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## **The effect a Bridge Resource Management course has upon the attitude towards Non-Technical Skills**

Bachelor thesis in Master Mariner

Jessica Sondell  
Matilda Lyman



# The effect a Bridge Resource Management course has upon the attitude towards Non-Technical Skills

Bachelor thesis in Mechanics and Maritime Sciences

JESSICA SONDELL  
MATILDA LYMAN

Department of Mechanics and Maritime Sciences  
*Division of Master Mariner*  
CHALMERS UNIVERSITY OF TECHNOLOGY  
Gothenburg, Sweden 2020

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JESSICA SONDELL  
MATILDA LYMAN

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Department of Mechanics and Maritime Sciences  
Chalmers University of Technology  
SE-412 96 Gothenburg  
Sweden  
Phone number: + 46 (0)31-772 1000

Cover:  
A ROPAX, with its officers in focus. Shutterstock, adapted with permission.

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## Abstract

The concept of Bridge Resource Management has been a part of the maritime industry since 1992 and in 2011 it became a part of international regulations for bridge officers to obtain training in BRM. The motive was to decrease accidents and strengthen safety at sea by educating officers to become more aware and learn how to exploit their NTS; as they are considered to be as important as one's technical proficiency. It is proven that NTS do make people more efficient and act safer.

This study was executed to see if it was possible to establish a correlation between bridge officer's attitude towards NTS before and after a BRM course was attended. A quantitative method was used as the participants received an online questionnaire before and after attending a BRM course at Chalmers. The responses were given on a scale from 1 to 5 i.e. a Likert scale, providing data on their attitude; how much they agreed with the statements given. The questionnaires' results were analyzed and compared using Microsoft® Excel® to establish if a change of attitude had occurred as a result of attending the BRM course.

The results show no significant difference between the responses before and after the course, meaning the officers' attitude towards NTS did not significantly improve after attending the three-day BRM course. This does not, however, indicate that the BRM course was unnecessary. The results together with previous research show that the officers in this study had a good attitude towards NTS to begin with. The officers' perception of the training was that they did gain knowledge and as BRM is still evolving to fit the needs of the maritime industry its importance as a safety course should not be discarded. Conclusively, this subject needs more research to evaluate and determine what could be done to develop BRM training to make it a better fit for the maritime industry.

Keywords: NTS, BRM, MRM, Attitude, Maritime Industry, ROPAX, Bridge Officers

## Pre-word

The bachelor thesis ‘The effect a Bridge Resource Management course has upon the attitude towards Non-technical Skills’ was conducted from November 2019 to March 2020, at Chalmers University of Technology, Gothenburg. It is written by two students, both studying the fourth and final year at Master Mariner. The choice of topic for this thesis is based on an interest in the human element and safety at sea.

We want to thank the examiner, Johan Magnusson, for his engagement and enthusiasm in this project from start to finish. We would also like to thank Professor Scott N. MacKinnon for all his help and interest in this subject as well as our supervisor Lars Axvi for his time, devotion and support throughout this project. Scott and Lars, this study would have been hard to accomplish without your help, thank you.

Authors, Gothenburg, February 2020.



## Glossary

### Abbreviations

BRM	Bridge Resource Management
CRM	Crew Resource Management
C.V.	Coefficient of variation
EMSA	European Maritime Safety Agency
ERM	Engine Resource Management
GDPR	The General Data Protection Regulation
IMO	International Maritime Organization
MRM	Maritime Resource Management
NASA	National Aeronautics and Space Administration
NTS	Non-Technical Skills
ROPAX	Roll On/Roll Off Passenger vessel
RORO	Roll On/Roll Off vessel
S.D.	Standard Deviation
STCW	The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers

### Terminology

Attitude	Refers to human behavior change and a person's stance towards something (Maio & Olson, 1995; Oppenheim, 1992).
Central tendency	Describes the central position of a data set, can be described using the mode, median or mean (Denscombe, 2014, Chapter 15).
Likert scale	Is a way to measure someone's stance (or assumption that we can measure attitude) in questionnaires with individual statements where the Likert scale can be 1. Strongly agree, 2. Undecided, 3. Strongly disagree, and the participant answers by choosing the answer closest to their stance or attitude (McLeod, 2019).
Noise	Sound louder than 80 decibels (Flin, O'Connor, & Crichton, 2008, p. 194).
Skewed	In this case, it refers to data that is distorted or asymmetric in e.g., a diagram or charts containing an unnormal distribution of data (Sharma, 2019).
Standardized errors	Measures the accuracy with a sample distribution which represents a specific group, by using standard deviation (Denscombe, 2014, p. 287).

## 1. Introduction

The shipping fleet is today bigger than ever before (United Nations Conference on Trade and Development, 2018, p. 76). In critical as well as in standard situations, bridge officers rely on technical equipment to solve different situations they encounter during their duty on the bridge (Fjeld, Tvedt, & Oltedal, 2018). Amendments made by the United Nations (UN) organ for seafarers, the International Maritime Organization (IMO), were to withstand these technical challenges, to make bridge officers certified to meet the technical requirements (IMO, 2017). Although, it is not exclusively technical skills that are required for bridge officers; a complement to the technical acquirements – are cognitive, social and personal resource skills, called Non-Technical Skills (NTS) (IMO, 2017).

Different definitions have been stated through the years (Fjeld et al., 2018), the most common definition includes seven different skills: Situation awareness, Decision-making, Communication, Teamwork, Leadership, Managing stress and Coping with fatigue (Flin et al., 2008). So, how important are these skills to practice? European Maritime Safety Agency (EMSA) searched for the root cause of 1645 accidental events from 2011 to 2017 and addressed 58% of them to human erroneous actions. The second biggest cause was equipment, at 25% (EMSA, 2014). From those numbers, NTS is presented as important, if not key practice.

In the 1970s the aviation industry started to develop a Crew Management Course (CRM), for the pilots to develop their NTS. This was done as a reaction to the many fatal aircraft incidents at that time (Kanki, Anca, & Helmreich, 2010). Twenty years later, this had reached the maritime sector (Grech, Horberry, & Koester, 2008), and the first Bridge Resource Management (BRM) course was developed in the 1992 (International Association of Independent Tanker Owners, 2006; Kanki et al., 2010, p. 319). 19 years later, in 2011, IMO decided to make amendments in The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), requiring all bridge officers to participate in BRM training. These amendments increased the interest in NTS throughout the maritime industry (Wahl & Kongsvik, 2018).

The first study with purpose to assess the effectiveness of BRM was issued 1995 (O'Connor, 2011), and since then studies have been published by different organizations and institutions (see Elashkar, 2016; Hong & Kim, 2016; O'Connor, 2011; Röttger, Vetter, & Kowalski, 2016, for a review). The study by O'Connor (2011) compares naval officers that conducted BRM training, with naval officers without BRM training, with the purpose to assess the effectiveness of BRM training. Concluded by O'Connor was that, there was no significant difference between the two groups. Furthermore, Röttger, Vetter, and Kowalskis (2016) study concluded that the BRM training assessed by them was positively perceived and considered useful by the participants, but their result did not show improvements on NTS or attitude.

This study will assess the BRM course's effectiveness in changing the participants' attitude. This will be done by letting bridge officers answer a questionnaire with 17 statements measuring their attitude towards NTS before taking a BRM course and then answer a second questionnaire containing the same 17 statements after taking the course. To our knowledge, no studies have been conducted with this method before.

## 1.1 Purpose

The purpose of this study is to analyze if a BRM course can impose a change in attitude towards NTS of bridge officers. As stated in the introduction, the purpose when BRM was first adopted as a course; was to reduce accidents caused by human actions, as well as accidents caused by technical equipment monitored by humans. To achieve this goal, maritime officers attending a BRM course need to understand the learning objectives defined within the course and that could lead to a possible change in attitudes. This study assesses the attitudes before and after the course is taken and examines if maritime officers developed their understanding of the importance of NTS.

## 1.2 Research Question

What effect does a BRM course have upon the attitude towards Non-Technical Skills?

## 1.3 Hypotheses

Hypothesis 1: Maritime bridge officers who participated in the BRM course obtain a more positive perception of NTS.

Hypothesis 2: The attitude towards the NTS *Teamwork* has improved after the participants conducted the BRM course.

Hypothesis 3: The attitude towards the NTS *Managing fatigue & stress* has improved after the participants conducted the BRM course.

Hypothesis 4: The attitude towards the NTS *Leadership* has improved after the participants conducted the BRM course.

Hypothesis 5: The attitude towards the NTS *Decision-making* has improved after the participants conducted the BRM course.

## 1.4 Limitations

This study is confined to a limited number of bridge officers as the survey is conducted on employees from one ferry company operating in Europe. This could, in the end, affect the results as e.g., generalizing the data and projecting it on the maritime sector would be misleading. The study is not limited to the bridge officers' nationality, as the company employs officers inside and outside of Europe. The second questionnaire is a limitation in the aspect of when it was sent. The participants all received the second questionnaire on the same date, consequently, the participants who took the course the 31<sup>st</sup> of January 2017 received the questionnaire 152 weeks after they attended and for the officers who took the course the 13<sup>th</sup> of December 2018, received it 54 weeks after. This could affect the results as it is nearly three years since the first participants took the BRM course. One cannot solely determine if it is this BRM course that possibly changed their attitude towards NTS, or if follow-up work has been made on the bridge to implement possible learning outcomes from the course.

The definitions used in this study for attitude and the different NTS should be considered as delimitations as different definitions exist in this line of study.

## 2. Background

This chapter will explain and define terms and theories important to this study as well as the historical aspect of the development and origin of BRM and NTS. The understanding of these theories and the development of BRM is an important part when discussing and analyzing the progression in relation to the possible attitude change.

### 2.1 Definitions

#### 2.1.1 Definition of attitude

The research question in this study aims to investigate the possible change in attitude and for that purpose, attitude will be explained and defined.

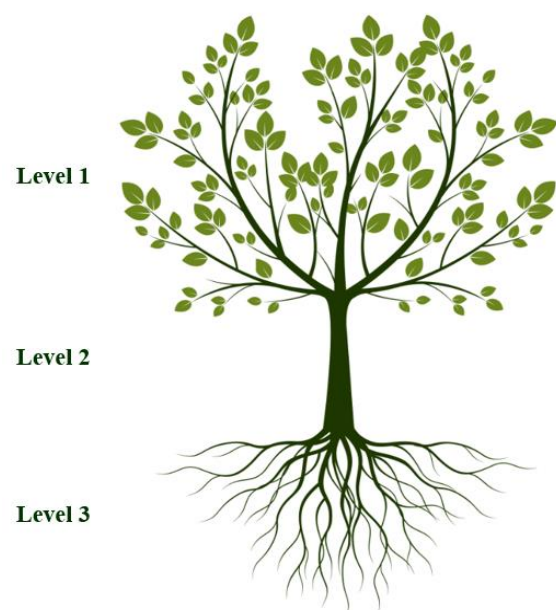
Researchers have defined attitude differently through the years (Oppenheim, 1992). Although, Oppenheim states that ‘most researchers seem to agree that an attitude is a state of readiness, a tendency to respond in a certain manner when confronted with certain stimuli.’ (Oppenheim, 1992, p. 174).

The origin of attitude change can be seen as a sequence divided into three different levels. Level 3 is the sequence’s base. It is represented by one’s fundamental values and acts as a determinative for level 2, the attitude. Level 2, will determine and direct the first level, one’s behavior and opinions (Homer & Kahle, 1988; Maio & Olson, 1995; Olson & Zanna, 1993; Oppenheim, 1992). This has been illustrated in different models, which the authors of this thesis have taken into consideration and been inspired by when creating Figure 2.1 (European Committee for Standardization, 2004; Oppenheim, 1992, Chapter 10). The figure should not be taken literally, but act as a model to help understand the structure of attitude change.

The tip of the branches, level 1 in Figure 2.1, represents the opinions and behaviors of a person. Consequently, they are easily affected by outside influence and will go back to their original position once the influence is over. In the same way, the opinions and behavior of humans are affected and will go back to what they originally were (depending on the deeper levels) when the external influence is over.

Following this model, at level 2 comes the attitude. The body of the tree, which is more resistant to external influence compared to level 1, can still be affected by heavy influence. For humans, the attitude is deeper rooted than opinions and behavior, but can still be influenced by external forces; it too will recur once the influence is over.

To really change the attitude and opinion, it is profoundly important to reach level 3, which represents the fundamental values of a person. It is symbolized by the roots of the tree that are sheltered against external forces. From a human perspective, a permanent change in attitude or



*Figure 2.1: The tree represents attitude change in humans. Level 3 is one’s values, level 2 is represented by attitude and level 1 by behavior and opinions. The levels are placed along the tree in order of how they are affected by external influence. The roots are not affected by wind while the leaves and outer branches will move with the wind. Adapted with permission from rolandtopor/Shutterstock.com.*

opinions cannot come directly from external influence, the change is required to come from the person's fundamental values. The change can originate from external influence, but to make a permanent change it needs to be adopted within a person's fundamental values (Homer & Kahle, 1988; Maio & Olson, 1995; Olson & Zanna, 1993; Oppenheim, 1992).

So, is it possible to change a person's attitude with a BRM course? Based on the theory described above, external influences cannot have a permanent impact on attitude, it has to come from a change of values. Therefore, a BRM course can give the participants knowledge, tools, and a new perspective, but the participants must adopt this as their new fundamental values. After that, a permanent change in a person's attitude can occur.

