and pumps maintenance	T
4.8.4	Familiar with: gate/butterfly valves(different parts+how to fix a leak)	T
4.9	**Areas of danger (Knows the specific dangers of...)**	
4.9.1	Machinery spaces (oil leak,defect, in lagging, hot work, ...)	M1
4.9.2	Accomodation spaces (cigaret, electrical defect, laundry)	M1
4.9.3	Galley (hot surfaces, deep fat frying)	M1
4.9.4	Radio/Battery rooms (hydrogen build-up, loose connections, short-circuit)	M1
4.9.5	Holds and containers (Dangerous cargo in bulk, DG, electric cars, ...)	M1
4.9.6	Storage of material (L.O barrels, thinners, paints, oxygen and acethylen cylinders)	M1
4.10	**Specific dangers in Machinery spaces**	
4.10.1	Familiar with: boiler uptake fires and exhaust fires (cause, dangers, procedure)?	M1
4.10.2	Familiar with: iron-in-steam fires in water-tubes boilers? (cause, dangers, procedure)?	M1
4.10.3	Know: what is a machinery space of category A?	S3
4.10.4	Familiar with: the mandatory measure for category A spaces ?	S10
4.11	**Familiar with the specific dangers and requirements of ...**	
4.11.1	Passenger ships	
4.11.2	Tankers	
4.11.3	Car carriers	
4.11.4	Cargo Ships	
4.11.5	Ships carrying DG	

Annex 2 EXAMPLE OF A SURVEY

What is the goal of this research?

The goal of this study is to help bridge the gap between academic training and industry needs.
I have created a **mapping** of **practical skills** expected from a **junior officer** in the inspection, maintenance, and testing of fire-detection and **fire-fighting systems and applicances**

For each skill, this survey will asses

1) The student's subjective confidence in performing the task
2) The student's perception of relevance
3) Where the student primarily acquired the skill (academy, sea-time, or both)

This will allow us to identify:

Content gaps: important skills where the students lack confidence
Awareness gaps: skills where students feel confident but underestimate their importance
Strengths: Skills that are both valued and mastered

Respondant Profile

Name

Department:
☐ Deck
☐ Engine
☐ Other (specify)

Current academic year or level:
☐ Bachelor
☐ Master
☐ Graduate

Have you already sailed onboard as part of your training?
☐ Yes
☐ No

How much time have you spent at sea (cumulative)?
☐ Less than 3 months
☐ 3–6 months
☐ 6–12 months
☐ More than 12 months

Have you sailed on tankers or RORO / ROPAX vessels?
☐ Yes
☐ No

Have you ever participated in maintenance or inspection of fire systems onboard?
☐ Yes
☐ No
☐ I don't remember

Have you followed Advanced fire-fighting and advanced safety courses?
☐ Yes
☐ No
☐ Not sure

Age bracket:
☐ < 20
☐ 20–25
☐ 26–30
☐ 31+

Do you plan to work as an officer after graduation?
☐ Yes
☐ No
☐ Not sure

Would you be willing to be contacted for a short follow-up interview?
☐ Yes (leave contact email/phone)
☐ No

How to fill-in the survey?

For each item, three answers are asked:

What is your degree of confidence	Put a x in the right box
How important is this item for you	Put a x in the right box
Where did you learn about this item	Put a x in the school "box", the "ship" box, or both

Optionally, write any **comments** in the right-hand columns

To be returned in .xls at
202104155@student.hzs.be

Part 1: Fire Fighting

	Fire main	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
1.1.1	Knows how to line line-up in case of fire													
1.1.2	Inspection for corrosion and watertightness													
1.1.3	Isolation valves (Inspection, requirements)													

	Fire pumps	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
1.2.1	Knowledge of the main parts of a centrifugal pump, normal flow and pressures, starting sequence													
1.2.2	Knows the difference between a fire pump and an emergency fire pump													
1.2.3	Knows the maintenance of a pump and the monthly test													

	Fire hydrants	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
1.3.1	Knows the main parts of a hydrant (spindle, seat, stuffing box, nuts, gaskets, flanges)													
1.3.2	Knows how to perform Pressure test for watertightness													
1.3.3	Knows how to react in case of leak: inspect/rectify the surface of the seat (lapping) or change the gasket													
1.3.4	Knows how to react if the wheel is blocked (open, clean, grease, adjust stuffing box tension, ...)													

	Hoses & Nozzles	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
1.4.1	Knows the mandatory length of the hoses													
1.4.2	Knows how to inspect a hose (couplings, gaskets, wire binding, leaks, sediments, ...)													
1.4.3	Knows the different kinds of couplings / nozzles													
1.4.4	Knows how to perform a pressure test													
1.4.5	Knows how to wire bind													
1.4.6	Knows the maintenance of the boxes (grease for nozzles, gasket for boxes)													
1.4.7	Knows how to store a hose (Common roll, O-shaped, S-Shaped)													

	Firefighter's outfits	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
1.5.1	Knows how to inspect FF outfits and equipment													
1.5.2	Knows good practices for operational readiness													
1.5.3	Inspection / Test of Radios (Working, charging arrangement state, not overcharging)													
1.5.4	Know the standard signals for steel-cored lifeline													
1.5.5	Know in which situation to use the fire axe													

	Self Contained Breathing Apparatus (SCBA)	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
1.6.1	Inspection BA Bottle (Body, connection, pressure) (+ When to replace)													
1.6.2	Inspection SCBA (Good state, storage, whistle, leaks)													
1.6.3	Test SCBA masks (void, overpressure, cleanliness, straps)													

	Portable fire extinguishers	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
1.7.1	Types of extinguishers and use (Fire category, Distance, Method)													
1.7.2	Inspection (Body, connection, pressure, handle, pin, seal, tags and marks)													
1.7.3	knows how to avoid powder caking (shaking)													
1.7.4	Knows how to check emptiness (weighting)													
1.7.5	Knows how to re-fill an empty extinguisher													

	ISC (International Shore Connection)	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
1.8.1	Know the use and locations													

Part 2: Fixed Fire-Extinguishing Systems

	Fixed fire-extinguishing systems	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
2.1.1	Knows the different fixed FFS allowed by SOLAS													
2.1.2	Knows the requirements for the different types of vessels / Parts of a vessel													

	Fixed gas extinguishing	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
2.2.1	Knows how to inspect (hose cracks, pressure, leakages)													
2.2.2	Knows the risk of explosion in flammable atmospheres													
2.2.3	Knows the importance of headcount and the master's orders before use													
2.2.4	Knows the importance of closing flaps and shutting ventilation before use													
2.2.5	Knows the importance of draining the lines for condensation													
2.2.6	Knows the different parts and the different modes of activation													

	Fixed dry chemical powder	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
2.3.1	Familiar with the following terms: Cacking, Packing, Gas point, Monitor													
2.3.2	Knows when to chose between using DCP versus shutting gas supply in a gas fire													
2.3.3	Has studied an exemple of DCP system and activation procedure													

	Foam fire extinguishing system	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
2.4.1	Knows the different elements and has studied an exemple of a system													
2.4.2	Inspection of control and section valves, and pressure gauges													
2.4.3	Can verify the quantity of foam concentrate in the storage tank.													

	Water mist spray, sprinkler	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
2.5.1	Knows the difference between dry pipe and wet pipe systems													
2.5.2	Knows the difference between mist, spray, and sprinkler													
2.5.3	Check nozzle integrity and prevent clogging													
2.5.4	Knows the common requirements and the different kind of arrangements													
2.5.5	Pressure tanks have correct level of water													
2.5.6	Verify that pump units and section valves are in the right position													
2.5.7	Knows how to test automatic start													
2.5.8	Check standby pressure air/gas gauges													

	Fixed aerosol extinguishing systems	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
2.6.1	Knows what an aerosol system is													
2.6.2	Knows the difference between condensed and dispersed aerosols													

	Galley equipment	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
2.7.1	Familiar with the mandatory extinguishing mediums for galley fire													
2.7.2	Knows the difference between dry chemical and wet chemical extinguishing systems													

	Paint lockers	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
2.8.1	Familiar with the extinguishing systems required for a paint locker?													
2.8.2	Knows the good practices for the housekeeping of a paint locker?													

Part 3: Detection, Containment, Auxiliaries

	Fixed fire detection system and fire alarm	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
3.1.1	Manual call points													
3.1.2	Types of sensors, their locations, and how to test them													
3.1.3	Fire alarm control pannel: main functions and how to use it													
3.1.4	Knows the difference between pre-alarm and alarm													
3.1.5	When fire rounds should take place, and what are the important items to be checked?													

	Public Adress and General Alarm	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
3.2.1	Familiar with the use of P.A and of G.A													
3.2.2	Knows the specificities of passenger ships for muster organization (crowd management)													

	Fire doors and control	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
3.3.1	Knows how to automatically and manually close a door													
3.3.2	Knows how to inspect a fire door and a release mechanism													
3.3.3	Familiar with adjusting the closing device													
3.3.4	Knows what are A, B, and C class divisions													
3.3.5	Knows the division of the ship into vertical zones by structural and thermal boundaries													

	Ventilation systems and fire dampers	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
3.4.1	Familiar with the principle and the main parts of fans and A/C units													
3.4.2	Knows the difference between a flap, a fire damper, and a smoke damper													
3.4.3	Knows the different parts of a ventilation mushroom													
3.4.4	Knows there are remote and manual activation for dampers													
3.4.5	Familiar with smoke extraction													

	Quick Closing Valves (QCV)	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
3.5.1	Knows the technology of a QCV (Spring, Pneumatic, ...)													
3.5.2	Knows which equipment are protected by a QCV													
3.5.3	Knows how to reset a QCV													
3.5.4	Knows in which situation to use a QCV													

	Emergency Diesel Generator (EDG)	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
3.6.1	Knows the requirements for an EDG (start, time running)													
3.6.2	Knows what equipment are powered by an EDG													
3.6.3	Knows the different modes for starting an EDG (local, remote, automatic)													

	SCBA compressor	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
3.7.1	Knows the different part of a SCBA compressor													
3.7.2	Knows the safe procedure for starting a SCBA compressor and filling a bottle													
3.7.3	Knows the common maintenance of a SCBA compressor													
3.7.4	Knows the importance of draining condensate traps													
3.7.5	Is aware of the dangers of high pressure systems													
3.7.6	Know how to change oil and filters													
3.7.7	Prepared to fill air bottles alone in safety?													

Part 4-2: Miscellaneous

	Regulatory Framework	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
4.7.1	Knows the content of SOLAS II-2?													
4.7.2	Knows the content of the model course 2.03 Advanced Fire Fighting													
4.7.3	Knows the content of FSS?													
4.7.4	Knows the content of the important MSC Circulars (1432, ...)													
4.7.5	Knows the mandatory content of a Planned Management System?													