### 2.1.2 Definition of Non-Technical Skills

For this thesis, the definition of NTS comes from the book *Safety at the sharp end* by Rhona Flin, Paul O'Connor and Margaret Crichton (2008). This definition will be used as it is one of the most common ones in this area of research. The book defines seven NTS, and the skills will be defined one by one for a deeper understanding of what these are comprised of.

#### 2.1.2.1 Situation awareness

Superficially explained, Situation awareness is to understand what is going on around you, often called perception or attention by psychologists. The most common definition (Flin et al., 2008, Chapter 2) is provided by Endsley (1995, p. 36): 'Situation awareness is the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and their projection of their status in the near future'.

#### 2.1.2.2 Decision-making

Decision-making can be defined as the process of reaching a judgment or choosing an option to meet the needs of a given situation. This skill focus on operational decision-making for personnel functioning under time pressure and stress, in contrast to the strategic decision-making in e.g., upper business management or high command in the military, which are not included in this NTS (Flin et al., 2008, Chapter 3).

#### 2.1.2.3 Communication

Communication is described as a major part of good teamwork, although it is defined as a separate skill. It is a skill with many components, e.g., it provides knowledge, institutes relationships, maintains attention to tasks and establishes predictable behavior patterns. Communication can be both verbal and non-verbal, both with the possibility to be misinterpreted. Development and improvement are possible, with tools like explicitness, timing, assertiveness and active listening (Flin et al., 2008, Chapter 4).

#### 2.1.2.4 Teamwork

Teamwork has been well researched through the years in different sectors with different objectives. For NTS, the main elements of the individual team working skills are to support others, solve conflicts, exchange information and co-ordinate activities. A common understanding is important for the team to reach a common goal while briefing, and later debriefing, are common practices to achieve that. Historically, many accidents are addressed to teamwork failure, which was part of the trigger for the NTS training in aviation, i.e. CRM (Flin et al., 2008, Chapter 5).

#### 2.1.2.5 Leadership

Leadership is about directing & coordinating the activities of team members, encourage them to work together, assigning tasks, motivating, planning, organizing and establish a positive atmosphere. As a NTS, leadership contains four main elements: use of authority & assertiveness, maintaining standards, planning & coordination and workload management (Flin et al., 2008, Chapter 6).

#### 2.1.2.6 Managing stress

*Safety at the sharp end* states two types of stress: acute stress and chronic stress. Acute stress is the sudden and intense stress that often emerges in critical situations, while chronic stress is related to how an employee reacts to the demands at the workplace in the long-term perspective. Stress-related problems can individually lead to severe health problems and for the workplace, it can reduce performance which leads to a higher risk for accidents. Therefore, the ability to recognize and manage stress, in oneself and in others, are important (Flin et al., 2008, Chapter 7).

#### 2.1.2.7 Coping with fatigue

Besides the lack of sleep, fatigue can be caused by factors such as stress, noise, vibrations, extreme temperatures and unstimulating tasks. Fatigue is a significant safety issue in high-risk workplaces and is shown to impact one's cognitive performance, motor skills, communication and social skills in a negative way. Important elements in this skill are to identify the causes of fatigue, recognize the effects of fatigue and implement coping strategies (Flin et al., 2008, Chapter 8).

## 2.2 Historical background

### 2.2.1 Aviation

In 1977 at Tenerife airport, two Boeing 747 collided during take-off and 583 people lost their lives (Flin et al., 2008, p. 3; Subsecretaría de Aviación Civil; NTSB, 1978, pp. 5–6). The accident report assessed the possible causes in a chapter called Human Factors with headings such as Behavior, Fixation, Fatigue, Overload and Authority in the cockpit. Reading the chapter Human Factors, one cannot miss the many similarities to the definitions of NTS (see Subsecretaría de Aviación Civil; National Transportation Safety Board, 1978, pp. 35–38, for a review). In 1978 Flight 173, on its way to Portland International Airport, crashed not far from the airport. In the accident report safety recommendations included: '[...]ensure that their flight crews are indoctrinated in principles of flight deck resource management, with particular emphasis on the merits of participative management for captain and assertiveness training for other cockpit crewmembers.' (NTSB, 1978, p. 30). What the report concluded was that the flight crew had not communicated, the captain had failed to accept inputs from the attending flight crew and the crew lacked certainty when addressing their captain. Together with disaster accidents like the Lockheed L-1011 in the Everglades 1972 and the Boeing 737 at Chicago Midway Airport 1972 (see Helmreich, B., 2006, for a review) these accidents were a big part introducing, what later became NTS. Six months later, on June 7, 1979, the National Transportation Safety Board recommended Cockpit Resource Management for flight crews (Helmreich, R., Merritt, & Wilhelm, 1999). This, after a meeting at National Aerospace and Space Administration (NASA), who during that time was pioneers in studying human factors in aeronautics and astronautics (Muñoz-marrón, 2018, p. 193). This training would cover communication, leadership, and decision-making, with the intention to manage all resources



available including crew members, procedures and technical equipment. To follow, United Airlines held the first CRM course in 1981 (Helmreich, R., et al., 1999, p. 2).

Since the first CRM training was issued it has been an ongoing progress to develop the CRM training program. In the late 1980's it was concluded that the training had to be modified to fit the environment and duties of pilots and the flight crew, as its original structure provided by NASA had elements specific to aeronauts and astronauts e.g., isolation training (Muñoz-marrón, 2018). As airplanes were modernized airlines began to implement CRM training specifically designed to cover technical and non-technical elements. The training now applied to flight attendants, dispatchers, and maintenance personnel, not only pilots. The training also focused on addressing behavior, critical components of the human factor and organizational culture (Helmreich, B., 2006; Muñoz-marrón, 2018). Another significant modification to the training program was the aim to standardize errors and develop strategies to deal with those issues (Helmreich, R., 1997). Today, the CRM program is considered to be at its sixth generation, with the new aspect of external threats to consider and, the continues challenge to standardize the different training curriculums within the aviation industry; even though it is 22 years since International Civil Aviation Organization (ICAO) in 1998 made CRM training a requirement (Helmreich, B., 2006; International Civil Aviation Organization, 1998; Muñoz-marrón, 2018).

#### 2.2.2 NTS in different professions

CRM, NTS and Human factor skills are different names for practically the same thing (Flin, Wilkinson, & Agnew, 2014), training in NTS can today be found in many different high-risk professions e.g., the mining industry, nuclear industry, gas & oil drilling industry, police and security industry (Flin et al., 2014; Helmreich, B., 2006; Kanki et al., 2010). The training is developed or specialized to fit the need of the specific profession the NTS training applies to. The adoption of NTS training from different industries is relatively new. The International Association of Oil and Gas Producers published a report 2014 declaring 'To date, the oil and gas exploration and production industry has not paid the same attention to providing training in cognitive, human factor skills such as situation awareness and decision making.' (Flin et al., 2014, p. v). The interest, according to the report, came after the Macondo and Montara wells platform disaster (see Anderson et al., 2011; Borthwick, 2010, for a review). Not only did NTS training develop to overcome disasters, it has also been acknowledged as an important part of companies' success rate in the global economy. The NTS are a part of human behavior, how we react and act. To adapt these skills and learn how to use them has become a part of what makes an industry, a company or a profession competitive on today's business market (C.P.M. Heath, 2000).

#### 2.2.3 Maritime

In the early 1970s at Warsash Maritime Centre, in Southampton, United Kingdom, a simulator-based training was developed and conducted for shipmasters and officers employed at a large oil company. The training was called Bridge Operations and Teamwork (Haberley, Barnett, Gatfield, Musselwhite, & McNeil, 2001) and had similar element as CRM, but was developed separately and focused mainly on passage planning and the relationship between the ships master and the pilot (Kanki et al., 2010, Chapter 12). It was not until 20 years later, in 1992, the first BRM course emerged. It was developed in a collaboration of Scandinavian Airlines

System (SAS) Flight Academy and seven major maritime industries<sup>i</sup>, with the purpose to establish a global BRM training initiative (Kanki et al., 2010, p. 319). The initiative was based on the idea that the success of implementing CRM training in the aviation industry, could be transferred to the maritime sector – this was soon proved to be correct. In June 1993 the first BRM course was launched and during the following years, the course became well established globally in the maritime industry (Kanki et al., 2010, Chapter 12). Parallel to this initiative, the Danish shipping company Mærsk implemented what they called CRM training for their crew in 1994. The implementation at Mærsk was a success and as a result of this training, incidents decreased, accident rates became lower and the company’s insurance premium went down (Byrdorf, 1998).

In 2010, IMO amended the STCW code and made it a requirement for masters and officers to obtain knowledge in bridge resource management principles. These principles are described in Chapter 2, table A-II/1 (IMO, 2011) and are:

- Allocation, assignment, and prioritization of resources
- Effective communication
- Assertiveness and leadership
- Obtaining and maintaining situational awareness
- Consideration of team experience

Considering it is now a requirement, it could be assumed that BRM training has been adjusted to fit the maritime industry. As stated by Flin, O’Connor & Crichton (2008), similarities between different domains can be expected, but it is needed to explore each domain separately to understand specific skills and behaviors needed for the operations performed in each domain. BRM training has evolved during the years, although studies show that the sector-specific adjustments have been too few (Elashkar, 2016; Fjeld et al., 2018; Hong & Kim, 2016; O’Connor, 2011; Wahl & Kongsvik, 2018). Studies also claim that we know too little about the specifics of NTS required for bridge officers today to make BRM training a perfect fit for the maritime industry (Fjeld et al., 2018; Hanzu-Pazara, Barsan, Arsesnie, Chiotoroiu, & Raicu, 2008; Håvold, 2005; O’Connor, 2011).

As BRM evolved from CRM, which went through an evolution in concept and name, BRM inspired new resource management concepts in the maritime industry with different focus groups and additional content. Two examples are Engine Resource Management (ERM) and Maritime Resource Management (MRM). ERM focuses on engine personnel and MRM is an umbrella term for all the maritime sectors (IMO, 2011, Chapter III/1; INTERTANKO, 2006). Except for BRM, this study will not cover the different maritime resource management concept as this study is limited to the participants attending a particular BRM course.

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<sup>i</sup> Collaborators with SAS Flight Academy on the initial BRM training initiative included the Dutch Maritime Pilots’ Corporation, Finnish Maritime Administration, National Maritime Administration Sweden, Norwegian Shipowners’ Association, Silja Line, the Swedish Shipowners’ Association and The Swedish Club.



### 3. Method

The primary data in this thesis consists of data collected in two online surveys. As a supplement to this primary data, information from secondary sources are used to acquire qualitative background information. Books, journal articles and reports used for this are mainly from Chalmers Library and its databases.

#### 3.1 Survey study

This survey study is based on two online questionnaires voluntarily taken by a shipping company's bridge officers. They attended a three-day BRM course at Chalmers University of Technology at various dates, between the 31<sup>st</sup> of January 2017 and the 13<sup>th</sup> of December 2018. The first questionnaire was sent to the participants before they arrived at the BRM course and the second questionnaire was sent to them on the 14<sup>th</sup> of January 2020. Essentially the questionnaires consist of 17 identical statements focusing on the officer's perception of given statements (see appendix C). The 17 statements in the questionnaires are sorted under three headings that relate to NTS, these are:

- Communication and Coordination
- Command Responsibility
- Recognition of Stress effects

The participants were to answer the statements on a Likert scale (Denscombe, 2014, p. 282) from one to five where the scale was:

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

To consider is that these questionnaires were not solely made for this bachelor thesis, they also consist of questions made by the Department of Mechanics and Maritime Science at Chalmers, to develop and evaluate the course, and for possible future research on this subject.

General weaknesses of online questionnaires are misinterpretations of statements which in the creator's perspective are well-defined, survey or questionnaire fatigue and lack of personal contact. This could lead to skewed data and a lower answer frequency (Denscombe, 2014, Chapter 11). The online surveys used in this study have no timestamp for when a questionnaire started and ended. This means a questionnaire could have been started but not finished until days later. The participants could have finished the questionnaire together with another officer, possibly changing the participants' original thoughts. These limitations are carefully considered when analyzing the results but not possible to do a statistic analysis on with the current data.

The participants should answer the statements from their perception of what the different topics concerning NTS represent. In this case, it needs to be considered that the participants may answer what they think is expected of them to answer and not what they themselves believe. This could be misleading when analyzing the result.

### 3.2 Questionnaire one

When the Department of Mechanics and Maritime Sciences at Chalmers started the collaboration with the shipping company who ordered the BRM course in 2017, the personnel involved at Chalmers started to research for a questionnaire design well established for this type of survey. Based on the studies from Baker, Krokos & Amodeo, 2008; Carter-Trahan, 2009; O'Connor, 2011; Röttger et al., 2013 and The Nautical Institute, 2014, the structure for the first questionnaire was formed. As the practical work on this bachelor thesis started the first week of November 2019, the authors of this thesis were not involved in the questionnaire's structure. Collecting data for the first questionnaire was also done by Chalmers prior to this study. That data had not been processed, cleaned or in any way used in research before this thesis.

One of the questionnaire's 6 short-answer questions had 21 missing values because of misperception while the others together had 5 missing values. For the follow-up questionnaire, the amount of short-answer questions was minimized to 3 and the question containing 21 missing values was changed to explicate it and hopefully avoid misunderstanding in questionnaire two.

### 3.3 Questionnaire two

In addition to the 17 statements from the first questionnaire, 6 statements and 2 questions were added (see appendix B). These additions were added to provide the authors with the officers' rank, how many BRM courses they have taken in the past and to receive the participants' opinion on wherever they thought, they gained a better understanding of the different NTS the BRM course covered. As this survey was sent to the participants' email 152 weeks (2 years and 11 months) after the first course took place, the answer frequency was not expected to be as high as on the first survey. To consider were that officers could have retired, changed company, did not want to answer or did not have access to their email. If they did want to answer but had retired or changed employer, this was added as an option under the heading Current position at [Name of the shipping company]. If they checked the box for Change Company, the data was marked as invalid as this survey is to contain participants employed at the shipping company collaborating with Chalmers.

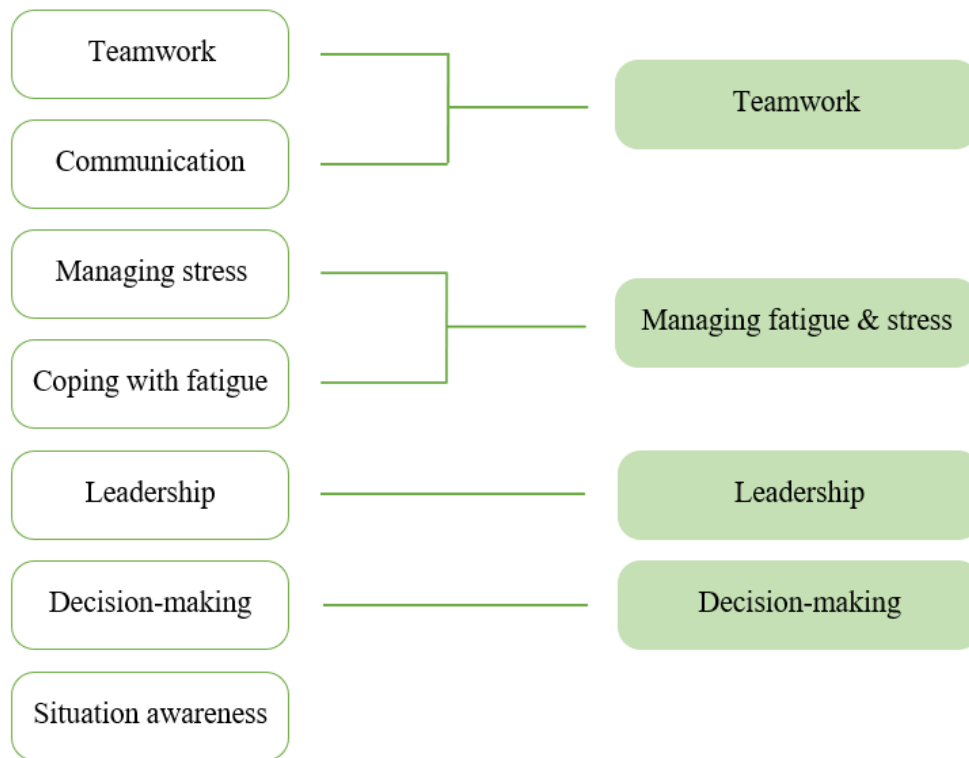
### 3.4 Recategorization of NTS-groups

The questionnaires' headings, as well as placing the statements under each heading were done by Chalmers. For the angle this thesis has chosen, the statements had to be recategorized into new categories more defined in NTS research. No statements covering the skill Situation awareness were included in the questionnaires, hence this NTS category will not be used in this study.

To make this study comparable to other studies covering this topic, it was necessary to reformat the three main headings from the questionnaires, i.e. Communication and Coordination, Command Responsibility and Recognition of Stress effects, into new groups similar to the ones defined by research as NTS. Different studies researching NTS use the definition from *Safety at the sharp end* (Flin et al., 2008). The questionnaires' statements were analyzed and compared to the definition of NTS and recategorized into new groups. Some of the statements include more than one NTS. In those statements, it is not known which NTS the participant based the answer on. To avoid misleading results, skills stated together stayed together when recategorizing them. From this process, four groups came together, two the same as defined by Flin, O'Connor, & Crichton (2008) and two combined groups:

**Categories defined by Flin et al. (2008)**

**NTS categories used in this study**



*Figure 3.1: Illustration of the seven NTS groups and how they are categorized into four new groups used in this study.*

As pictured in Figure 3.1, the two new categories are called Managing fatigue & stress and Teamwork. These new groups each consists of two sets of skills from Flin et al. (2008): Managing stress, Coping with fatigue, Communication and Teamwork. Communication and Teamwork have previously been combined in other studies, e.g., in *Basic concepts for crew resource management and non-technical skills* by Flin and Maran (2015) where six NTS were used instead of seven. They include communication in teamwork, defined as ‘the team skills relate to effective communication, task coordination, supporting other team members, negotiating and resolving conflicts.’ (Flin & Maran, 2015, p. 4).

To determine which statement was to be sorted into which new group, the statements were analyzed and compared to the four new groups described above. The motivation for this sorting can be found in Appendix D.

*Table 3.1: Statements (no. 1 – 17) from the questionnaires sorted into the new Non-Technical Skills categories.*

<b>Non-Technical Skills</b>	<b>Statement number</b>
Teamwork	1, 3, 4, 5, 7, 8, 9, 10, 15
Managing fatigue & stress	2, 6, 14, 16
Leadership	11, 12, 13
Decision-making	17

## 3.5 Managing the data

### 3.5.1 Processing the data

When the second questionnaire had been distributed, the data from the first questionnaire was processed. First, the collected data had to be cleaned, i.e. data cleaning which means correction or removal of erroneous data (Elgabry, 2019). These errors were mostly caused by misinterpretation of a question, or answers to short-answer questions provided in text instead of numbers e.g., in the question Number of years served at sea (see Appendix F).

As the questionnaires were sent to all of the 228 officers participating in the BRM course, no sampling was made and the collected data were treated as a census study (Australian Bureau of Statistics, 2013).

When the data had been cleaned it was inserted into Microsoft® Excel® for Office 365, version 1902. Excel was used to calculate the frequency distribution, range, mode, median, mean, standard deviation and coefficient of variation. Once the deadline to respond to questionnaire two had passed, the process from the first questionnaire was repeated to make the two questionnaires' values comparable.

When all data had been gathered, a t-Test was performed using Microsoft® Excel®. Performing a t-Test which is a parametric test, on ordinal data which is non-parametric; is not mathematically correct. Hence, it is considered an accepted method to use as a parametric test is likely to show a significant effect (Fagerland, 2012). As no respondent tracking was done, the number of responses from the two questionnaires were not equal and because the standard deviation differs between the individual statements in questionnaire one and two; a *t-Test: Two Sample Assuming Unequal Variance* was carried out. One t-Test was performed for each statement, and in the input box [Variable 1 Range] the 123 valid answers from questionnaire one were inserted, and the 65 valid answers from questionnaire two were put into the input box [Variable 2 Range]. This gives each statement its own p-value, presented in Table 4.7.

### 3.5.2 Presentation of data

When the data from the two questionnaires had been processed, it was inserted into tables and charts to present the outcome. Figures 4.1, 4.2, 4.3, 4.4 and 4.5 presents the differences between questionnaire one and two using the median, for it is considered to be a representative value for charts showing results from a Likert scale (McLeod, 2019). To make a more definitive difference between the changes of questionnaire one and two a third value was added to the charts: the optimal tendency. This was done to make the questionnaire's results more interpretable, to show if the result from the second questionnaire was moving towards the optimal tendency values, i.e. the direction showing greater knowledge of NTS and resource management. The optimal tendency values were provided by the authors together with the BRM course coordinator and supervisor of this thesis, Lars Axvi. Note that these values are extreme answers, i.e. not always what we expect the participants to answer.

## 3.6 Ethics

The participants have in the questionnaires submitted their approval, on the basis that they are anonymous and the data integrity is conformed to the GDPR regulations (European Union, 2018). To protect the participants' privacy, the authors of this bachelor thesis do not know any personal information since the contact information was edited out by Chalmers before given to the authors. The shipping company where the bridge officers participating were employed during this time will not be named to not compromise their integrity.

## 4. Results

In this chapter, the result from the two questionnaires will be presented. Information about data concerning valid participants, missing values and the t-Test will be explained. Tables containing response data are presented and, in the end, charts comparing these responses in different contexts.

### 4.1 Response rate

The first questionnaire received 124 responses, of those, one person answered the questionnaire twice and the number of valid responses was reduced to 123. When the result was processed and cleaned 26 values were marked as erroneous or missing. The invalid values were in the short-answer questions. The responses to the short-answer questions used in both questionnaires one and two are not processed or included as results in this study (but are available for future research). Conclusively, the 123 valid responses could be used for the result.

The second questionnaire received 72 responses and out of those, 3 were persons answering twice, providing 69 valid responses. 4 of those 69 participants checked the box for [Changed company] in the questionnaire, making their data invalid for this study. Conclusively, the second questionnaire had 65 valid responses, containing no erroneous values.

The response rate was as expected lower on the second questionnaire, 29%  $\left(\left(\frac{65}{228}\right) * 100\right)$  in comparison to the first questionnaire which had a 54% response rate  $\left(\left(\frac{123}{228}\right) * 100\right)$ .

### 4.2 Missing values

As described in chapter 3.2, the second questionnaire's short-answer questions were edited, with the purpose to explicate the questions and by that decrease erroneous values. In Table 4.2 the result from these modifications is presented. Table 4.1 presents one column with the short-answer questions from the first questionnaire with the number of erroneous values in the other. Each short-answer question is presented with its erroneous values. Table 4.2 is structured in the same way as 4.1. The results, looking at the different erroneous values shows how important it is to be explicit and what is obvious for one person is undecipherable for others.

*Table 4.1: Contains data showing the amount of erroneous values from the short-answer questions in questionnaire one.*

<i>Questionnaire one</i>	
<b>Short-answer questions</b>	<b>Amount of erroneous values</b>
Years Serving at Sea	3
Years Serving at [Company]	1
Years at Current [Company] Position	21
Name of [Company] vessel	1

*Table 4.2: Contains data showing the amount of erroneous values from the short-answer questions in questionnaire two.*

<i>Questionnaire two</i>	
<b>Short-answer questions</b>	<b>Amount of erroneous values</b>
Years Serving at Sea	0
Years Serving at [Company]	0
Number of years at current position in [Company]	0

#### 4.3 Questionnaire one

*Table 4.3: Presenting data from the first questionnaire. A frequency table of the statements with a Likert scale showing how many participants answered 1, 2, 3, 4 or 5. It is followed by mode, median, mean, standard deviation and coefficient of variation and range.*

Statements #	Likert scale					Central tendencies			Variability		
	1	2	3	4	5	Mode	Median	Mean	S.D.	C.V.(%)	Range
1	1	5	17	54	46	4	4	4,130	0,859	21	4
2	1	1	18	50	53	5	4	4,244	0,793	19	4
3	2	1	2	27	91	5	5	4,659	0,711	15	4
4	6	13	29	48	27	4	4	3,626	1,089	30	4
5	2	0	7	40	74	5	5	4,496	0,751	17	4
6	2	2	9	53	57	5	4	4,309	0,811	19	4
7	3	3	19	43	55	5	4	4,171	0,947	23	4
8	1	2	15	44	61	5	4	4,317	0,813	19	4
9	1	1	10	33	78	5	5	4,512	0,751	17	4
10	2	2	26	49	44	4	4	4,065	0,885	22	4
11	7	13	43	28	32	3	3	3,528	1,155	33	4
12	15	38	32	27	11	2	3	2,846	1,167	41	4
13	28	32	30	18	15	2	3	2,675	1,309	49	4
14	25	33	37	24	4	3	3	2,585	1,116	43	4
15	15	34	39	30	5	3	3	2,805	1,069	38	4
16	13	25	41	35	9	3	3	3,016	1,101	37	4
17	11	22	41	37	12	3	3	3,138	1,104	35	4

#### 4.4 Questionnaire two

*Table 4.4: Presenting data from the second questionnaire. A frequency table of the statements with a Likert scale showing how many participants answered 1, 2, 3, 4 or 5. It is followed by mode, median, mean, standard deviation, coefficient of variation and range.*

Statements #	Likert scale					Central tendencies			Variability		
	1	2	3	4	5	Mode	Median	Mean	S.D.	C.V.(%)	Range
1	1	6	8	25	25	4	4	4,031	1,015	25	4
2	1	0	3	29	32	5	4	4,400	0,725	16	4
3	0	0	3	18	44	5	5	4,631	0,575	12	2
4	4	5	14	26	16	4	4	3,692	1,117	30	4
5	0	0	4	13	48	5	5	4,677	0,589	13	2
6	1	0	4	31	29	4	4	4,338	0,735	17	4
7	0	0	12	26	27	5	4	4,231	0,745	18	2
8	0	1	9	22	33	5	5	4,338	0,776	18	3
9	0	0	5	26	34	5	5	4,446	0,638	14	2
10	1	1	10	34	19	4	4	4,062	0,808	20	4
11	2	10	18	17	18	5	4	3,600	1,143	32	4
12	16	19	12	14	4	2	2	2,554	1,250	49	4
13	16	15	19	10	5	3	3	2,585	1,236	48	4
14	15	22	16	12	0	2	2	2,385	1,041	44	4
15	5	30	16	12	2	2	2	2,631	0,977	37	4
16	7	19	20	14	5	4	4	4,031	0,977	34	4
17	5	15	12	25	8	5	4	4,400	1,173	36	4

## 4.5 Trends

### 4.5.1 Central tendencies

*Table 4.5: Comparison of the central tendencies from the two questionnaires, comparing mode, median and mean.*

Statements #	Questionnaire one			Questionnaire two		
	Mode	Median	Mean	Mode	Median	Mean
<b>1</b>	4	4	4,130	4	4	4,031
<b>2</b>	5	4	4,244	5	4	4,400
<b>3</b>	5	5	4,659	5	5	4,631
<b>4</b>	4	4	3,626	4	4	3,692
<b>5</b>	5	5	4,496	5	5	4,677
<b>6</b>	5	4	4,309	4	4	4,338
<b>7</b>	5	4	4,171	5	4	4,231
<b>8</b>	5	4	4,317	5	5	4,338
<b>9</b>	5	5	4,512	5	5	4,446
<b>10</b>	4	4	4,065	4	4	4,062
<b>11</b>	3	3	3,528	5	4	3,600
<b>12</b>	2	3	2,846	2	2	2,554
<b>13</b>	2	3	2,675	3	3	2,585
<b>14</b>	3	3	2,585	2	2	2,385
<b>15</b>	3	3	2,805	2	2	2,631
<b>16</b>	3	3	3,016	3	3	2,862
<b>17</b>	3	3	3,138	4	4	3,246

### 4.5.2 Trends in NTS categories

This chapter contains subchapters for each NTS category, with every subchapter presenting a graph. Each graph shows the median for each statement in that category from questionnaires one, two and the optimal trend. For each statement the median from the first questionnaire is presented to the far left, the median from the second questionnaire is presented to the far right and the optimal tendency in the middle.