	Technology	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
4.8.1	Knows what essential equipment should be found in a safety locker?													
4.8.2	Knows the difference between grease/vaseline/silicon grease?													
4.8.3	Valves and pumps maintenance													
4.8.4	Different parts of a gate/butterfly valve, how to maintain it or fix it of leaking?													

	Areas of danger Knows the specific dangers of ...	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
4.9.1	Machinery (oil leak,defect, in lagging, hot work, ...)													
4.9.2	Accomodation (cigaret, electrical defect, laundry)													
4.9.3	Galley (hot surfaces, deep fat frying)													
4.9.4	Radio/Battery rooms (hydrogen build-up, loose connections, short-circuit)													
4.9.5	Holds and containers (Dangerous cargo in bulk, DG, electric cars, ...)													
4.9.6	Storage of material (L.O barrels, thinners, paints, oxygen and acethylen cylinders)													

	Specific dangers in Machinery spaces	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
4.10.1	Familiar with Boiler uptake fires and exhaust fires (cause, dangers, procedure)?													
4.10.2	Familiar with iron-in-steam fires in water-tubes boilers? (cause, dangers, procedure)?													
4.10.3	Know what is a machinery space of category A?													
4.10.4	Familiar with the mandatory measure for these spaces ?													

	Specific type of ships Familiar with the specific dangers and requirements of ...	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
4.11.1	Passenger ships													
4.11.2	Tankers													
4.11.3	Car carriers													
4.11.4	Cargo Ships													
4.11.5	Ships carrying DG													

Part 4-1: Miscellaneous

	Emergency Escape	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
4.1.1	Knows what spaces should have an emergency escape													
4.1.2	Is aware of the conflict between safety and security (locking of emergency escapes)													

	EEBD	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
4.2.1	Knows how to check the state of an EEBD													

	Helideck	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
4.3.1	Familiar with helideck fire fighting equipment?													

	Portable foam applicators	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
4.4.1	Knows where foam applicators should be placed													
4.4.2	Knows how to inspect foam applicators													

	Wheeled mobile fire extinguishers	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
4.5.1	Know the location and use													

	Fire control Station	Confidence					Importance			Source				Comments
		1	2	3	4	5	1	2	3	School	Ship	Other	No	
4.6.1	What equipment shall be located in the Fire Control Station?													
4.6.2	Able to read a Fire Control Plan													

Annex 3 INITIAL LIST OF ITEMS

1.1	Fire main	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.1.1	Knows: how to line line-up in case of fire	3,88	2,82	0,78	0,39	0,56	0,47	0,00	0,00	M2
1.1.2	Inspection for corrosion and watertightness	3,35	2,47	1,00	0,62	0,32	0,50	0,00	0,18	M2
1.1.3	Isolation valves (Inspection, requirements)	3,24	2,71	1,15	0,47	0,32	0,59	0,00	0,12	M3+S10
	AVERAGE	3,49	2,67	0,97	0,50	0,40	0,52	0,00	0,10	

1.2	Fire pumps	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.2.1	Knows: main parts of a centrifugal pump, normal flow and pressures, starting sequence	2,88	2,29	1,36	0,59	0,68	0,28	0,00	0,06	T
1.2.2	Knows: difference between a fire pump and an emergency fire pump	3,65	2,41	1,41	0,80	0,35	0,56	0,00	0,12	M2+S10
1.2.3	Knows: maintenance of a pump and the mandatory monthly tests	2,29	2,47	1,16	0,62	0,26	0,59	0,00	0,18	C
	AVERAGE	2,94	2,39	1,31	0,67	0,43	0,48	0,00	0,12	

1.3	Fire hydrants	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.3.1	Knows the main parts of a hydrant (spindle, seat, stuffing box, nuts, gaskets, flanges)	3,65	2,24	1,32	0,66	0,59	0,38	0,00	0,06	T
1.3.2	Knows how to perform pressure test for watertightness	2,88	2,12	1,45	0,60	0,47	0,38	0,00	0,18	M3+P
1.3.3	Knows how to react if leaking: rectify the surface of the seat (lapping), or change the gasket	3,12	2,47	1,17	0,62	0,29	0,56	0,00	0,13	M3+P
1.3.4	Knows how to react if the wheel is blocked (open, clean, grease, adjust stuffing box tension, ...)	2,76	2,59	1,44	0,51	0,24	0,38	0,12	0,25	M3+P
	AVERAGE	3,10	2,35	1,34	0,60	0,40	0,42	0,03	0,15	

1.4	Hoses & Nozzles	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.1	Knows the mandatory length of the hoses	2,94	1,71	1,56	0,85	0,65	0,13	0,06	0,07	S10
1.4.2	Knows how to inspect a hose (couplings, gaskets, wire binding, leaks, sediments, ...)	4,12	2,47	0,93	0,51	0,50	0,41	0,03	0,00	M3+B
1.4.3	Knows the different kinds of couplings / nozzles	3,88	1,94	1,11	0,75	0,71	0,25	0,00	0,00	T
1.4.4	Knows how to perform a pressure test	3,35	2,41	1,58	0,62	0,38	0,34	0,06	0,19	M3
1.4.5	Knows how to wire bind	3,35	2,47	1,54	0,62	0,35	0,31	0,00	0,31	P
1.4.6	Knows how to maintain storing boxes (grease for nozzles, gasket for boxes)	3,41	2,12	1,18	0,49	0,35	0,41	0,03	0,19	M3
1.4.7	Knows how to store a hose (Common roll, O-shaped, S-Shaped)	4,47	2,12	0,87	0,78	0,62	0,41	0,00	0,00	P

1.5	Firefighter's outfits	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.5.1	Knows how to inspect FF outfits and equipment	4,24	3,00	0,66	0,00	0,62	0,31	0,03	0,06	M3+B
1.5.2	Knows good practices for operational readiness	4,06	2,88	0,66	0,33	0,71	0,19	0,06	0,06	P+B
1.5.3	Familiar with Inspection / Test of Radios and charging arrangements	3,88	2,76	0,78	0,44	0,26	0,68	0,00	0,06	M3
1.5.4	Knows the standard signals for steel-cored lifeline	2,29	2,06	1,40	0,83	0,24	0,18	0,00	0,59	M3
1.5.5	Knows in which situation to use the fire axe	3,00	2,06	1,46	0,83	0,35	0,24	0,12	0,29	M3

1.6	Self Contained Breathing Apparatus (SCBA)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.6.1	Familiar with: Inspection of BA Bottles (Body, connection, pressure) (+ When to replace)	4,65	3,00	0,61	0,00	0,68	0,26	0,06	0,00	M3+B
1.6.2	Familiar with: Inspection of SCBA (Good state, storage, whistle, leaks)	4,65	3,00	0,61	0,00	0,65	0,29	0,06	0,00	M3+B
1.6.3	Familiar with: Test of SCBA masks (void, overpressure, cleanliness, straps)	4,59	3,00	0,71	0,00	0,71	0,24	0,06	0,00	M3+B
	AVERAGE	4,63	3,00	0,64	0,00	0,68	0,26	0,06	0,00	

1.7	Portable fire extinguishers	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.7.1	Familiar with: types of extinguishers, and their use (Fire category, Distance, Method)	4,35	2,88	0,61	0,33	0,79	0,15	0,06	0,00	M
1.7.2	Familiar with: extinguishers inspection (Body, connection, pin, seal, tags and marks, ...)	4,24	2,71	0,83	0,47	0,44	0,38	0,06	0,12	C+B
1.7.3	knows how to avoid powder caking (shaking)	3,06	2,24	1,52	0,75	0,32	0,24	0,03	0,38	P
1.7.4	Knows how to check emptiness (weighting)	3,65	2,18	1,22	0,81	0,29	0,26	0,09	0,35	P
1.7.5	Knows how to re-fill an empty extinguisher	1,88	1,88	1,17	0,86	0,21	0,18	0,03	0,59	M3+S14
	AVERAGE	3,44	2,38	1,07	0,64	0,41	0,24	0,05	0,29	

1.8	International Shore Connection	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.8.1	Knows the use and locations of ISCs	3,88	2,88	0,93	0,78	0,68	0,34	0,00	0,00	S14 +C

2.1	Fixed fire-extinguishing systems	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.1.1	Knows the different types of fixed FFS allowed by SOLAS	3,29	2,29	0,99	0,69	0,59	0,25	0,00	0,18	S10
2.1.2	Knows the regulatory requirements for the different types of vessels / Parts of a vessel	2,76	2,18	1,20	0,73	0,44	0,28	0,00	0,29	S10

2.2	Fixed gas-extinguishing	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.2.1	Knows how to inspect an installation (hose cracks, pressure, leakages, ...)	3,29	2,59	1,10	0,71	0,32	0,41	0,00	0,29	C + S14
2.2.2	Aware of the risk of explosion in flammable atmospheres	4,18	3,00	0,88	0,00	0,74	0,28	0,00	0,00	P
2.2.3	Aware of the importance of headcount and the master's orders before use	4,47	3,00	0,72	0,00	0,62	0,34	0,00	0,00	P
2.2.4	Aware of the importance of closing flaps and shutting ventilation before use	4,65	2,94	0,49	0,24	0,65	0,38	0,00	0,00	P
2.2.5	Knows the importance of draining the lines for condensation	3,47	2,59	1,28	0,62	0,32	0,38	0,03	0,29	P
2.2.6	Knows the different parts of an installation and the different modes of activation	3,76	2,82	1,20	0,39	0,41	0,47	0,03	0,12	T + P
	AVERAGE	3,97	2,82	0,95	0,33	0,51	0,38	0,01	0,12	

2.3	Fixed dry chemical powder	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.3.1	Familiar with the following terms: Cacking, Packing, Gas point, Monitor	2,29	2,06	0,99	0,56	0,41	0,13	0,00	0,47	C
2.3.2	Knows when to chose between using DCP versus shutting gas supply during a gas fire	2,35	2,59	1,41	0,51	0,26	0,09	0,06	0,56	p
2.3.3	Familiar with the layout of a DCP system and its different activation procedures	2,35	2,24	1,37	0,66	0,29	0,19	0,06	0,44	T
	AVERAGE	2,33	2,29	1,25	0,58	0,32	0,14	0,04	0,49	

2.4	Foam fire extinguishing system	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.4.1	Familiar with the layout of a system	2,82	2,35	1,38	0,49	0,41	0,16	0,09	0,35	T
2.4.2	Familiar with: Inspection of control and section valves, and pressure gauges	2,53	2,35	1,18	0,61	0,35	0,25	0,06	0,35	C + B
2.4.3	Knows: how to verify the quantity of foam concentrate in a storage tank	2,12	2,53	1,11	0,62	0,18	0,19	0,06	0,56	C + B
	AVERAGE	2,49	2,41	1,22	0,57	0,31	0,20	0,07	0,42	