#### 4.5.2.1 Teamwork

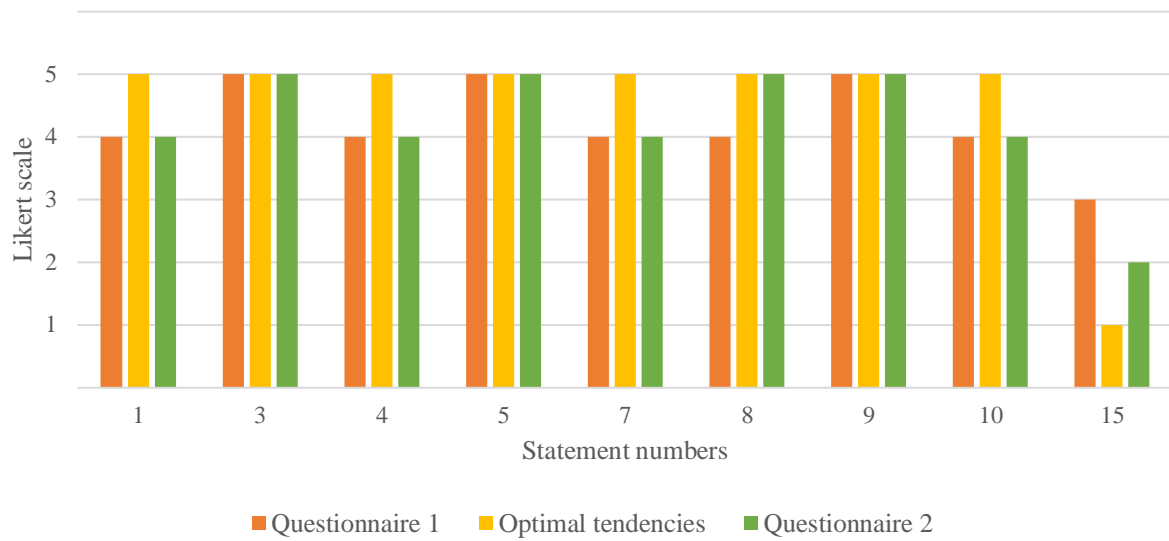


Figure 4.1: The bar chart shows the median from questionnaires one and two with the optimal trend in the middle. The Y-axis represents the Likert scale (1 – 5) and X-axis represents the statements included in Teamwork (1, 3, 4, 5, 7, 8, 9, 10 and 15).

#### 4.5.2.2 Managing fatigue & stress

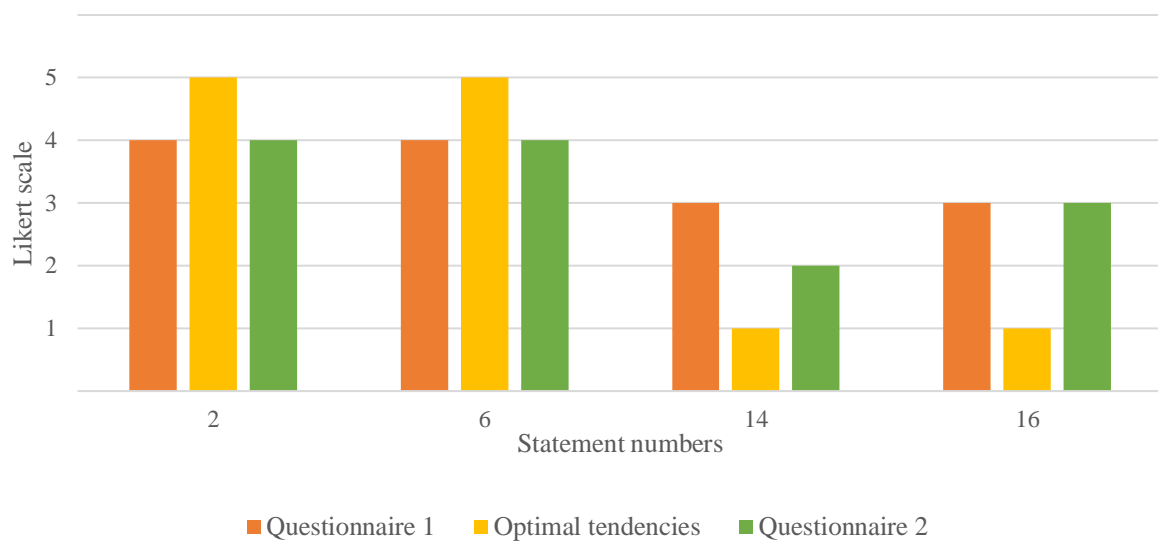


Figure 4.2: The bar chart shows the median from questionnaire one and two with the optimal trend in the middle. The Y-axis represents the Likert scale (1 – 5) and X-axis represents the statements included in Managing fatigue & stress (2, 6, 14 and 16).



#### 4.5.2.3 Leadership

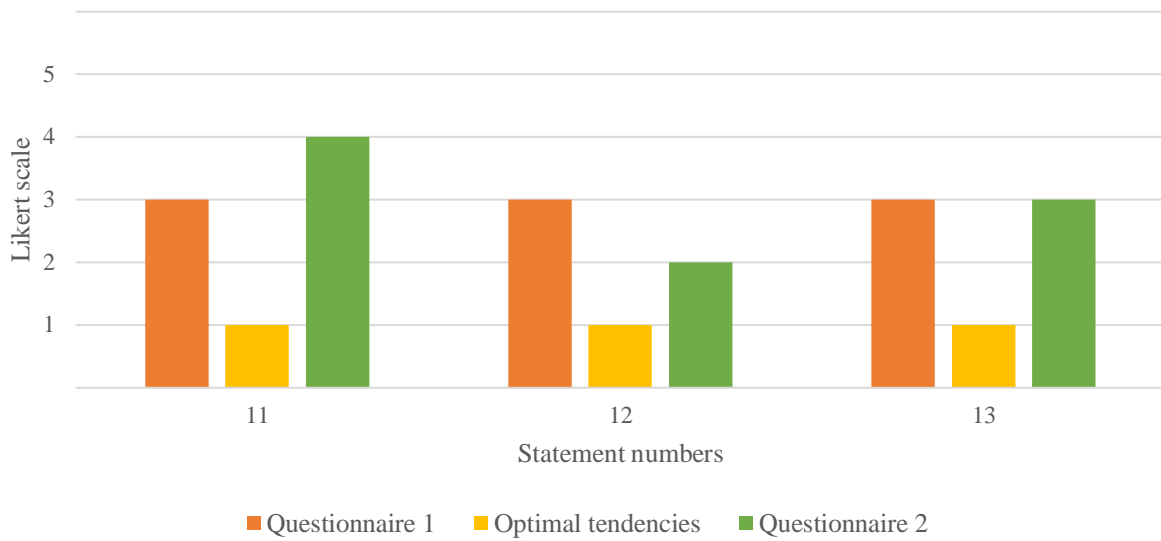


Figure 4.3: The bar chart shows the median from questionnaire one and two with the optimal trend in the middle. The Y-axis represents the Likert scale (1 – 5) and X-axis represents the statements included in Leadership (11, 12 and 13).

#### 4.5.2.4 Decision-making

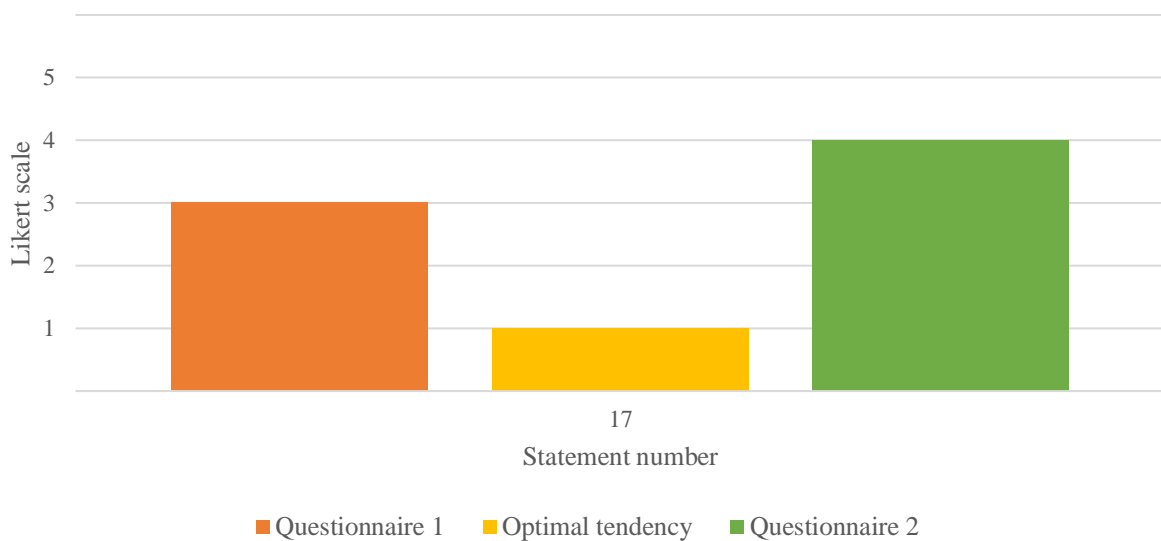


Figure 4.4: The bar chart shows the median from questionnaire one and two with the optimal trend in the middle. The Y-axis represents the Likert scale (1 – 5) and X-axis represents the statement included in Decision-making (17).

### 4.5.3 Trend overview

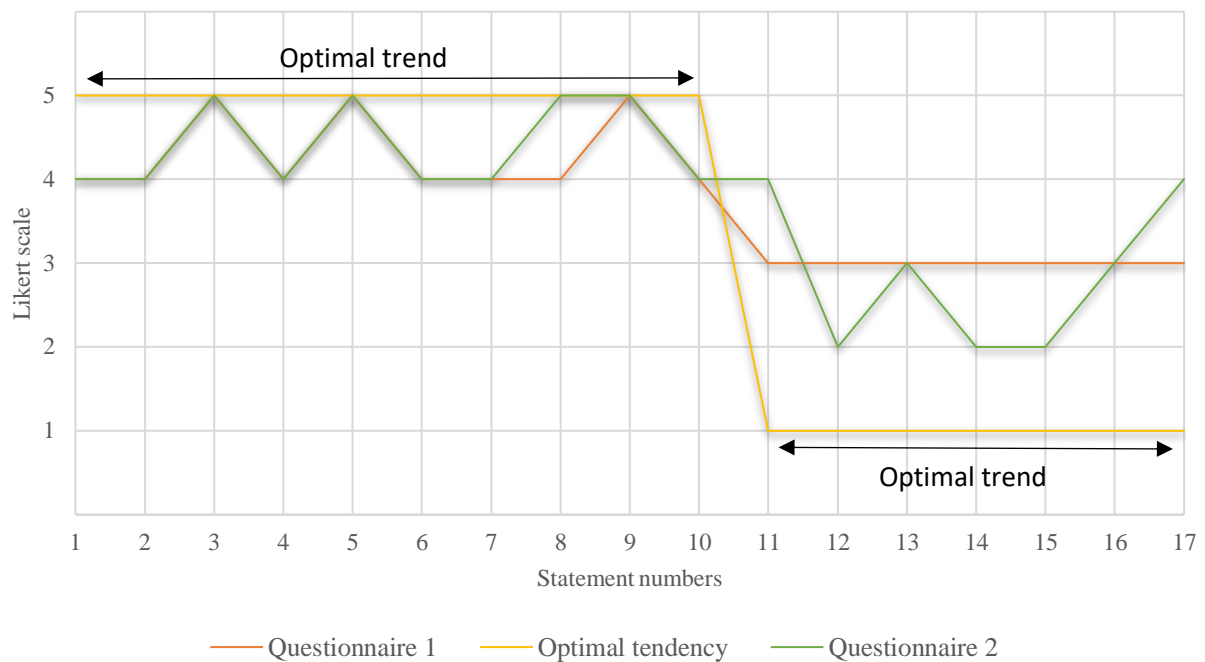


Figure 4.5: The Scatter plot presents an overview of the medians from the two questionnaires. The Y-axis represents the Likert scale (1 – 5) and X-axis represents the 17 statements. Optimal trend is added to the chart for an easier interpretation of how the different trends look when comparing questionnaire one and two.