2.5	Water mist spray, sprinkler	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.5.1	Knows: the difference between dry pipe and wet pipe systems	3,06	2,24	1,39	0,66	0,38	0,28	0,00	0,31	C
2.5.2	Knows: the difference between mist, spray, and sprinkler	4,06	2,35	0,75	0,79	0,59	0,38	0,00	0,06	C
2.5.3	Knows: how to check nozzles integrity and prevent clogging	3,35	2,59	0,86	0,51	0,38	0,38	0,00	0,24	M3
2.5.4	Knows: common requirements and different kind of arrangements	2,82	2,24	1,24	0,75	0,21	0,38	0,00	0,41	T
2.5.5	Aware that pressure tanks must have a correct level of water	2,88	2,53	1,32	0,62	0,24	0,31	0,00	0,44	M3
2.5.6	Familiar with: right position of valves for pump units	2,94	2,65	1,20	0,70	0,26	0,41	0,00	0,31	M3 + C
2.5.7	Knows: how to test automatic start	2,53	2,41	1,37	0,71	0,21	0,34	0,00	0,44	C
2.5.8	Familiar with: standby pressure air/gas gauges inspection	2,94	2,29	1,25	0,77	0,18	0,38	0,00	0,47	M3 + C
	AVERAGE	3,07	2,41	1,17	0,69	0,31	0,36	0,00	0,33	

2.6	Fixed aerosol extinguishing systems	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.6.1	Knows: what an aerosol system is	2,76	2,00	1,39	0,61	0,24	0,06	0,06	0,63	C
2.6.2	Knows: the difference between condensed and dispersed aerosols	1,94	1,88	0,90	0,60	0,18	0,06	0,00	0,73	C

2.7	Galley equipment	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.7.1	Familiar with: the mandatory extinguishing mediums for galley fire	3,71	2,65	1,10	0,49	0,35	0,50	0,00	0,18	S10
2.7.2	Knows: the difference between dry chemical and wet chemical extinguishing systems	3,18	2,29	1,29	0,69	0,32	0,28	0,00	0,38	P

2.8	Paint lockers	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.8.1	Familiar with: the extinguishing systems required for a paint locker?	3,41	2,71	1,12	0,47	0,32	0,44	0,00	0,24	S10
2.8.2	Knows: the good practices for the housekeeping of a paint locker?	3,65	2,71	1,06	0,47	0,44	0,38	0,00	0,18	M1

3.1	Fixed fire detection system and fire alarm	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.1.1	Knows: how to use a manual call point	4,12	2,65	1,17	0,61	0,26	0,59	0,00	0,18	M2 + B
3.1.2	Familiar with: types of sensors, their locations, testing methods	3,88	2,76	0,99	0,44	0,50	0,47	0,00	0,06	M3 + B + S7 + S14
3.1.3	Familiar with: main functions and use of fire alarm control pannel	3,65	2,82	1,11	0,39	0,18	0,75	0,00	0,12	B
3.1.4	Knows: the difference between pre-alarm and alarm	3,12	2,29	1,62	0,59	0,12	0,44	0,00	0,40	P
3.1.5	Knows: when fire rounds should take place, what are the important items to be inspected?	4,12	2,71	0,99	0,47	0,15	0,78	0,00	0,12	M2 + B
	AVERAGE	3,78	2,65	1,18	0,50	0,24	0,61	0,00	0,17	

3.2	Public Adress and General Alarm	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.2.1	Familiar with: the use of P.A and of G.A	3,65	2,76	1,46	0,56	0,26	0,59	0,00	0,18	C + S12
3.2.2	Familiar with: specificities of passenger ships for muster organization (crowd management)	3,35	2,59	1,41	0,62	0,21	0,59	0,00	0,24	C + B

3.3	Fire doors and control	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.3.1	Knows: how to automatically and manually close a door	4,35	2,88	0,61	0,33	0,24	0,71	0,06	0,00	C + B
3.3.2	Knows: how to inspect a fire door and a release mechanism	3,76	2,47	1,20	0,62	0,12	0,65	0,06	0,13	C + B
3.3.3	Familiar with: adjusting the closing device	3,29	2,47	1,40	0,72	0,12	0,59	0,06	0,19	C
3.3.4	Familiar with: A, B, and C class divisions	3,71	2,53	1,21	0,62	0,62	0,28	0,00	0,12	S3 + C
3.3.5	Familiar with: the division of the ship into vertical zones by structural/ thermal boundaries	3,59	2,59	1,46	0,62	0,44	0,44	0,00	0,12	M1
	AVERAGE	3,74	2,59	1,18	0,58	0,31	0,53	0,04	0,11	

3.4	Ventilation systems and fire dampers	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.4.1	Familiar with: the operation and the layout of fans and A/C units	3,00	2,29	1,12	0,69	0,26	0,47	0,06	0,24	T
3.4.2	Understands: the difference between a flap, a fire damper, a smoke damper	3,06	2,24	1,25	0,75	0,44	0,34	0,00	0,24	M1 + B + S9 + C
3.4.3	Familiar with: ventilation mushrooms	2,59	2,12	1,23	0,70	0,41	0,31	0,00	0,25	T
3.4.4	Aware that: there are remote and manual actwation for dampers	3,59	2,65	1,06	0,49	0,47	0,50	0,00	0,06	B + C
3.4.5	Familiar with: smoke extraction	3,53	2,59	1,01	0,62	0,56	0,34	0,00	0,12	M1
	AVERAGE	3,15	2,38	1,13	0,65	0,43	0,39	0,01	0,18	

3.5	Quick Closing Valves (QCV)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.5.1	Knows: the technology of a QCV (Spring, Pneumatic, ...)	3,06	2,41	1,30	0,62	0,50	0,22	0,00	0,29	T
3.5.2	Knows: which parts are protected by a QCV	2,76	2,47	1,30	0,62	0,50	0,22	0,00	0,25	R4
3.5.3	Knows: how to reset a QCV	2,00	2,29	1,22	0,69	0,24	0,25	0,00	0,50	B
3.5.4	Knows: when to use a QCV	2,71	2,65	1,49	0,49	0,38	0,22	0,00	0,38	M1
	AVERAGE	2,63	2,46	1,33	0,61	0,40	0,23	0,00	0,35	

3.6	Emergency Diesel Generator (EDG)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.6.1	Knows: the requirements for an EDG (start, time running)	2,94	2,35	1,25	0,70	0,47	0,31	0,00	0,13	SOLAS II-1 42+43
3.6.2	Knows: which equipment is powered by an EDG	3,35	2,71	1,32	0,59	0,38	0,41	0,06	0,07	SOLAS II-1 42+43
3.6.3	Knows: the different modes for starting an EDG (local, remote, automatic)	3,06	2,59	1,34	0,51	0,29	0,44	0,00	0,20	M2 + SOLAS II-1 44
	AVERAGE	3,12	2,55	1,30	0,60	0,38	0,39	0,02	0,13	

3.7	SCBA compressor	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.7.1	Knows: the different parts of a SCBA compressor	2,82	2,00	1,29	0,79	0,26	0,32	0,12	0,29	T
3.7.2	Knows: safe procedure for starting a SCBA compressor and filling a bottle	2,88	2,41	1,50	0,80	0,18	0,47	0,06	0,29	P
3.7.3	Familiar with: the common maintenance of a SCBA compressor	2,06	1,94	1,09	0,75	0,12	0,38	0,00	0,50	P
3.7.4	Aware of: the importance of draining condensate traps	2,53	2,18	1,62	0,73	0,12	0,38	0,06	0,44	P
3.7.5	Aware of: the dangers of high pressure systems	3,65	2,71	1,37	0,47	0,26	0,28	0,12	0,31	P
3.7.6	Knows: how to change oil and filters	2,29	1,88	1,53	0,93	0,06	0,25	0,12	0,53	P
3.7.7	Prepared to fill air bottles alone in safety?	2,71	2,35	1,49	0,79	0,00	0,44	0,06	0,47	S15
	AVERAGE	2,71	2,21	1,41	0,75	0,14	0,36	0,08	0,41	

4.1	Emergency Escape	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.1.1	Knows: what spaces must have an emergency escape	4,24	2,76	0,75	0,44	0,34	0,56	0,00	0,06	S13 + B
4.1.2	Aware of: the conflict between safety and security (locking of emergency escapes)	4,35	2,47	0,79	0,62	0,50	0,44	0,00	0,06	S13 + B

4.2	EEBD	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.2.1	Knows: how to inspect an EEBD	4,06	2,82	0,90	0,39	0,47	0,41	0,00	0,12	B

4.3	Helideck	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.3.1	Familiar with: helideck fire fighting equipment?	2,88	2,53	1,32	0,62	0,18	0,47	0,00	0,31	S18

4.4	Portable foam applicators	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.4.1	Knows: where foam applicators should be placed	2,53	2,47	1,18	0,62	0,26	0,21	0,00	0,50	S10 + C
4.4.2	Knows: how to inspect foam applicators	2,59	2,41	1,37	0,71	0,26	0,15	0,00	0,56	C

4.5	Wheeled mobile fire extinguishers	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.5.1	Familiar with: location and use	3,65	2,41	1,17	0,62	0,26	0,50	0,00	0,24	C

4.6	Fire control Station	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.6.1	Knows: what equipment must be located in the Fire Control Station?	3,76	2,59	0,90	0,71	0,35	0,59	0,00	0,06	S9
4.6.2	Able to: read a Fire Control Plan	4,00	2,94	1,00	0,24	0,38	0,53	0,03	0,06	M2 + S15

4.7	Regulatory Framework	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.7.1	Familiar with: the content of SOLAS II-2?	2,88	2,06	1,17	0,83	0,79	0,03	0,06	0,06	S
4.7.2	Familiar with: the content of the model course 2.03 Advanced Fire Fighting	2,94	2,12	1,20	0,70	0,76	0,06	0,00	0,07	M
4.7.3	Familiar with: the content of FSS?	3,12	2,35	1,17	0,61	0,71	0,13	0,00	0,13	FFS
4.7.4	Familiar with: the content of the important MSC Circulars (1432, ...)	2,29	2,06	1,16	0,66	0,41	0,13	0,00	0,44	C
4.7.5	Familiar with: the mandatory content of a Planned Management System?	2,53	2,12	1,18	0,70	0,47	0,25	0,00	0,25	S14
	AVERAGE	2,75	2,14	1,17	0,70	0,63	0,12	0,01	0,19	

4.8	Technology	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.8.1	Knows: what essential equipment should be found in a safety locker?	3,35	2,41	1,17	0,71	0,56	0,41	0,00	0,06	P
4.8.2	Knows: the difference between grease/vaseline/silicon grease?	3,00	1,94	1,27	0,56	0,21	0,35	0,09	0,31	T
4.8.3	Familiar with: valves and pumps maintenance	2,76	2,35	1,35	0,79	0,29	0,35	0,00	0,31	T
4.8.4	Familiar with: gate/butterfly valves (different parts + how to fix a leak)	2,76	2,18	1,30	0,64	0,53	0,18	0,00	0,29	T
	AVERAGE	2,97	2,22	1,27	0,67	0,40	0,32	0,02	0,24	

4.9	Areas of danger (Knows the specific dangers of...)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.9.1	Machinery spaces (oil leak, defect, in lagging, hot work, ...)	4,41	2,82	0,71	0,39	0,53	0,44	0,03	0,00	M1
4.9.2	Accomodation spaces (cigaret, electrical defect, laundry)	4,41	2,76	0,87	0,44	0,47	0,50	0,03	0,00	M1
4.9.3	Galley (hot surfaces, deep fat frying)	4,53	2,71	0,62	0,47	0,44	0,53	0,03	0,00	M1
4.9.4	Radio/Battery rooms (hydrogen build-up, loose connections, short-circuit)	3,65	2,76	1,32	0,44	0,35	0,50	0,03	0,06	M1
4.9.5	Holds and containers (Dangerous cargo in bulk, DG, electric cars, ...)	3,59	2,76	1,28	0,44	0,53	0,26	0,09	0,06	M1
4.9.6	Storage of material (L.O barrels, thinners, paints, oxygen and acethylen cylinders)	4,18	2,76	0,95	0,44	0,53	0,35	0,06	0,00	M1
	AVERAGE	4,13	2,76	0,96	0,44	0,48	0,43	0,04	0,02	

4.10	Specific dangers in Machinery spaces	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.10.1	Familiar with: boiler uptake fires and exhaust fires (cause, dangers, procedure)?	2,41	2,41	1,00	0,80	0,41	0,24	0,00	0,31	M1
4.10.2	Familiar with: iron-in-steam fires in water-tubes boilers? (cause, dangers, procedure)?	2,06	2,35	1,14	0,79	0,29	0,24	0,00	0,44	M1
4.10.3	Know: what is a machinery space of category A?	1,88	2,06	1,11	0,66	0,24	0,12	0,00	0,63	S3
4.10.4	Familiar with: the mandatory measure for category A spaces ?	2,12	2,29	1,11	0,77	0,32	0,21	0,00	0,44	S10
	AVERAGE	2,12	2,28	1,09	0,75	0,32	0,20	0,00	0,45	

4.11	Familiar with the specific dangers and requirements of ...	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N
4.11.1	Passenger ships	4,00	2,76	1,32	0,56	0,41	0,50	0,03	0,06
4.11.2	Tankers	3,76	2,88	1,20	0,33	0,79	0,15	0,00	0,06
4.11.3	Car carriers	4,06	2,82	0,97	0,39	0,68	0,24	0,03	0,06
4.11.4	Cargo Ships	3,59	2,71	1,00	0,47	0,85	0,06	0,03	0,06
4.11.5	Ships carrying DG	3,41	2,76	1,23	0,44	0,76	0,15	0,03	0,06
	AVERAGE	3,76	2,79	1,14	0,44	0,70	0,22	0,02	0,06

CONSOLIDATED SECTIONS

1.4-A	Hoses & Nozzles (Inspection)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.2	Knows how to inspect a hose (couplings, gaskets, wire binding, leaks, sedimen	4,12	2,47	0,93	0,51	0,50	0,41	0,03	0,00	M3+B

1.5-A	Firefighter's outfits (Outfits)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.5.1	Knows how to inspect FF outfits and equipment	4,24	3,00	0,66	0,00	0,62	0,31	0,03	0,06	M3+B
1.5.2	Knows good practices for operational readiness	4,06	2,88	0,66	0,33	0,71	0,19	0,06	0,06	P+B
1.5.3	Familiar with Inspection / Test of Radios and charging arrangements	3,88	2,76	0,78	0,44	0,26	0,68	0,00	0,06	M3
	AVERAGE VALUES	4,06	2,88	0,70	0,26	0,53	0,39	0,03	0,06	

1.6	Self Contained Breathing Apparatus (SCBA)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.6.1	Familiar with: Inspection of BA Bottles (Body, connection, pressure) (+ When to	4,65	3,00	0,61	0,00	0,68	0,26	0,06	0,00	M3+B
1.6.2	Familiar with: Inspection of SCBA (Good state, storage, whistle, leaks)	4,65	3,00	0,61	0,00	0,65	0,29	0,06	0,00	M3+B
1.6.3	Familiar with: Test of SCBA masks (void, overpressure, cleanliness, straps)	4,59	3,00	0,71	0,00	0,71	0,24	0,06	0,00	M3+B
	AVERAGE VALUES	4,63	3,00	0,64	0,00	0,68	0,26	0,06	0,00	

1.7-A	Portable fire extinguishers (type and inspection)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.7.1	Familiar with: types of extinguishers, and their use (Fire category, Distance, Meth	4,35	2,88	0,61	0,33	0,79	0,15	0,06	0,00	M
1.7.2	Familiar with: extinguishers inspection (Body, connection, pin, seal, tags and m	4,24	2,71	0,83	0,47	0,44	0,38	0,06	0,12	C+B

2.2-A	Fixed gas-extinguishing (Procedure)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.2.2	Aware of the risk of explosion in flammable atmospheres	4,18	3,00	0,88	0,00	0,74	0,28	0,00	0,00	P
2.2.3	Aware of the importance of headcount and the master's orders before use	4,47	3,00	0,72	0,00	0,62	0,34	0,00	0,00	P
2.2.4	Aware of the importance of closing flaps and shutting ventilation before use	4,65	2,94	0,49	0,24	0,65	0,38	0,00	0,00	P
	AVERAGE VALUES	4,43	2,98	0,70	0,08	0,67	0,33	0,00	0,00	

3.1-A	Fixed fire detection system and fire alarm (Detection)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.1.1	Knows: how to use a manual call point	4,12	2,65	1,17	0,61	0,26	0,59	0,00	0,18	M2 + B
3.1.2	Familiar with: types of sensors, their locations, testing methods	3,88	2,76	0,99	0,44	0,50	0,47	0,00	0,06	M3 + B + S7 + S14
3.1.5	Knows: when fire rounds should take place, what are the important items to bei	4,12	2,71	0,99	0,47	0,15	0,78	0,00	0,12	M2 + B
	AVERAGE VALUES	4,04	2,71	1,05	0,50	0,30	0,61	0,00	0,12	

4.6-B	Fire Plan	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.6.2	Able to: read a Fire Control Plan	4,00	2,94	1,00	0,24	0,38	0,53	0,03	0,06	M2 + S15

4.1	Emergency Escape	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.1.1	Knows: what spaces must have an emergency escape	4,24	2,76	0,75	0,44	0,34	0,56	0,00	0,06	S13 + B
4.1.2	Aware of: the conflict between safety and security (locking of emergency escapes)	4,35	2,47	0,79	0,62	0,50	0,44	0,00	0,06	S13 + B

4.2	EEBD	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.2.1	Knows: how to inspect an EEBD	4,06	2,82	0,90	0,39	0,47	0,41	0,00	0,12	B

4.9	Areas of danger (Knows the specific dangers of...)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.9.1	Machinery spaces (oil leak, defect, in lagging, hot work, ...)	4,41	2,82	0,71	0,39	0,53	0,44	0,03	0,00	M1
4.9.2	Accomodation spaces (cigaret, electrical defect, laundry)	4,41	2,76	0,87	0,44	0,47	0,50	0,03	0,00	M1
4.9.3	Galley (hot surfaces, deep fat frying)	4,53	2,71	0,62	0,47	0,44	0,53	0,03	0,00	M1
4.9.4	Radio/Battery rooms (hydrogen build-up, loose connections, short-circuit)	3,65	2,76	1,32	0,44	0,35	0,50	0,03	0,06	M1
4.9.5	Holds and containers (Dangerous cargo in bulk, DG, electric cars, ...)	3,59	2,76	1,28	0,44	0,53	0,26	0,09	0,06	M1
4.9.6	Storage of material (L.O barrels, thinners, paints, oxygen and acethylen cylinders	4,18	2,76	0,95	0,44	0,53	0,35	0,06	0,00	M1
	AVERAGE VALUES	4,13	2,76	0,96	0,44	0,48	0,43	0,04	0,02	

MILD SECTIONS

1.1	Fire main	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.1.1	Knows: how to line line-up in case of fire	3,88	2,82	0,78	0,39	0,56	0,47	0,00	0,00	M2
1.1.2	Inspection for corrosion and watertightness	3,35	2,47	1,00	0,62	0,32	0,50	0,00	0,18	M2
1.1.3	Isolation valves (Inspection, requirements)	3,24	2,71	1,15	0,47	0,32	0,59	0,00	0,12	M3+S10
	AVERAGE VALUES:	3,49	2,67	0,97	0,50	0,40	0,52	0,00	0,10	

2.2-B	Fixed gas-extinguishing (Inspection)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.2.1	Knows how to inspect an installation (hose cracks, pressure, leakages, ...)	3,29	2,59	1,10	0,71	0,32	0,41	0,00	0,29	C+S14
2.2.5	Knows the importance of draining the lines for condensation	3,47	2,59	1,28	0,62	0,32	0,38	0,03	0,29	P
2.2.6	Knows the different parts of an installation and the different modes of activation	3,76	2,82	1,20	0,39	0,41	0,47	0,03	0,12	T+P
	AVERAGE VALUES:	3,51	2,67	1,20	0,57	0,35	0,42	0,02	0,24	

2.5-A	Water mist spray, sprinkler (definition)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.5.2	Knows: the difference between mist, spray, and sprinkler	4,06	2,35	0,75	0,79	0,59	0,38	0,00	0,06	C
2.5.3	Knows: how to check nozzles integrity and prevent clogging	3,35	2,59	0,86	0,51	0,38	0,38	0,00	0,24	M3

2.8	Paint lockers	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.8.1	Familiar with: the extinguishing systems required for a paint locker?	3,41	2,71	1,12	0,47	0,32	0,44	0,00	0,24	S10
2.8.2	Knows: the good practices for the housekeeping of a paint locker?	3,65	2,71	1,06	0,47	0,44	0,38	0,00	0,18	M1

3.3	Fire doors and control	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.3.1	Knows: how to automatically and manually close a door	4,35	2,88	0,61	0,33	0,24	0,71	0,06	0,00	C+B
3.3.2	Knows: how to inspect a fire door and a release mechanism	3,76	2,47	1,20	0,62	0,12	0,65	0,06	0,13	C+B
3.3.3	Familiar with: adjusting the closing device	3,29	2,47	1,40	0,72	0,12	0,59	0,06	0,19	C
3.3.4	Familiar with: A, B, and C class divisions	3,71	2,53	1,21	0,62	0,62	0,28	0,00	0,12	S3+C
3.3.5	Familiar with: the division of the ship into vertical zones by structural / thermal b	3,59	2,59	1,46	0,62	0,44	0,44	0,00	0,12	M1
	AVERAGE VALUES:	3,74	2,59	1,18	0,58	0,31	0,53	0,04	0,11	