### 4.6 Result of summarizing questions

Table 4.6: Presenting data from Section 6 summarizing questions, in the second questionnaire. A frequency table with the Likert scale showing how many participants answered 1, 2, 3, 4 or 5, followed by mode, median and mean.

Summarizing questions	Likert scale					Central tendencies		
	1	2	3	4	5	Mode	Median	Mean
<b>I gained a better understanding of:</b>								
<b>Bridge Management</b>	1	1	13	34	16	4	4	4,0
<b>Teamwork</b>	1	3	14	37	10	4	4	3,8
<b>Leadership</b>	2	4	21	28	10	4	4	3,6
<b>Decision-making</b>	1	4	16	27	17	4	4	3,8
<b>Managing fatigue &amp; stress</b>	1	2	16	33	13	4	4	3,8

#### 4.7 t-Test and p-value

Table 4.7: This shows the mean for each statement from questionnaire one (Q1) and two (Q2), the  $t$  Stat and  $\rho_{2-tail}$ . The values are extracted from the performed t-Test and sorted after the different NTS categories. The negative number in  $t$  Stat indicates increased response values i.e. higher Likert scale answers in Q2. Regarding statement 1 – 10 this is a positive trend, it indicates the responses are going towards the optimal tendency; alas, this is not a positive trend for statement 11 – 17. On statement 11 – 17, the optimal tendency is low numbers on the Likert scale i.e. smaller or equal to 2. This is misleading looking at the table for a quick overview of the results. The  $p$ -value, represented by  $\rho$  ( $\rho$ ), indicates weak or strong evidence against the null hypothesis. As a reference-value for  $p$  0,05 is used to reject or confirm the null hypothesis; the closer to zero the  $p$  is, the stronger the evidence against the null hypothesis.

NTS categories	Statements	Mean Q1	Mean Q2	t Stat	$\rho_{2-tail}$
<b>Teamwork</b>	1	4,130	4,031	0,672	0,503
	3	4,659	4,631	0,289	0,772
	4	3,626	3,692	-0,390	0,697
	5	4,496	4,677	-1,817	0,071
	7	4,171	4,231	-0,477	0,634
	8	4,317	4,338	-0,177	0,860
	9	4,512	4,446	0,634	0,527
	10	4,065	4,062	0,027	0,978
	15	2,805	2,631	1,124	0,263
<b>Managing fatigue &amp; stress</b>	2	4,244	4,400	-1,395	0,176
	6	4,309	4,338	-0,253	0,801
	14	2,585	2,385	1,226	0,222
	16	3,016	2,862	0,908	0,366
<b>Leadership</b>	11	3,528	3,600	-0,407	0,685
	12	2,846	2,554	1,556	0,122
	13	2,675	2,585	0,466	0,642
<b>Decision-making</b>	17	3,138	3,246	-0,612	0,541

For more detailed information about the t-Test and p-values see Appendix G.

## 5. Discussion

The result shows that there is no significant difference between questionnaire one and two. However, positive changes from questionnaire two can be seen together with unchanged values and values moving away from the optimal trend. These different trends will be discussed in this chapter in relation to the method and other, aforementioned studies. Following, the method will be analyzed, sources of error and suggestions for future research will be discussed.

### 5.1 Tendencies and variances

In Figure 4.1, presenting the results from Teamwork, the bars from questionnaire one (Q1) and questionnaire two (Q2) remains the same except from two statements, that had a positive development, i.e. values moving towards its optimal value. Managing fatigue & stress (Figure 4.2) had one statement moving towards its optimal value whilst the others stayed the same. Figure 4.3, Leadership, also had one statement moving away from its optimal value and one statement with a positive development. Last is the category of Decision-making (Figure 4.4), its statement's bar from Q2 moved away from its optimal value.

Conclusively, there are four positive developments and two statements moving away from its optimal value. The last-mentioned do not necessarily need to be negative developments due to different reasons, e.g., the participants' current mindset when answering Q2 or the response rate.

Looking at the response rate for the second questionnaire, it was lower than in the first as expected (see chapter 3.3). The participants did not receive access to the questionnaire on the planned date, the 16<sup>th</sup> of December 2019 but 4 weeks later, due to administrative problem at the shipping company combined with the Christmas holidays. This might have made the response rate even lower than first expected. Regardless, the answering frequency was more than half of the first questionnaire (see chapter 4.1). If questionnaire two had been provided to the participants at the planned date, the results could possibly have been different. It is unknown what effect the late launch of questionnaire two have had on the results. Had it been sent on time the answering frequency might have been higher and the result different. If that difference is a negative, positive or unchanged trend is not possible to know.

Another interesting variance is the range, presented in the frequency tables (Table 4.3 and 4.4), where a change can be seen between the two questionnaires. In the first questionnaire, a range of 4 was found in all the statements, i.e. scale values 1 – 5 were represented in all the statements. In the second questionnaire, 12 of the 17 statements maintained a range of 4, 1 statement decreased to the range of 3 and the remaining 4 statements decreased to the range of 2. This means that in the second questionnaire the responses were more alike i.e. centered around the median, which can be seen as a positive change. This can e.g., be due to a progression from attending the BRM course or because of the lower respondent rate in the second questionnaire.

### 5.2 BRM as a resource

When comparing the two data sets, the data from the first questionnaire could be considered good, i.e. close to the optimal trend. This could mean that the officers who attended the course, overall had a good attitude towards NTS before the course and therefore no significant difference is seen in the second questionnaire. What is unknown, is if the course reinforced their attitudes. Possibly, their attitudes decrease over time and taking BRM courses regularly should, therefore, be seen as a reinforcement to keep up the attitude.

Another explanation for unchanged trends could be the structure of the survey. Displayed in the result, Table 4.6, are the central tendencies of the evaluation statements. All of the evaluation statements have a value of 4 in both median and mode, meaning that the officers agree that taking this BRM course has increased their knowledge in this area. This might be seen as contradictive when looking at the results since the results show no significant difference. This phenomenon has been discovered in other studies, e.g., a study from Röttger, Vetter & Kowalski (2016), where they concluded that the training was positively perceived and considered useful by the attendees, but it did not bring a significant gain in resource management knowledge. This phenomenon could have different explanations; one might be that the type of survey used in this study is not suitable. Perhaps, the participants have changed their attitude, but the questionnaires cannot pinpoint that change.

To investigate if a significant difference between the two questionnaires' responses existed, a t-Test was conducted (see method, chapter 3.5.1). The result of the test is presented in Table 4.7, and as seen there, the p-values are considered high numbers. Normally 0.05 is considered to be the limit when deciding if the null hypothesis can be denied or not. The closer to 1 the p-value is, the bigger the chance, the null hypothesis is verified. The p-values presented in Table 4.7 are high in relation to 0.05 but the three statements 2, 5, and 12, are presented with a p-value between 0.07 and 0.18 which in this study can be considered low. Each statement belongs to one separate NTS category (Teamwork, Managing fatigue & stress and Leadership). Even if this study set a limit for the p-value at 0.2, only three of the statements could be identified with a significant difference. Therefore, no specific NTS group can be pinpointed as extra learnable or considered more important to the participants.

In chapter 1.3, five hypotheses are presented, one for each NTS category and one general for BRM. To verify these five hypotheses or reject their null hypothesis; a statistic significance must be found. In this study, the p-value shows weak evidence to reject all the five null hypotheses.

### 5.3 Method analysis

The literature search was done in advance before questionnaire two was edited to make sure the authors had a deepened knowledge on the subject of NTS and BRM. Finding research papers and articles studying the keywords NTS and BRM was not hard, but it took time to review all material and be critical towards the information, to sift out and use well-established information. In the beginning, the authors researched the basics of NTS together to make sure a common picture was established and had a shared mental picture of the subject. After that, the authors divided the topics to specialize in different areas, this saved of course time but was also efficient.

As online questionnaires were used, no in-person contact occurred between the authors and the participants. Face to face contact would have given the participants the opportunity to ask questions about the statements presented, clarify uncertainties and for the interviewer to ask the participant why they answered a certain number on a statement. In-person contact, either meeting participants on their vessel or at shore, could have provided a more genuine response as they would not have been able to discuss the statements with other crew members.

In the online questionnaires the answering method, the Likert scale, leaves no space for the participants to elaborate their answers. If the option to elaborate had been added it could have provided an insight in if the answer comes from the attendants' fundamental values, are based on a situation they encountered, or if they have been drilled to think a specific way working on

the same bridge for a long time. With this option, they still would have had the opportunity to discuss their answers with other crew members in contrast to in-person interviews. To prolong the questionnaire would have increased the possibility of questionnaire fatigue which could have led to fewer responses. It is hard to know what would have been the optimal combination or concept of the structure of the questionnaire, but for future research, a combination of a simple structured questionnaire and in-person interviews might give a deeper understanding of the results.

### 5.3.1 Limitation of findings

The follow-up questionnaire was sent out to every participant 152 weeks after the first course took place, because of this it is hard to be certain that a change of trend in the answers solely depends on the officers' attendance at the BRM course. For the first group that attended the BRM course in January 2017, it is 2 years and 11 months between the course and the second questionnaire. This study cannot determine if a trend change is a cause of new procedures, follow-up work taking place after the course or new demands from the office, captain or charterer. A change of trends could also be because of an emergency or other extreme situation, looking at the Tree model (Figure 2.1) the situation could have affected an individual's attitude or behavior, but the effect will wear off. A lot could have happened during the period of two to three years.

The part of the method where the second questionnaire was sent to the participants, was not possible to carry out differently in the aspect of sending the participants the questionnaire earlier. The authors discussed the possibility and the effect it could have had on the result if the follow-up questionnaire was sent to the participants in intervals. When a group of participants has finished their three-day BRM course a chosen amount of time will pass e.g., two months and then the questionnaire is sent to only that group. This is repeated for every group attending the BRM course.

To consider, because of the limitations, is that the result of this study is not applicable on the whole maritime industry. It does not show if there is a difference between maritime divisions or companies. It is, however, an interesting approach, to investigate the needs in different divisions and companies to possibly study why the result might differ or between which topics it might correlate. The result is also limited to the BRM course, which is authorized by IMO, but since it is not a model course, the instructors create the layout of the course themselves. Therefore, the result could have differed if the same officers took the BRM course at another facility providing it with other instructors with a different layout.

During the time the authors worked with this thesis, researching and discussing, an interesting approach came to light. Different perspectives to consider when measuring the attitude change are culture, ethnicity, age, education, rank, sex or organization and is something that could be researched in the future. This study could only investigate the officers as one census group but a different research question and editing the questionnaires using this method could e.g., make it possible to study the influence education or culture has on an individual's attitude towards NTS.

## 6. Conclusion

The purpose of this thesis was to analyze if a three-day BRM course could impose a change in bridge officers' attitude towards NTS. Looking at the result, the course did not impose a significant change in bridge officers' attitude towards NTS. Regardless of this, the BRM course itself cannot be considered unnecessary due to three reasons.

1. Looking at the results from questionnaire one, the officers show they possessed good knowledge and had a good attitude towards NTS to begin with. The results from questionnaire two, however, present a small but insignificant improvement and the course could, conclusively, be seen as a reinforcement to maintain the standard of NTS knowledge.
2. A phenomenon detected by other studies is that officers who attended a BRM course expressed they gained knowledge, but no learning outcome could be measured. This thesis's evaluation questions, together with the trend results from the NTS categories, confirm this phenomenon. As the participants clearly experience that they gained knowledge after attending the course, it cannot be pronounced as unnecessary.
3. Looking at the origin of BRM, CRM has had an evolution customizing it to fit the aviation industry and the same applies to BRM. Comparing today's concept and structure of BRM with the current generation of CRM, BRM courses are not as efficient. This is shown by the results of the CRM courses' evaluation, which presents a greater, measurable learning outcome. Some argue this is because the BRM course has not been customized enough to fit the needs of the maritime sector and looking at this survey's results, nothing can conclusively prove the opposite.

### 6.1 Recommendations for future research

Here three distinct recommendations for future research will be presented, each connected to the three subjects presented above.

1. To better understand BRM as a reinforcement, future studies could address the possibility to implement an introduction course followed by a refresh course. For officers and masters to keep their license they are obligated to renew other certificates concerning safety with a refresh course on a regular basis. This could be applied as: 'BRM Basic' as an introduction course and 'BRM Refresh' as a follow-up course. This could help maintain the standard of NTS knowledge, and be an interesting approach; to see if it is applicable to refresh the certificate given when attending a BRM course.
2. To better understand this phenomenon further research could address this subject by looking at the research method. Why has not previous methods been able to intercept this phenomenon? Perhaps an entirely new method needs to be applied to this type of research to detect the underlying cause.
3. Further research is needed to determine the next step in developing the next generation of BRM training, to customize it to become an even better fit for the maritime industry. If it is possible to adapt the training even more, maybe BRM courses will present a greater, measurable learning outcome.



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## Appendix

### Appendix A – Questionnaire one

#### Section 1

##### **Bridge Resource Management Course Survey**

Thank you for volunteering to be a participant in this questionnaire as a follow-up to the Bridge Resource Management Course. You will be asked to answer a number of questions.