3.4-B	Ventilation systems and fire dampers (Theory)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.4.4	Aware that: there are remote and manual activation for dampers	3,59	2,65	1,06	0,49	0,47	0,50	0,00	0,06	B+C
3.4.5	Familiar with: smoke extraction	3,53	2,59	1,01	0,62	0,56	0,34	0,00	0,12	M1

4.5	Wheeled mobile fire extinguishers	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.5.1	Familiar with: location and use	3,65	2,41	1,17	0,62	0,26	0,50	0,00	0,24	C

4.11	Familiar with the specific dangers and requirements of ...	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N
4.11.1	Passenger ships	4,00	2,76	1,32	0,56	0,41	0,50	0,03	0,06
4.11.2	Tankers	3,76	2,88	1,20	0,33	0,79	0,15	0,00	0,06
4.11.3	Car carriers	4,06	2,82	0,97	0,39	0,68	0,24	0,03	0,06
4.11.4	Cargo Ships	3,59	2,71	1,00	0,47	0,85	0,06	0,03	0,06
4.11.5	Ships carrying DG	3,41	2,76	1,23	0,44	0,76	0,15	0,03	0,06
	AVERAGE VALUES:	3,76	2,79	1,14	0,44	0,70	0,22	0,02	0,06

TRAINING GAPS

2.4	Foam fire extinguishing system	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.4.1	Familiar with the layout of a system	2,82	2,35	1,38	0,49	0,41	0,16	0,09	0,35	T
2.4.2	Familiar with: Inspection of control and section valves, and pressure gauges	2,53	2,35	1,18	0,61	0,35	0,25	0,06	0,35	C+B
2.4.3	Knows: how to verify the quantity of foam concentrate in a storage tank	2,12	2,53	1,11	0,62	0,18	0,19	0,06	0,56	C+B
	AVERAGE VALUES	2,49	2,41	1,22	0,57	0,31	0,20	0,07	0,42	

1.2	Fire pumps	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.2.1	Knows: main parts of a centrifugal pump, normal flow and pressures, starting se	2,88	2,29	1,36	0,59	0,68	0,28	0,00	0,06	T
1.2.2	Knows: difference between a fire pump and an emergency fire pump	3,65	2,41	1,41	0,80	0,35	0,56	0,00	0,12	M2+S10
1.2.3	Knows: maintenance of a pump and the mandatory monthly tests	2,29	2,47	1,16	0,62	0,26	0,59	0,00	0,18	C
	AVERAGE VALUES	2,94	2,39	1,31	0,67	0,43	0,48	0,00	0,12	

3.5	Quick Closing Valves (QCV)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.5.1	Knows: the technology of a QCV (Spring, Pneumatic, ...)	3,06	2,41	1,30	0,62	0,50	0,22	0,00	0,29	T
3.5.2	Knows: which parts are protected by a QCV	2,76	2,47	1,30	0,62	0,50	0,22	0,00	0,25	R4
3.5.3	Knows: how to reset a QCV	2,00	2,29	1,22	0,69	0,24	0,25	0,00	0,50	B
3.5.4	Knows: when to use a QCV	2,71	2,65	1,49	0,49	0,38	0,22	0,00	0,38	M1
	AVERAGE VALUES	2,63	2,46	1,33	0,61	0,40	0,23	0,00	0,35	

1.3	Fire hydrants	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.3.1	Knows the main parts of a hydrant (spindle, seat, stuffing box, nuts, gaskets, fla	3,65	2,24	1,32	0,66	0,59	0,38	0,00	0,06	T
1.3.2	Knows how to perform pressure test for watertightness	2,88	2,12	1,45	0,60	0,47	0,38	0,00	0,18	M3+P
1.3.3	Knows how to react if leaking: rectify the surface of the seat (lapping), or change t	3,12	2,47	1,17	0,62	0,29	0,56	0,00	0,13	M3+P
1.3.4	Knows how to react if the wheel is blocked (open, clean, grease, adjust stuffing b	2,76	2,59	1,44	0,51	0,24	0,38	0,12	0,25	M3+P
	AVERAGE VALUES	3,10	2,35	1,34	0,60	0,40	0,42	0,03	0,15	

4.4	Portable foam applicators	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.4.1	Knows: where foam applicators should be placed	2,53	2,47	1,18	0,62	0,26	0,21	0,00	0,50	S10+C
4.4.2	Knows: how to inspect foam applicators	2,59	2,41	1,37	0,71	0,26	0,15	0,00	0,56	C

3.6	Emergency Diesel Generator (EDG)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.6.1	Knows: the requirements for an EDG (start, time running)	2,94	2,35	1,25	0,70	0,47	0,31	0,00	0,13	SOLAS II-1 42+43
3.6.2	Knows: which equipment is powered by an EDG	3,35	2,71	1,32	0,59	0,38	0,41	0,06	0,07	SOLAS II-1 42+43
3.6.3	Knows: the different modes for starting an EDG (local, remote, automatic)	3,06	2,59	1,34	0,51	0,29	0,44	0,00	0,20	M2 + SOLAS II-1 44
	AVERAGE VALUES	3,12	2,55	1,30	0,60	0,38	0,39	0,02	0,13	

OTHER GAPS

1.4-B	Hoses & Nozzles (test and binding)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.4	Knows how to perform a pressure test	3,35	2,41	1,58	0,62	0,38	0,34	0,06	0,19	M3
1.4.5	Knows how to wire bind	3,35	2,47	1,54	0,62	0,35	0,31	0,00	0,31	P

1.4-C	Hoses & Nozzles (Coupling, nozzles, storage)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.3	Knows the different kinds of couplings / nozzles	3,88	1,94	1,11	0,75	0,71	0,25	0,00	0,00	T
1.4.6	Knows how to maintain storing boxes (grease for nozzles, gasket for boxes)	3,41	2,12	1,18	0,49	0,35	0,41	0,03	0,19	M3
1.4.7	Knows how to store a hose (Common roll, O-shaped, S-Shaped)	4,47	2,12	0,87	0,78	0,62	0,41	0,00	0,00	P
	AVERAGE VALUES	3,92	2,06	1,05	0,67	0,56	0,35	0,01	0,06	

1.8	International Shore Connection	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.8.1	Knows the use and locations of ISCs	3,88	2,88	0,93	0,78	0,68	0,34	0,00	0,00	S14 + C

2.6	Fixed aerosol extinguishing systems	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.6.1	Knows: what an aerosol system is	2,76	2,00	1,39	0,61	0,24	0,06	0,06	0,63	C
2.6.2	Knows: the difference between condensed and dispersed aerosols	1,94	1,88	0,90	0,60	0,18	0,06	0,00	0,73	C

3.2	Public Adress and General Alarm	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.2.1	Familiar with: the use of P.A and of G.A	3,65	2,76	1,46	0,56	0,26	0,59	0,00	0,18	C + S12
3.2.2	Familiar with: specificities of passenger ships for muster organization (crowd ma	3,35	2,59	1,41	0,62	0,21	0,59	0,00	0,24	C + B

4.6-A	Fire control Station	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.6.1	Knows: what equipment must be located in the Fire Control Station?	3,76	2,59	0,90	0,71	0,35	0,59	0,00	0,06	S9

HIGH FOCUS SECTIONS

4.10	Specific dangers in Machinery spaces	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.10.1	Familiar with: boiler uptake fires and exhaust fires (cause, dangers, procedure)?	2,41	2,41	1,00	0,80	0,41	0,24	0,00	0,31	M1
4.10.2	Familiar with: iron-in-steam fires in water-tubes boilers? (cause, dangers, proced	2,06	2,35	1,14	0,79	0,29	0,24	0,00	0,44	M1
4.10.3	Know: what is a machinery space of category A?	1,88	2,06	1,11	0,66	0,24	0,12	0,00	0,63	S3
4.10.4	Familiar with: the mandatory measure for category A spaces ?	2,12	2,29	1,11	0,77	0,32	0,21	0,00	0,44	S10
	AVERAGE VALUES	2,12	2,28	1,09	0,75	0,32	0,20	0,00	0,45	

2.1	Fixed fire-extinguishing systems	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.1.1	Knows the different types of fixed FFS allowed by SOLAS	3,29	2,29	0,99	0,69	0,59	0,25	0,00	0,18	S10
2.1.2	Knows the regulatory requirements for the different types of vessels / Parts of ave	2,76	2,18	1,20	0,73	0,44	0,28	0,00	0,29	S10

3.7	SCBA compressor	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.7.1	Knows: the different parts of a SCBA compressor	2,82	2,00	1,29	0,79	0,26	0,32	0,12	0,29	T
3.7.2	Knows: safe procedure for starting a SCBA compressor and filling a bottle	2,88	2,41	1,50	0,80	0,18	0,47	0,06	0,29	P
3.7.3	Familiar with: the common maintenance of a SCBA compressor	2,06	1,94	1,09	0,75	0,12	0,38	0,00	0,50	P
3.7.4	Aware of: the importance of draining condensate traps	2,53	2,18	1,62	0,73	0,12	0,38	0,06	0,44	P
3.7.5	Aware of: the dangers of high pressure systems	3,65	2,71	1,37	0,47	0,26	0,28	0,12	0,31	P
3.7.6	Knows: how to change oil and filters	2,29	1,88	1,53	0,93	0,06	0,25	0,12	0,53	P
3.7.7	Prepared to fill air bottles alone in safety?	2,71	2,35	1,49	0,79	0,00	0,44	0,06	0,47	S15
	AVERAGE VALUES	2,71	2,21	1,41	0,75	0,14	0,36	0,08	0,41	

4.7	Regulatory Framework	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.7.1	Familiar with: the content of SOLAS II-2?	2,88	2,06	1,17	0,83	0,79	0,03	0,06	0,06	S
4.7.2	Familiar with: the content of the model course 2.03 Advanced Fire Fighting	2,94	2,12	1,20	0,70	0,76	0,06	0,00	0,07	M
4.7.3	Familiar with: the content of FSS?	3,12	2,35	1,17	0,61	0,71	0,13	0,00	0,13	FFS
4.7.4	Familiar with: the content of the important MSC Circulars (1432, ...)	2,29	2,06	1,16	0,66	0,41	0,13	0,00	0,44	C
4.7.5	Familiar with: the mandatory content of a Planned Management System?	2,53	2,12	1,18	0,70	0,47	0,25	0,00	0,25	S14
	AVERAGE VALUES	2,75	2,14	1,17	0,70	0,63	0,12	0,01	0,19	

1.4-D	Hoses & Nozzles (length of hoses)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.4.1	Knows the mandatory length of the hoses	2,94	1,71	1,56	0,85	0,65	0,13	0,06	0,07	S10