Your responses will only be used for academic-related documentation. Recorded data will be separated from your identity; at no time now, nor in the future, will any information you provide be published that allows you as an individual to be identified by any parties.

We certify to treat collected data according to best ethical practice and rules. All your answers are protected by the Public Access to Information and Secrecy Act [24 kap 8 § (2009:400)] and the Personal Data Act (1998:204). Chalmers University of Technology is responsibility for all personal data. Your participation in this data collection is voluntarily and you have the right to withdraw from the study at any time without having to give any explanation; in this case your data will be deleted.

Definitions:

Crew member is any person on board having duties within the ship's safety organization.

Bridge team member is any person fulfilling duties on the bridge alongside, at anchor or at sea.

\* Required

##### **Contact for this study**

If you have any questions or comments concerning this study, you can ask the session leader or contact the person responsible for the study:

First name Surname

Address:

Phone:

Email:

##### **Agreement\***

You need to agree to participate in order to proceed in this study. If you don't agree, please close this window.

I "agree to participate" in this study

## Section 2

### Demographics

Name\*

(Short answer text)

Email address\*

(Short answer text)

Sex\*

Male

Female

Name of vessel\*

(Short answer text)

Highest Certificate\*

(Short answer text)

Years at current position in [Company]\*

(Short answer text)

Years serving at [Company]\*

(Short answer text)

Years serving at sea\*

(Short answer text)

### Section 3

#### Communication and Coordination

The following statements focus on communication and coordination. Please click the number that best reflects your agreement with each statement listed below.

##### Criteria

- 1 – Strongly disagree
- 2 – disagree
- 3 – neither agree nor disagree
- 4 – agree
- 5 – strongly agree

Crew members should feel obligated to mention their own psychological stress or physical problems to other bridge team members before or during the watch.\*  
(Linear scale 1 to 5)

Each crew member should monitor other crew members for signs of stress or fatigue and should discuss the situation with the crew member.\*  
(Linear scale 1 to 5)

Good communications and crew coordination are as important as technical proficiency for the safety of seafaring.\*  
(Linear scale 1 to 5)

All crew members should be aware of and sensitive to the personal problems of other crew members.\*  
(Linear scale 1 to 5)

The officer of the watch should verbalize plans for procedures or maneuvers and should be sure that the information is understood and acknowledged by the other crew members.\*  
(Linear scale 1 to 5)

Crew members should alert others to their actual or potential work overloads.\*  
(Linear scale 1 to 5)

Officers should encourage crew members to question procedures during normal operations and emergencies.\*  
(Linear scale 1 to 5)

A debriefing and critique of procedures and decisions after a maneuver is an important part of developing and maintaining effective crew coordination.\*  
(Linear scale 1 to 5)

Briefings are important for safety and for effective crew coordination.\*  
(Linear scale 1 to 5)

Effective crew coordination requires crew members to take into account the personalities of other crew members.\*  
(Linear scale 1 to 5)

## Section 4

### Command responsibility

The following statements focus on Command Responsibility. Please click the number that best reflects your agreement with each statement listed below.

#### Criteria

- 1 – Strongly disagree
- 2 – disagree
- 3 – neither agree nor disagree
- 4 – agree
- 5 – strongly agree

In emergencies and nonstandard situations, the master should directly command this situation himself or herself.\*

(Linear scale 1 to 5)

Crew members should not question the decisions or actions of the master except when they threaten the safety of the ship.\*

(Linear scale 1 to 5)

Overall, successful bridge management is primarily a function of the master's nautical proficiency.\*

(Linear scale 1 to 5)

## Section 5

### Recognition of stressor effects

The following statements focus on stress. Please click the number that best reflects your agreement with each statement listed below.

#### Criteria

- 1 – Strongly disagree
- 2 – disagree
- 3 – neither agree nor disagree
- 4 – agree
- 5 – strongly agree

Even when fatigued, I perform my duties effectively.\*

(Linear scale 1 to 5)

My performance is not adversely affected by working with an inexperienced or less capable crew member.\*

(Linear scale 1 to 5)

A truly professional crew member can leave personal problems behind during the watch.\*

(Linear scale 1 to 5)

My decision-making ability is as good in emergencies as in routine situations.\*

(Linear scale 1 to 5)

## Section 1

### Bridge Resource Management Course Survey

Thank you for volunteering to be a participant in this questionnaire as a follow-up to the Bridge Resource Management Course. You will be asked to answer a number of questions.

Your responses will only be used for academic-related documentation. Recorded data will be separated from your identity; at no time now, nor in the future, will any information you provide be published that allows you as an individual to be identified by any parties.

We certify to treat collected data according to best ethical practice and rules. All your answers are protected by the Public Access to Information and Secrecy Act [24 kap [sic] 8 § (2009:400)] and the Personal Data Act (1998:204). Chalmers University of Technology is responsibility for all personal data. Your participation in this data collection is voluntarily and you have the right to withdraw from the study at any time without having to give any explanation; in this case your data will be deleted.

Definitions:

Crew member is any person on board having duties within the ship's safety organization.

Bridge team member is any person fulfilling duties on the bridge alongside, at anchor or at sea.

\* Required

### Contact for this study

If you have any questions or comments concerning this study, you can ask the session leader or contact the person responsible for the study:

First name Surname

Address:

Phone:

Email:

### Agreement\*

You need to agree to participate in order to proceed in this study. If you don't agree, please close this window.

I "agree to participate" in this study



## Section 2

### Demographics

Name\*

(Short answer text)

Email address\*

(Short answer text)

Sex\*

Male

Female

Name of vessel\*

Shore-based

No vessel

Currently working on another company's vessel

Checkbox answers with all the participating vessel

Highest Certificate\*

(Short answer text)

Current position\*

Retired

Master

Chief Officer

2nd Officer

3rd Officer

Number of years at current position in [Company]\*

(Short answer text)

Years serving at [Company]\*

(Short answer text)

Years serving at sea\*

(Short answer text)

How many BRM courses have you taken in your career?\*

0

1

2

3

4

5

More than 5

## Section 3

### Communication and Coordination

The following statements focus on communication and coordination. Please click the number that best reflects your agreement with each statement listed below.

#### Criteria

- 1 – Strongly disagree
- 2 – disagree
- 3 – neither agree nor disagree
- 4 – agree
- 5 – strongly agree

Crew members should feel obligated to mention their own psychological stress or physical problems to other bridge team members before or during the watch.\*  
(Linear scale 1 to 5)

Each crew member should monitor other crew members for signs of stress or fatigue and should discuss the situation with the crew member.\*  
(Linear scale 1 to 5)

Good communications and crew coordination are as important as technical proficiency for the safety of seafaring.\*  
(Linear scale 1 to 5)

All crew members should be aware of and sensitive to the personal problems of other crew members.\*  
(Linear scale 1 to 5)

The officer of the watch should verbalize plans for procedures or maneuvers and should be sure that the information is understood and acknowledged by the other crew members.\*  
(Linear scale 1 to 5)

Crew members should alert others to their actual or potential work overloads.\*  
(Linear scale 1 to 5)

Officers should encourage crew members to question procedures during normal operations and emergencies.\*  
(Linear scale 1 to 5)

A debriefing and critique of procedures and decisions after a maneuver is an important part of developing and maintaining effective crew coordination.\*  
(Linear scale 1 to 5)

Briefings are important for safety and for effective crew coordination.\*  
(Linear scale 1 to 5)

Effective crew coordination requires crew members to take into account the personalities of other crew members.\*  
(Linear scale 1 to 5)

## Section 4

### Command responsibility

The following statements focus on Command Responsibility. Please click the number that best reflects your agreement with each statement listed below.

#### Criteria

- 1 – Strongly disagree
- 2 – disagree
- 3 – neither agree nor disagree
- 4 – agree
- 5 – strongly agree

In emergencies and nonstandard situations, the master should directly command this situation himself or herself.\*

(Linear scale 1 to 5)

Crew members should not question the decisions or actions of the master except when they threaten the safety of the ship.\*

(Linear scale 1 to 5)

Overall, successful bridge management is primarily a function of the master's nautical proficiency.\*

(Linear scale 1 to 5)

## Section 5

### Recognition of stressor effects

The following statements focus on stress. Please click the number that best reflects your agreement with each statement listed below.

#### Criteria

- 1 – Strongly disagree
- 2 – disagree
- 3 – neither agree nor disagree
- 4 – agree
- 5 – strongly agree

Even when fatigued, I perform my duties effectively.\*

(Linear scale 1 to 5)

My performance is not adversely affected by working with an inexperienced or less capable crew member.\*

(Linear scale 1 to 5)

A truly professional crew member can leave personal problems behind during the watch.\*

(Linear scale 1 to 5)

My decision-making ability is as good in emergencies as in routine situations.\*

(Linear scale 1 to 5)

## Section 6

### Summarizing questions

The following statements focus on your learning outcome from the BRM course. Please click the number that best reflects your agreement with each statement listed below.

#### Criteria

- 1 – Strongly disagree
- 2 – disagree
- 3 – neither agree nor disagree
- 4 – agree
- 5 – strongly agree

After taking the BRM course, I gained a better understanding of Bridge Management.\*  
(Linear scale 1 to 5)

After taking the BRM course, I gained a better understanding of Teamwork.\*  
(Linear scale 1 to 5)

After taking the BRM course, I gained a better understanding of Leadership.\*  
(Linear scale 1 to 5)

After taking the BRM course, I gained a better understanding of Situational Awareness.\*  
(Linear scale 1 to 5)

After taking the BRM course, I gained a better understanding of Decision Making.\*  
(Linear scale 1 to 5)

After taking the BRM course, I gained a better understanding of Managing Fatigue and Stress.\*  
(Linear scale 1 to 5)

## Appendix C – The 17 Statements

1	Crew members should feel obligated to mention their own psychological stress or physical problems to other bridge team members before or during the watch.
2	Each crew member should monitor other crew members for signs of stress or fatigue and should discuss the situation with the crew member.
3	Good communications and crew coordination are as important as technical proficiency for the safety of seafaring.
4	All crew members should be aware of and sensitive to the personal problems of other crew members.
5	The officer of the watch should verbalize plans for procedures or maneuvers and should be sure that the information is understood and acknowledged by the other crew members.
6	Crew members should alert others to their actual or potential work overloads.
7	Officers should encourage crew members to question procedures during normal operations and emergencies.
8	A debriefing and critique of procedures and decisions after a maneuver is an important part of developing and maintaining effective crew coordination.
9	Briefings are important for safety and for effective crew coordination.
10	Effective crew coordination requires crew members to take into account the personalities of other crew members.
11	In emergencies and nonstandard situations, the master should directly command this situation himself or herself.
12	Crew members should not question the decisions or actions of the master except when they threaten the safety of the ship.
13	Overall, successful bridge management is primarily a function of the master's nautical proficiency.
14	Even when fatigued, I perform my duties effectively.
15	My performance is not adversely affected by working with an inexperienced or less capable crew member.
16	A truly professional crew member can leave personal problems behind during the watch.
17	My decision-making ability is as good in emergencies as in routine situations.

## Appendix D – Motivation of NTS categorization

<b>Statement 1</b>	Crew members should feel obligated to mention their own psychological stress or physical problems to other bridge team members before or during the watch.
Placed into	Teamwork
Statement essence	Sharing personal information to other team members in relation to improved safety and establish the relieving officer is fit for duty.
Motivation	To support each other and exchange information are key elements in Teamwork.
<b>Statement 2</b>	Each crew member should monitor other crew members for signs of stress or fatigue and should discuss the situation with the crew member.
Placed into	Managing fatigue & stress
Statement essence	Monitoring signs of stress and fatigue and discuss coping strategies.
Motivation	To monitor other team members for signs of stress and fatigue and implement coping strategies are key elements for the skill Managing fatigue & stress.
<b>Statement 3</b>	Good communications and crew coordination are as important as technical proficiency for the safety of seafaring.
Placed into	Teamwork
Statement essence	Understand the importance of communication and coordination.
Motivation of sorting	To co-ordinate, exchange information and communicate are key elements of the skill Teamwork.
<b>Statement 4</b>	All crew members should be aware of and sensitive to the personal problems of other crew members.
Placed into	Teamwork
Statement essence	To build interpersonal relationships strengthens a group, and team performance is dependent on a shared mental picture as the team needs to work towards the same goal.
Motivation of sorting	To support each other and exchange information are key elements of the skill Teamwork.
<b>Statement 5</b>	The officer of the watch should verbalize plans for procedures or manoeuvres and should be sure that the information is understood and acknowledged by the other crew members.
Placed into	Teamwork
Statement essence	Creating a shared goal and work together, acknowledged by all team members.

Motivation of sorting	To support others, exchange information and co-ordinate activities are key elements in Teamwork and to verbalize them helps to institute relationships and maintain attention to the task.
<b>Statement 6</b>	Crew members should alert others to their actual or potential work overloads.
Placed into	Managing fatigue & stress
Statement essence	To recognize symptoms of stress and fatigue and communicate that to crew members.
Motivation of sorting	To recognize signs for work overload and stress are a key element in the skill Managing fatigue & stress.
<b>Statement 7</b>	Officers should encourage crew members to question procedures during normal operations and emergencies.
Placed into	Teamwork
Statement essence	Challenge procedures to maintain and develop good teamwork.
Motivation of sorting	To challenge and improve procedures are important for safety and helps to ensure that the mental picture coincides for the whole team.
<b>Statement 8</b>	A debriefing and critique of procedures and decisions after a manoeuvre is an important part of developing and maintaining effective crew coordination.
Placed into	Teamwork
Statement essence	Challenge procedures to maintain and develop good teamwork.
Motivation of sorting	To maintain a common goal, to support others and team coordination are successful components in Teamwork.
<b>Statement 9</b>	Briefings are important for safety and for effective crew coordination.
Placed into	Teamwork
Statement essence	Understand the importance of a common goal and briefings are ways to increase safety.
Motivation of sorting	To have a common goal and execute briefings are important to maintain good coordination.
<b>Statement 10</b>	Effective crew coordination requires crew members to take into account the personalities of other crew members.
Placed into	Teamwork
Statement essence	Team members have different personalities which have to be considered in group dynamics when coordinating crew.
Motivation of sorting	In Teamwork it is important to support others, solve conflicts, exchange information, and for that it is important to respect different personalities.

<b>Statement 11</b>	In emergencies and nonstandard situations, the master should directly command this situation himself or herself.
Placed into	Leadership
Statement essence	The leader should consider inputs from all crew members with different experiences to solve the situations as good as possible.
Motivation of sorting	This is placed in Leadership since the essence of the question discuss how the leader should command the situation.
<b>Statement 12</b>	Crew members should not question the decisions or actions of the master except when they threaten the safety of the ship.
Placed into	Leadership
Statement essence	The leader should consider inputs from all crew members to maintain the shared mental picture of all situations.
Motivation of sorting	Good leadership allows crew members to question and challenge officers' decisions, and an officer with good leadership skills is able to accept and accompany this critique.
<b>Statement 13</b>	Overall, successful bridge management is primarily a function of the master's nautical proficiency.
Placed into	Leadership
Statement essence	Understand that successful bridge management is highly depending on the NTS of the master and the crew.
Motivation of sorting	This is placed in Leadership to understand that the role of the leader, in this case the master, is dependent on a well-functioning team with competence in NTS.
<b>Statement 14</b>	Even when fatigued, I perform my duties effectively.
Placed into	Managing fatigue & stress
Statement essence	Understand that the human performance decreases when fatigued.
Motivation of sorting	To have knowledge that fatigue is shown to have significant effect on cognitive performance, motor skills, communication and social skills.
<b>Statement 15</b>	My performance is not adversely affected by working with an inexperienced or less capable crew member.
Placed into	Teamwork
Statement essence	The competence level of the individual team members will affect the performance of the whole team.
Motivation of sorting	The main elements of the individual's teamworking skill are to support others, solve conflicts, exchange information and co-ordinate activities.
<b>Statement 16</b>	A truly professional crew member can leave personal problems behind during the watch.
Placed into	Managing fatigue & stress



Statement essence Personal problems can lead to stress and fatigue, which can lead to safety issues.

Motivation of sorting Personal problems can cause fatigue & stress, which is why this statement is sorted into this category.

**Statement 17** My decision-making ability is as good in emergencies as in routine situations.

Placed into Decision-making

Statement essence To understand that the decision-making ability is affected by outer circumstances, such as working under time pressure and stress.

Motivation of sorting Understanding the process of decision-making and what can affect this process in a negative way.

Appendix E – BRM Course Schedule

Chalmers BRM – Bridge Resource Management	
Day 1	
0900 – 0930	Course Introduction <ul style="list-style-type: none"> <li>▪ Program purpose and objectives; outline and agenda</li> <li>▪ Participant introductions</li> </ul>
0930 – 1030	[Company] – our view on safety and being one company
1030 – 1130	Who is in control? Making sense of things.
1130 – 1300	Lunch
1300 – 1600	The Bridge Team – building a foundation for safe operations
1600 – 1700	Simulator familiarization (homework handout)
Day 2	
0830 – 0900	Recap
0900 – 1100	Taking risks/Risk assessment/Drift into failure
1100 – 1200	Communicating with others
1200 – 1300	Lunch
1300 – 1330	Communicating with others
1330 – 1500	Getting tired and stressed
1500 – 1830	Simulator Exercises (Light meal is served around 1700)
Day 3	
0830 – 0900	Recap
0900 – 1000	Making decisions, mistakes and just culture
1000 – 1200	Simulator exercises
1200 – 1300	Lunch
1300 – 1430	Simulator exercises
1430 – 1500	Sum up MRM & Course evaluation

**Symbol explanation**

- \* The data has been removed to protect the participants privacy (see chapter 3.6)
- \*\* Invalid data
- \*\*\* Currently working on another company's vessel
- XXX Participants who answered more than once. The crossed-out row is the second answer and is not used in the results.

**Questionnaire 1**

## Demographics, ID 1 – 33

ID	Sex	Highest Certificate	Years Serving at Sea	Years Serving at [Company]	Years at Current [Company] Position	Name of [Company] Vessel
1	M	Captain unlimited	25	0	0	Shore based
2	M	Master Mariner	**	10	6	Shore-based
3	M	Deck Officer Class 5	0,5	3	0,5	*
4	M	FB II	10	10	2	*
5	M	Master	30	30	6	*
6	M	Master	40	8	7	*
7	M	Chief mate on ships 3000GT or more	11	3	1	*
8	M	IV	20	5	1,5	*
9	M	Class 2	11	10	0	*
10	M	Master	23	14	2	*
11	M	MBO Maritiem Officer	10	7	1	*
12	M	Master All Ships	30	23	2	*
13	M	K	46	39	23	*
14	M	master	40	24	**	*
15	M	Deck off II	11	6	**	*
16	M	CHIEF OFFICER	10	3	3	*
17	M	Master Marine	18	9	6	*
18	M	Master Unlimited	15	6	6	*
19	M	Academy	15	9	1	*
20	M	Eerste Stuurman Grote Handelsvaart	35	25	5	*
21	M	master	32	22	15	*
22	M	Master	38	30	15	*
23	M	n. a.	20	1,5	**	*
24	M	Master	14	6	**	*
25	M	Master all ships.	36	27	14	*
26	M	Master all ships	35	19	3	*
27	M	Master Mariner	32	22	16	*
28	M	Chief officer	11	6	3	*
29	M	HBO maritiem officier	15	7	1	*
30	M	Fb klass 2	15	12	**	*
31	M	MASTER	30	22	9	*
32	M	2	24	22	1	*
33	M	Master	30	**	1	*

Statements 1 – 17, ID 1 – 33

ID	S. 1	S. 2	S. 3	S. 4	S. 5	S. 6	S. 7	S. 8	S. 9	S. 10	S. 11	S. 12	S. 13	S. 14	S. 15	S. 16	S. 17
1	5	5	4	3	5	5	5	5	5	4	3	1	3	3	4	4	4
2	3	5	5	2	5	4	5	5	5	5	3	3	2	1	2	1	2
3	4	4	4	4	3	4	3	4	5	3	3	3	3	3	3	3	3
4	3	4	5	2	5	5	5	5	5	5	2	1	2	1	3	1	2
5	2	4	5	2	4	4	4	5	5	3	2	2	1	4	4	2	4
6	5	5	5	5	5	5	5	4	5	5	5	2	2	3	4	4	4
7	4	5	5	4	5	4	4	5	4	5	4	2	2	4	4	5	4
8	4	4	4	3	4	4	4	4	5	3	3	3	2	3	3	3	2
9	2	3	4	3	5	5	4	5	4	3	3	3	3	1	3	2	3
10	4	5	4	4	4	5	5	4	4	4	3	4	3	2	2	2	2
11	5	4	5	1	5	1	1	5	5	5	5	1	1	1	3	3	4
12	5	4	5	4	5	5	5	5	5	5	5	3	4	3	3	3	4
13	5	5	5	4	4	5	3	3	5	5	3	3	3	1	1	1	1
14	4	4	5	1	5	5	5	4	5	4	2	2	4	1	2	2	2
15	3	4	5	5	5	5	3	5	5	4	4	4	2	2	3	4	3
16	4	5	5	3	5	5	5	5	5	4	3	2	2	1	1	2	3
17	5	5	5	5	5	5	5	5	5	5	5	4	5	4	5	4	4
18	5	5	5	5	5	5	5	5	5	5	2	1	1	3	3	2	3
19	4	4	2	4	3	4	4	2	3	1	1	2	2	2	4	2	1
20	4	3	5	3	4	4	4	4	4	3	4	4	1	1	2	2	2
21	5	5	5	5	5	5	4	4	5	4	5	4	2	2	4	3	5
22	4	4	4	3	4	4	4	4	4	4	4	3	2	2	2	2	2
23	3	3	5	3	3	3	4	4	4	3	4	4	2	4	2	4	4
24	5	4	5	3	5	4	3	4	4	4	1	4	1	3	1	4	5
25	5	5	5	3	5	3	4	5	5	4	5	2	2	1	1	1	3
26	4	4	5	4	4	4	4	5	4	4	4	4	3	3	4	4	4
27	5	4	5	4	5	5	4	4	5	4	4	4	4	3	4	4	4
28	3	4	5	4	4	4	4	4	4	4	3	2	3	2	2	1	3
29	5	5	5	5	5	5	5	3	3	4	3	3	1	4	4	5	5
30	4	4	4	4	4	3	3	4	4	4	3	4	3	2	2	4	2
31	5	4	5	5	5	5	5	5	5	4	5	5	4	3	3	4	4
32	2	3	3	4	5	4	4	5	4	4	4	2	2	4	1	2	2
33	5	5	5	5	5	5	5	5	5	4	3	3	5	3	2	3	3

## Demographics, ID 34 – 78

ID	Sex	Highest Certificate	Years Serving at Sea	Years Serving at [Company]	Years at Current [Company] Position	Name of [Company] Vessel
34	M	master all ships deap sea	36	27	20	*
35	M	Chief Officer	16	4	**	*
36	M	Master all ships	20	5	**	*
37	M	sjökaptén klass 2	17	10	**	*
38	M	Master	31	14	4	*
39	M	master all ships	32	29	**	*
40	M	CHIEF MATE	22	15	**	*
41	M	Chief officer	10	4	2	*
42	M	Master all ships	21	1,5	1,5	*
43	M	Master all ships	25	9	**	*
44	M	Master all Ships	45	31	21	*
45	M	Officer All Ships	5	2	2	*
46	M	mate all ships	23	5	5	*
47	M	Class II	15	9	4	*
48	M	COC master all ships	10	3	**	*
49	M	Sjökaptén	12	1,5	1,5	*
50	M	Master all ships	10	3,5	3,5	*
51	M	Officer all ships	2	2	2	*
52	M	Class 2	15	5	15	*
53	M	Chief Mate	7	3	3	*
54	M	Master all ships	18	16	6	*
55	M	Master all ship's no limitations	32	27	14	*
56	M	5	9	9	2,5	*
57	M	HBO	31	22	**	*
58	M	OOW	7	3	3	*
59	M	Master all ships	31	21	3	*
60	M	Ch.off all ships	20	6	2	**
61	M	Master	41	18	16	*
62	M	Master unlimited	**	3	2	Office
63	M	Master all ships	28	22	**	*
64	M	master all ships	21	8	2	*
65	M	2nd Officer	3	1,5	0,6	*
66	M	Master all Ships	11	9	2	*
67	M	Fbv class 2	17	13	**	*
68	M	Class 3	8	8	**	*
69	M	Class 1	25	15	2	*
70	M	Master	28	20	7	*
71	M	Master all ships	45	31	21	*
72	M	Master	33	22	10	*
73	M	Sjökaptén	35	27	12	*
74	M	Sjökaptén	35	27	12	*
75	M	Master (K)	18	10	1	*
76	M	klass 2	10	2	1	*
77	M	Class V	2	2	1	*
78	M	Chief Mate	12	4	4	*