1.5-B	Fire fighter's outfits (Tools)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.5.4	Knows the standard signals for steel-cored lifeline	2,29	2,06	1,40	0,83	0,24	0,18	0,00	0,59	M3
1.5.5	Knows in which situation to use the fire axe	3,00	2,06	1,46	0,83	0,35	0,24	0,12	0,29	M3

1.7-B	Portable fire extinguishers (Maintenance, Re-fill)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
1.7.3	knows how to avoid powder caking (shaking)	3,06	2,24	1,52	0,75	0,32	0,24	0,03	0,38	P
1.7.4	Knows how to check emptiness (weighting)	3,65	2,18	1,22	0,81	0,29	0,26	0,09	0,35	P
1.7.5	Knows how to re-fill an empty extinguisher	1,88	1,88	1,17	0,86	0,21	0,18	0,03	0,59	M3+S14
	AVERAGE VALUES	2,86	2,10	1,30	0,81	0,27	0,23	0,05	0,44	

2.3	Fixed dry chemical powder	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.3.1	Familiar with the following terms: Cacking, Packing, Gas point, Monitor	2,29	2,06	0,99	0,56	0,41	0,13	0,00	0,47	C
2.3.2	Knows when to chose between using DCP versus shutting gas supply during a ga	2,35	2,59	1,41	0,51	0,26	0,09	0,06	0,56	p
2.3.3	Familiar with the layout of a DCP system and its different activation procedures	2,35	2,24	1,37	0,66	0,29	0,19	0,06	0,44	T
	AVERAGE VALUES	2,33	2,29	1,25	0,58	0,32	0,14	0,04	0,49	

2.5-B	Water mist spray, sprinkler (Inspection, Test, Types of systems, requirements	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.5.5	Aware that pressure tanks must have a correct level of water	2,88	2,53	1,32	0,62	0,24	0,31	0,00	0,44	M3
2.5.6	Familiar with: right position of valves for pump units	2,94	2,65	1,20	0,70	0,26	0,41	0,00	0,31	M3 + C
2.5.7	Knows: how to test automatic start	2,53	2,41	1,37	0,71	0,21	0,34	0,00	0,44	C
2.5.1	Knows: the difference between dry pipe and wet pipe systems	3,06	2,24	1,39	0,66	0,38	0,28	0,00	0,31	C
2.5.4	Knows: common requirements and different kind of arrangements	2,82	2,24	1,24	0,75	0,21	0,38	0,00	0,41	T
2.5.8	Familiar with: standby pressure air/gas gauges inspection	2,94	2,29	1,25	0,77	0,18	0,38	0,00	0,47	M3 + C
	AVERAGE VALUES	2,86	2,39	1,29	0,70	0,25	0,35	0,00	0,40	

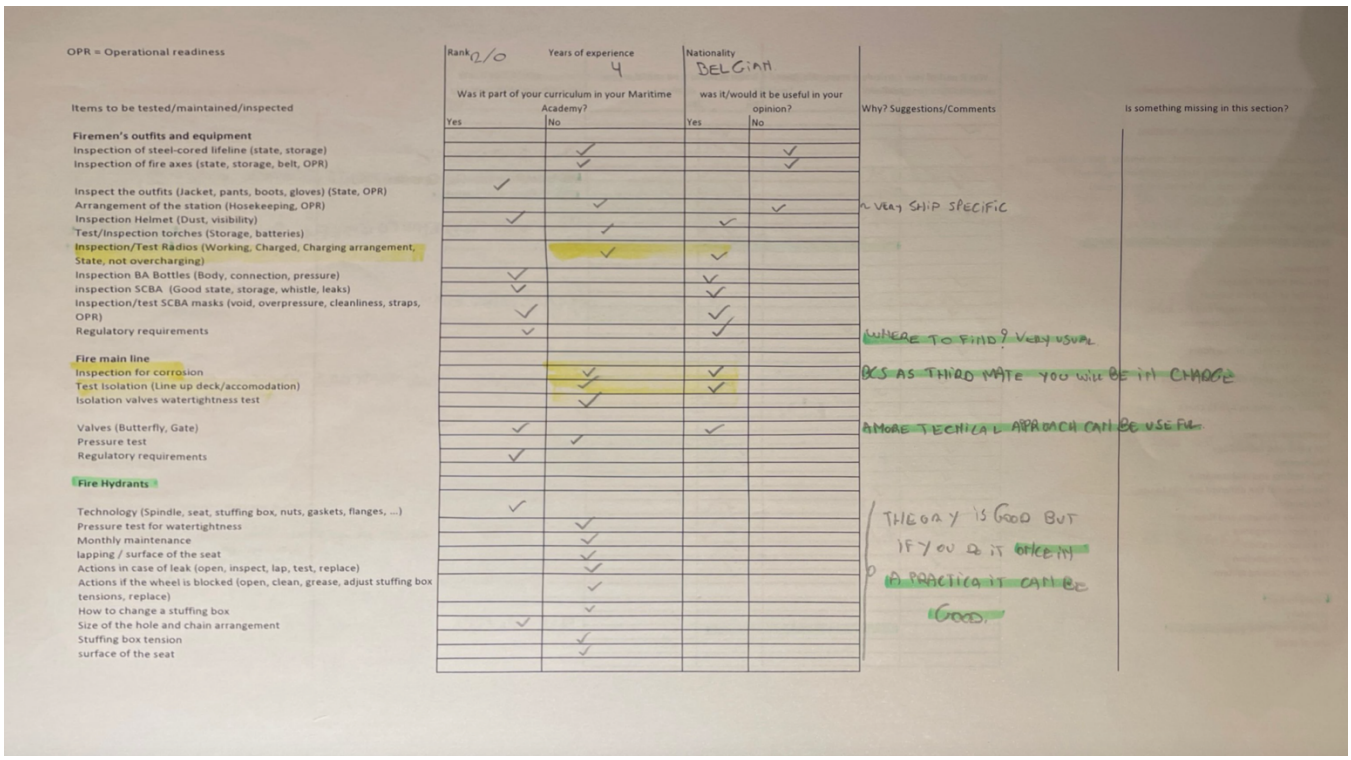
2.7	Galley equipment	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
2.7.1	Familiar with: the mandatory extinguishing mediums for galley fire	3,71	2,65	1,10	0,49	0,35	0,50	0,00	0,18	S10
2.7.2	Knows: the difference between dry chemical and wet chemical extinguishing sys	3,18	2,29	1,29	0,69	0,32	0,28	0,00	0,38	P

3.1-B	Fixed fire detection system and fire alarm (alarm)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.1.3	Familiar with: main functions and use of fire alarm control pannel	3,65	2,82	1,11	0,39	0,18	0,75	0,00	0,12	B
3.1.4	Knows: the difference between pre-alarm and alarm	3,12	2,29	1,62	0,59	0,12	0,44	0,00	0,40	P

3.4-A	Ventilation systems and fire dampers (Physical elements)	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
3.4.1	Familiar with: the operation and the layout of fans and A/C units	3,00	2,29	1,12	0,69	0,26	0,47	0,06	0,24	T
3.4.2	Understands: the difference between a flap, a fire damper, a smoke damper	3,06	2,24	1,25	0,75	0,44	0,34	0,00	0,24	M1 + B + S9 + C
3.4.3	Familiar with: ventilation mushrooms	2,59	2,12	1,23	0,70	0,41	0,31	0,00	0,25	T
	AVERAGE VALUES	2,88	2,22	1,20	0,71	0,37	0,38	0,02	0,24	

4.8	Technology	AVCON	AVIMP	DEVCON	DEVIMP	A	V	O	N	ORG
4.8.1	Knows: what essential equipment should be found in a safety locker?	3,35	2,41	1,17	0,71	0,56	0,41	0,00	0,06	P
4.8.2	Knows: the difference between grease/vaseline/silicon grease?	3,00	1,94	1,27	0,56	0,21	0,35	0,09	0,31	T
4.8.3	Familiar with: valves and pumps maintenance	2,76	2,35	1,35	0,79	0,29	0,35	0,00	0,31	T
4.8.4	Familiar with: gate/butterfly valves (different parts+how to fix a leak)	2,76	2,18	1,30	0,64	0,53	0,18	0,00	0,29	T
	AVERAGE VALUES	2,97	2,22	1,27	0,67	0,40	0,32	0,02	0,24	

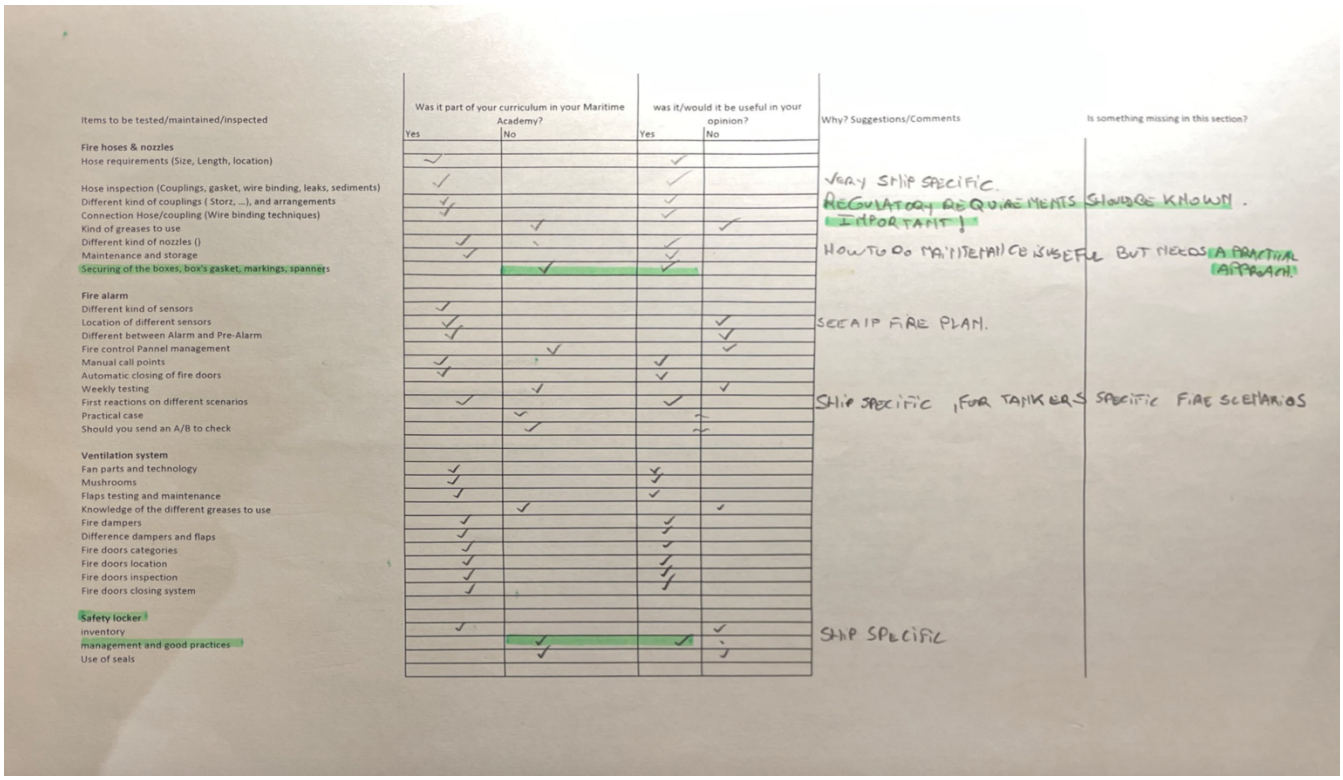
Annex 5 EXAMPLE OF INFORMAL FEEDBACK



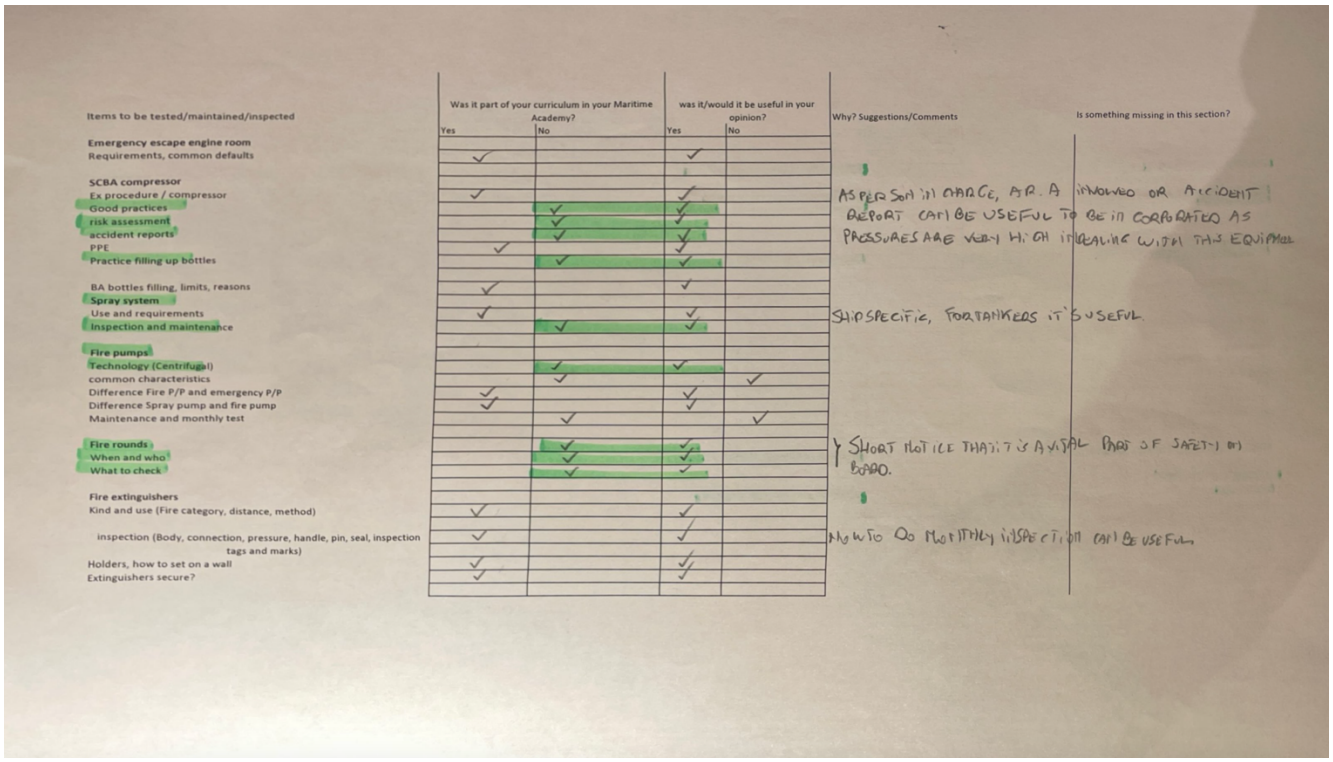
OPR = Operational readiness

Rank 2/O | Years of experience 4 | Nationality BELGIAN

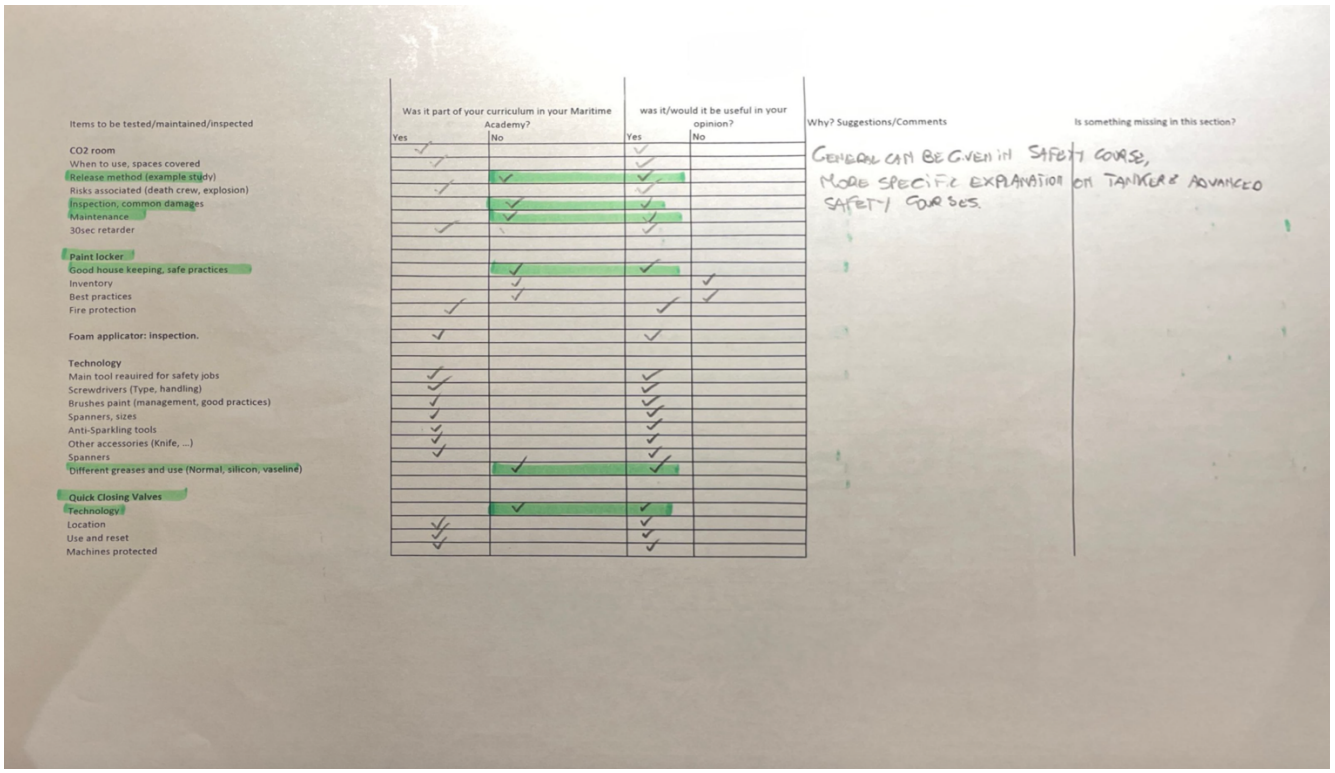
Items to be tested/maintained/inspected	Was it part of your curriculum in your Maritime Academy? Yes	Was it part of your curriculum in your Maritime Academy? No	was it/would it be useful in your opinion? Yes	was it/would it be useful in your opinion? No	Why? Suggestions/Comments	Is something missing in this section?
Firemen's outfits and equipment						
Inspection of steel-cored lifeline (state, storage)		✓		✓		
Inspection of fire axes (state, storage, belt, OPR)		✓		✓		
Inspect the outfits (Jacket, pants, boots, gloves) (State, OPR)	✓					
Arrangement of the station (Hosekeeping, OPR)		✓		✓	VERY SHIP SPECIFIC	
Inspection Helmet (Dust, visibility)	✓		✓			
Test/Inspection torches (Storage, batteries)		✓				
Inspection/Test Radios (Working, Charged, Charging arrangement, State, not overcharging)		✓	✓			
Inspection BA Bottles (Body, connection, pressure)	✓		✓			
inspection SCBA (Good state, storage, whistle, leaks)	✓		✓			
Inspection/test SCBA masks (void, overpressure, cleanliness, straps, OPR)	✓		✓			
Regulatory requirements	✓		✓		WHERE TO FIND? VERY USUAL	
Fire main line						
Inspection for corrosion		✓	✓		BCS AS THIRD MATE YOU WILL BE IN CHARGE	
Test Isolation (Line up deck/accomodation)		✓	✓			
Isolation valves watertightness test		✓				
Valves (Butterfly, Gate)	✓		✓		A MORE TECHICAL APPROACH CAN BE USEFUL	
Pressure test		✓				
Regulatory requirements	✓					
Fire Hydrants						
Technology (Spindle, seat, stuffing box, nuts, gaskets, flanges, ...)	✓				THEORY IS GOOD BUT IF YOU DO IT OFTEN IN PRACTICA IT CAN BE GOOD.	
Pressure test for watertightness		✓				
Monthly maintenance		✓				
lapping / surface of the seat		✓				
Actions in case of leak (open, inspect, lap, test, replace)		✓				
Actions if the wheel is blocked (open, clean, grease, adjust stuffing box tensions, replace)		✓				
How to change a stuffing box		✓				
Size of the hole and chain arrangement	✓					
Stuffing box tension		✓				
surface of the seat		✓				



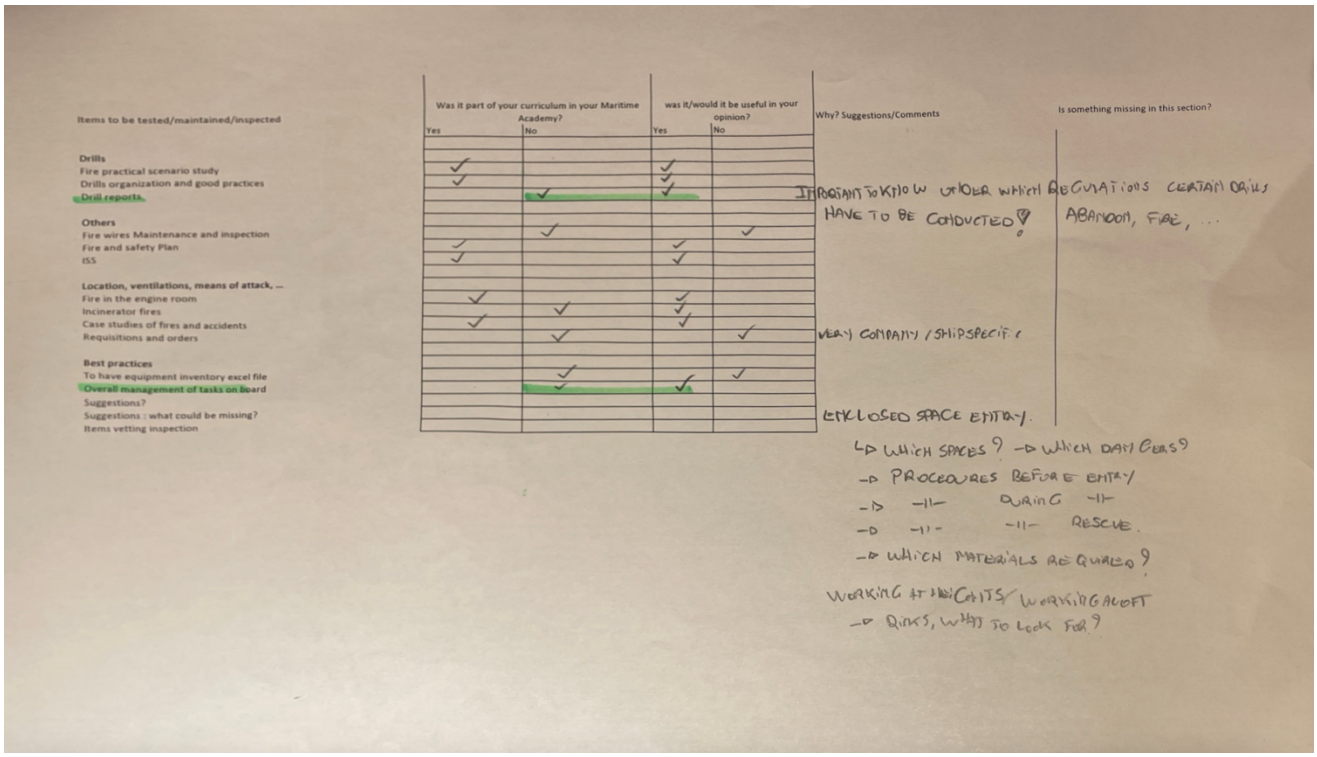
Items to be tested/maintained/inspected	Was it part of your curriculum in your Maritime Academy? Yes	Was it part of your curriculum in your Maritime Academy? No	was it/would it be useful in your opinion? Yes	was it/would it be useful in your opinion? No	Why? Suggestions/Comments	Is something missing in this section?
Fire hoses & nozzles						
Hose requirements (Size, Length, location)	✓		✓			
Hose inspection (Couplings, gasket, wire binding, leaks, sediments)	✓		✓		VERY SHIP SPECIFIC.	
Different kind of couplings (Storz, ...), and arrangements	✓		✓		REGULATORY REQUIREMENTS SHOULD KNOWN. IMPORTANT!	
Connection Hose/coupling (Wire binding techniques)	✓		✓			
Kind of greases to use		✓		✓		
Different kind of nozzles ()	✓		✓			
Maintenance and storage	✓		✓		HOW TO DO MAINTENANCE IS USEFUL BUT NEEDS A PRACTICAL APPROACH	
Securing of the boxes, box's gasket, markings, spanners		✓	✓			
Fire alarm						
Different kind of sensors	✓					
Location of different sensors	✓			✓	SEE AIP FIRE PLAN.	
Different between Alarm and Pre-Alarm	✓			✓		
Fire control Pannel management		✓		✓		
Manual call points	✓		✓			
Automatic closing of fire doors	✓		✓			
Weekly testing		✓		✓		
First reactions on different scenarios	✓		✓		SHIP SPECIFIC, FOR TANKERS SPECIFIC FIRE SCENARIOS	
Practical case		✓				
Should you send an A/B to check		✓				
Ventilation system						
Fan parts and technology	✓		✓			
Mushrooms	✓		✓			
Flaps testing and maintenance	✓		✓			
Knowledge of the different greases to use		✓		✓		
Fire dampers	✓		✓			
Difference dampers and flaps	✓		✓			
Fire doors categories	✓		✓			
Fire doors location	✓		✓			
Fire doors inspection	✓		✓			
Fire doors closing system	✓		✓			
Safety locker						
inventory	✓			✓	SHIP SPECIFIC	
management and good practices		✓	✓			
Use of seals		✓		✓		



Items to be tested/maintained/inspected	Was it part of your curriculum in your Maritime Academy? Yes	Was it part of your curriculum in your Maritime Academy? No	was it/would it be useful in your opinion? Yes	was it/would it be useful in your opinion? No	Why? Suggestions/Comments	Is something missing in this section?
Emergency escape engine room						
Requirements, common defaults	✓		✓			
SCBA compressor						
Ex procedure / compressor	✓		✓			
Good practices		✓	✓		AS PER SOPEMARCE, AR. A INVOLVED OR ACCIDENT REPORT CAN BE USEFUL TO BE INCORPORATED AS PRESSURES ARE VERY HIGH IN DEALING WITH THIS EQUIPMENT	
risk assessment		✓	✓			
accident reports		✓	✓			
PPE	✓		✓			
Practice filling up bottles		✓	✓			
BA bottles filling, limits, reasons	✓		✓			
Spray system						
Use and requirements	✓		✓		SHIP SPECIFIC, FOR TANKERS IT'S USEFUL	
Inspection and maintenance		✓	✓			
Fire pumps						
Technology (Centrifugal)		✓	✓			
common characteristics		✓		✓		
Difference Fire P/P and emergency P/P	✓		✓			
Difference Spray pump and fire pump	✓		✓			
Maintenance and monthly test		✓		✓		
Fire rounds		✓	✓		SHORT NOTICE THAT IT'S A VITAL PART OF SAFETY ON BOARD.	
When and who		✓	✓			
What to check		✓	✓			
Fire extinguishers						
Kind and use (Fire category, distance, method)	✓		✓			
inspection (Body, connection, pressure, handle, pin, seal, inspection tags and marks)	✓		✓		HOW TO DO MONTHLY INSPECTION CAN BE USEFUL	
Holders, how to set on a wall	✓		✓			
Extinguishers secure?	✓		✓			



Items to be tested/maintained/inspected	Was it part of your curriculum in your Maritime Academy? Yes	Was it part of your curriculum in your Maritime Academy? No	was it/would it be useful in your opinion? Yes	was it/would it be useful in your opinion? No	Why? Suggestions/Comments	Is something missing in this section?
CO2 room	✓		✓		GENERAL CAN BE GIVEN IN SAFETY COURSE, MORE SPECIFIC EXPLANATION ON TANKER & ADVANCED SAFETY COURSES.	
When to use, spaces covered	✓		✓			
Release method (example study)		✓	✓			
Risks associated (death crew, explosion)	✓		✓			
Inspection, common damages		✓	✓			
Maintenance		✓	✓			
30sec retarder	✓		✓			
Paint locker						
Good house keeping, safe practices		✓	✓			
Inventory		✓		✓		
Best practices		✓		✓		
Fire protection	✓		✓			
Foam applicator: inspection.	✓		✓			
Technology						
Main tool reauired for safety jobs	✓		✓			
Screwdrivers (Type, handling)	✓		✓			
Brushes paint (management, good practices)	✓		✓			
Spanners, sizes	✓		✓			
Anti-Sparkling tools	✓		✓			
Other accessories (Knife, ...)	✓		✓			
Spanners	✓		✓			
Different greases and use (Normal, silicon, vaseline)		✓	✓			
Quick Closing Valves						
Technology		✓	✓			
Location	✓		✓			
Use and reset	✓		✓			
Machines protected						



Items to be tested/maintained/inspected	Was it part of your curriculum in your Maritime Academy? Yes	Was it part of your curriculum in your Maritime Academy? No	was it/would it be useful in your opinion? Yes	was it/would it be useful in your opinion? No	Why? Suggestions/Comments	Is something missing in this section?
Drills						
Fire practical scenario study	✓		✓			
Drills organization and good practices	✓		✓			
Drill reports.		✓	✓		IMPORTANT TO KNOW UNDER WHICH REGULATIONS CERTAIN DRILLS HAVE TO BE CONDUCTED	ABANDON, FIRE, ..
Others						
Fire wires Maintenance and inspection		✓		✓		
Fire and safety Plan	✓		✓			
ISS	✓		✓			
Location, ventilations, means of attack, ..						
Fire in the engine room	✓		✓			
Incinerator fires		✓	✓			
Case studies of fires and accidents	✓		✓			
Requisitions and orders		✓		✓	VERY COMPANY / SHIPSPECIFIC	
Best practices						
To have equipment inventory excel file		✓		✓		
Overall management of tasks on board		✓	✓			
Suggestions?						
Suggestions : what could be missing?						
Items vetting inspection					ENCLOSED SPACE ENTRY.	

↳ WHICH SPACES? → WHICH DANGERS?
→ PROCEDURES BEFORE ENTRY
→ " DURING "
→ " " RESCUE.
→ WHICH MATERIALS REQUIRED?

WORKING AT HEIGHTS / WORKING ALOFT
→ RISKS, WHAT TO LOOK FOR?

Annex 6 EXCEL FILE

A digital annex has been submitted, consisting of an Excel file that contains the initial dataset and all related analytical calculations. This file supports the exploratory study presented in the thesis and provides transparency regarding the methodological process and data treatment.

Page 1: MAPPING – Item List

Contains the initial list of items, organized by section, which served to construct the initial mapping used in the survey. The origin of each item is indicated.

Page 2: RESPONDENTS

An anonymized list of participants, including the optional personal information they provided.

Page 3: SOURCE WEIGHTING

Calculation sheet used to generate the [%A, %V, %O, %N] matrix for source weighting.

Page 4: THRESHOLDS

Statistical calculations and visualizations (histograms, graphs) used to define cut-off points and interpret variability across responses.

Page 5: DATA – ORIGIN GRAPH

Data-driven analysis categorized by source, with corresponding graphs for interpretation.

Page 6: DATA – CORR_MATRIX & GRAPHS

Correlation-based data analysis, including scatter plots and residual graphs to explore interdependencies.

Page 7: SECDRIV – P1

Section-driven analysis with statistical markers and conditional formatting. Composite sections are identified and color-coded.

Page 8: SECDRIV – P2

Composite sections are subdivided into subsections and reinserted into the original item list for detailed analysis.

Page 9: SECDRIV – P3

Final reorganization of all subsections into conclusive categories:

- Consolidated
- Mild
- Training Gap
- Other Gap
- High Focus