Statements 1 – 17, ID 34 – 78

ID	S. 1	S. 2	S. 3	S. 4	S. 5	S. 6	S. 7	S. 8	S. 9	S. 10	S. 11	S. 12	S. 13	S. 14	S. 15	S. 16	S. 17
34	5	5	5	4	5	5	4	5	5	4	3	3	4	3	3	3	3
35	4	5	5	4	5	5	4	5	5	5	5	5	4	4	4	4	5
36	4	5	5	5	5	4	3	3	3	5	5	2	1	1	2	3	4
37	4	3	5	4	5	4	4	5	5	3	4	3	4	3	4	2	4
38	5	5	5	4	4	5	4	5	5	5	5	1	1	3	1	4	4
39	5	5	5	4	5	4	5	5	4	4	5	3	2	4	4	4	5
40	4	4	4	4	4	4	4	4	4	5	2	3	3	4	2	3	3
41	4	4	5	4	5	5	5	5	5	4	3	4	3	3	2	4	3
42	4	4	4	4	4	4	4	4	4	3	3	3	3	4	4	4	3
43	4	4	4	2	4	4	4	4	4	3	4	4	3	2	2	3	2
44	3	4	5	3	5	4	4	3	3	4	5	4	4	3	3	4	4
45	5	4	5	3	4	5	4	5	5	4	2	1	1	2	2	3	2
46	5	5	5	5	5	5	5	5	5	5	4	2	1	1	1	4	3
47	4	4	4	4	4	4	4	4	4	4	3	2	3	3	3	3	3
48	3	3	4	4	4	4	3	3	3	2	3	2	2	2	2	2	2
49	4	3	5	3	4	4	3	4	4	3	4	4	3	3	3	3	3
50	4	5	5	4	5	4	4	5	5	4	3	2	3	4	3	3	4
51	3	4	4	3	3	4	3	3	3	3	4	2	2	3	2	3	3
52	2	3	4	1	4	4	4	3	3	3	1	1	1	3	2	3	2
53	4	5	5	3	5	4	5	5	5	5	2	2	1	1	2	3	3
54	5	5	5	4	4	4	5	4	4	4	4	3	3	3	3	3	3
55	5	4	5	5	5	5	5	5	4	5	3	2	2	2	2	4	3
56	4	4	5	4	5	4	4	4	4	4	3	2	4	4	5	4	4
57	5	4	4	4	3	5	5	4	5	4	5	4	3	4	4	5	4
58	4	3	4	3	4	4	5	3	4	3	1	2	3	4	2	4	3
59	5	5	5	5	5	5	5	5	5	5	5	2	2	2	2	2	4
60	4	5	5	4	4	3	4	4	5	3	3	3	2	2	2	2	2
61	5	3	5	2	5	5	5	4	3	5	5	1	1	2	4	1	1
62	4	4	5	2	4	5	3	5	4	3	4	4	5	2	3	2	3
63	4	5	5	4	5	5	4	5	5	4	5	2	1	3	1	3	3
64	4	4	4	4	4	4	4	3	3	4	3	3	3	2	3	2	4
65	5	3	5	3	4	4	4	4	5	4	3	3	2	4	4	5	3
66	4	4	4	4	4	4	4	4	4	4	3	3	3	4	4	3	4
67	3	3	5	4	5	5	5	5	5	3	3	3	1	4	3	4	3
68	4	5	5	5	4	4	5	5	5	4	4	3	3	1	1	2	2
69	5	5	5	5	5	5	5	5	5	5	4	4	5	2	3	4	3
70	5	5	5	3	5	5	1	3	5	5	5	5	1	1	1	1	1
71	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	4	4
72	5	5	5	5	5	5	5	4	5	5	3	1	1	1	2	3	3
73	4	4	5	3	4	4	4	5	5	4	3	3	3	4	4	3	3
74	4	4	5	3	4	4	4	5	5	4	3	3	3	4	4	3	3
75	5	5	5	3	5	5	5	5	5	5	4	1	1	2	2	1	3
76	4	5	5	3	5	4	4	3	5	4	3	2	3	3	2	3	4
77	4	4	5	2	5	4	3	4	4	3	3	3	2	2	3	4	3
78	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	5	5

## Demographics, ID 79 – 124

ID	Sex	Highest Certificate	Years Serving at Sea	Years Serving at [Company]	Years at Current [Company] Position	Name of [Company] Vessel
79	MF	Maroff	15	12,5	7	*
80	M	Master all ships	**	10	10	*
81	M	Class II	14	10	1	*
82	M	Master	30	15	8	*
83	M	Master	15	h4	1,5	*
84	M	1st officer	38	3	3	*
85	M	Master licens	22	14	5	*
86	M	Chief Officer [unlimited]	4,5	3,5	3,5	*
87	M	Class 2	22	16	11	*
88	M	FB V	18	14	4	*
89	M	OIC-NW	16	5	5	*
90	M	Master	33	23	11	*
91	M	Master mariner	10	7	1	*
92	M	Master	44	34	14	*
93	M	Master	33	21	8	*
94	M	COLLEGE GRADUATE	20	2	0,2	*
95	M	College Graduate	8	2	2	*
96	M	Master	11	8	3	*
97	M	Fartygsbefäl klass V	12	12	4	*
98	M	Class 5	2,5	2,5	1,5	*
99	M	Master	33	33	11	*
100	M	Chiefmate license	15	15	6	*
101	M	Master all ships	21	17	**	*
102	M	Class II	20	18	10	*
103	M	Chief Officer	8	5	5	*
104	M	Klass V	10	10	1	*
105	M	Captain	28	6	6	*
106	M	Foreign Going Masters	27	12	1	*
107	M	master	31	21	10	*
108	M	class3	55	19	0	*
109	M	Chief officer	6	1	**	*
110	M	klass 2	23	21	16	*
111	M	Foreign Going Masters	27	12	1	*
112	M	Styrman b	42	18	18	*
113	M	oow	0,5	0,3	0,3	*
114	M	2 officer	43	18	18	*
115	M	Fartygsbefäl klass V	2	2	2	*
116	F	Fartygsbefäl klass V	0,5	0,5	0,5	*
117	M	Chief Off	20	7	1	*
118	M	klass V	1	1	1	*
119	M	Fb 2	8	8	2	*
120	F	Deck Officer Class V	5	2	**	*
121	M	OOW	4	2,5	0,5	*
122	M	Class 5	9	4	**	*
123	M	Chief mate	7	1,5	1,5	*
124	M	Class 5	9	4	**	*

Statements 1 – 17, ID 79 – 124

ID	S. 1	S. 2	S. 3	S. 4	S. 5	S. 6	S. 7	S. 8	S. 9	S. 10	S. 11	S. 12	S. 13	S. 14	S. 15	S. 16	S. 17
79	5	5	5	5	5	5	5	5	5	5	3	4	1	3	3	3	3
80	4	4	4	2	4	4	4	4	4	4	5	3	4	1	1	4	1
81	3	3	5	3	3	3	3	3	5	3	3	3	3	1	1	1	1
82	3	4	5	5	4	4	3	4	4	4	2	2	2	3	2	3	4
83	5	5	5	3	5	5	4	5	5	4	5	4	5	3	4	3	3
84	5	5	5	4	5	5	5	5	5	5	5	5	5	2	3	3	3
85	4	4	4	4	4	4	2	4	4	3	4	2	2	3	3	3	3
86	4	4	5	2	4	3	3	4	5	4	5	5	4	3	3	2	3
87	4	4	5	3	4	5	5	4	5	4	2	2	1	1	2	3	2
88	4	5	5	2	5	4	5	4	4	3	1	2	2	2	3	4	3
89	3	4	5	4	5	4	5	4	5	4	5	4	5	3	3	4	5
90	5	4	4	4	5	5	5	5	5	5	4	2	4	2	3	4	4
91	3	4	4	4	4	4	4	3	3	3	2	3	2	2	3	3	3
92	4	3	5	2	5	2	5	5	5	4	5	5	5	2	4	2	4
93	5	5	5	5	5	5	5	5	5	5	1	1	1	1	1	1	5
94	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
95	4	4	5	4	4	5	4	4	5	4	4	5	4	4	4	4	4
96	4	4	5	3	5	5	5	5	5	5	3	2	1	1	1	1	1
97	3	3	4	4	5	5	5	3	5	5	5	3	4	2	3	2	4
98	3	4	5	1	5	4	5	5	5	5	4	4	3	2	2	3	2
99	5	4	5	5	4	5	3	5	5	5	5	4	3	2	2	2	4
100	5	5	5	5	5	5	5	5	5	5	2	5	2	1	5	1	5
101	2	2	1	2	1	2	2	2	2	2	1	2	2	3	3	2	2
102	4	5	5	3	5	4	2	5	5	5	3	2	3	4	4	5	5
103	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1
104	5	3	5	4	4	3	3	4	5	5	5	3	1	2	3	4	1
105	4	3	4	5	5	4	5	4	5	3	4	4	4	3	3	3	4
106	4	4	5	4	5	4	5	4	5	4	4	1	1	4	4	3	4
107	5	5	5	5	5	5	5	4	5	4	4	1	3	3	2	3	4
108	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	4	4
109	5	5	5	3	5	5	4	5	5	5	5	3	1	1	3	5	3
110	4	5	5	4	4	5	3	5	5	5	3	2	3	2	2	2	3
111	4	4	5	4	5	4	5	4	5	4	4	1	1	4	4	3	4
112	4	4	5	4	5	4	5	5	5	4	4	4	5	5	5	4	5
113	4	5	5	5	5	4	3	3	5	5	3	2	1	3	2	3	4
114	5	5	3	4	5	4	5	5	5	5	4	5	5	5	4	5	5
115	5	5	5	4	5	5	5	5	5	3	5	3	2	2	3	2	2
116	3	4	5	1	5	3	5	5	5	3	3	2	1	3	4	3	1
117	4	5	5	5	5	4	4	4	4	4	3	2	2	5	3	3	3
118	4	4	4	2	4	4	4	4	4	3	3	4	2	2	2	3	2
119	3	3	4	3	3	3	3	4	4	4	3	2	2	1	3	2	3
120	4	5	5	4	5	5	5	5	5	5	3	2	2	1	3	2	1
121	5	5	5	4	5	5	5	4	5	4	3	2	5	4	4	3	3
122	4	5	5	4	5	5	5	5	5	5	3	1	4	2	4	4	2
123	5	5	5	3	5	5	5	5	5	5	5	3	5	3	1	5	4
124	4	5	5	4	5	5	5	5	5	5	3	1	4	2	4	4	2



## Questionnaire 2

### Demographics, ID 1 – 35

ID	Sex	Name of vessel	Highest Certificate	Current position	Number of years at current position in [Company]	Years serving at [Company]	Years serving at sea	How many BRM courses have you taken in your career?
1	Male	*	Master license	Master	24	33	47	4
2	Male	*	Master all ships	Master	2 years	24 years	34 years	3
3	Male	*	Chief Officer All Ships	2nd Officer	5	5	8	3
4	Male	*	Master All ships	2nd Officer	3 years	3	16	2
5	Male	*	K	Chief Officer	8	25	35	3
6	Male	*	Captain	2nd Officer	14	14	43	2
7	Male	****	D2	Chief Officer	0	2	6	3
8	Male	*	University BA	Chief Officer	3	8	13	3
9	Male	*	Officer of the Watch	2nd Officer	1.5	3	9	2
10	Male	*	Master all ships	2nd Officer	4	4	25	2
11	Male	*	captain	Master	15	32	40	2
12	Male	*	2	Chief Officer	3	13	17	2
13	Male	*	Captain	Chief Officer	3	3	15	2
14	Male	*	Master	Master, Chief Officer	10	15	20	2
15	Male	*	Sjökapten	Master	13	32	40	2
16	Male	*	Master all ships	Chief Officer	26	30	40	5
17	Male	*	Master Mariner	Chief Officer	23	24	34	2
18	Male	Shore-based	Nautical officer class II	Shore-based	0,5	3	6	2
19	Male	*	Master all ships	Master	15	32	39	4
20	Male	*	Master	Master	1	20	30	3
21	Male	*	Class 1 Master's	Chief Officer	2	13	30	3
22	Male	*	Master all ships	Chief Officer	5	12	30	4
23	Male	*	Master all ships	Master, Chief Officer	5	19	23	3
24	Male	*	master	Chief Officer	20	25	45	2
25	Male	*	Master all ships	Chief Officer	10	14	18	4
26	Male	*	2nd Officer	2nd Officer	2	3	6	1
27	Male	*	Senior Master	Master	10years	30	30	5
28	Male	*	Master Mariner unlimited	Chief Officer	3	8	12	3
29	Male	*	klass 2	2nd Officer	18	23	25	2
30	Male	*	Master	Master	12	24	34	3
31	Male	*	Master	Chief Officer	1	6,5	9	4
32	Male	*	Master	Master	25	41	49	3
33	Male	*	Master	Chief Officer	12	19	24	2
34	Male	*	Bachelor	2nd Officer	2	2	3	3
35	Male	*	master all ships	Chief Officer	5	12.5	30	4

Statements 1 – 17, ID 1 – 35

ID	S. 1	S. 2	S. 3	S. 4	S. 5	S. 6	S. 7	S. 8	S. 9	S. 10	S. 11	S. 12	S. 13	S. 14	S. 15	S. 16	S. 17
1	4	4	4	4	5	5	4	4	4	4	5	4	5	4	3	4	4
2	5	5	5	5	5	5	5	5	5	5	5	2	3	3	3	3	4
3	4	5	5	4	5	4	4	5	4	5	3	1	3	2	2	2	2
4	5	4	4	4	5	5	4	4	4	4	3	3	2	2	2	3	4
5	3	4	5	4	4	4	3	5	3	4	3	3	2	1	2	2	2
6	3	5	5	3	5	4	5	3	3	5	5	1	1	3	2	1	2
7	3	5	5	3	3	5	3	5	5	5	2	1	2	1	1	1	1
8	2	4	5	2	5	4	3	3	5	4	5	1	2	1	4	1	3
9	5	4	3	3	5	5	4	4	4	4	2	2	4	4	3	4	3
10	4	4	4	3	4	4	4	4	4	3	3	2	2	3	3	4	4
11	4	4	4	4	5	4	4	4	4	4	4	4	3	2	2	2	3
12	2	4	5	4	5	4	5	5	5	4	2	3	1	3	3	2	2
13	4	5	5	4	5	5	4	5	5	4	4	2	5	1	2	1	5
14	3	4	4	3	5	4	3	2	3	5	2	1	2	1	2	5	4
15	5	5	5	5	5	5	5	5	5	5	5	5	3	3	4	4	4
16	5	5	5	5	5	5	4	4	5	4	4	2	4	2	3	3	3
17	5	5	5	5	5	5	5	5	5	5	3	1	1	2	2	1	1
18	5	5	5	3	4	5	5	5	5	5	3	3	1	1	2	3	1
19	5	4	5	4	5	4	3	5	5	4	5	5	3	4	5	5	4
20	4	5	4	5	5	5	4	4	4	4	3	3	3	4	4	3	5
21	4	4	5	4	5	4	5	5	5	5	4	1	1	3	3	3	3
22	4	4	4	1	4	4	4	4	4	3	4	3	3	1	2	2	2
23	5	5	5	5	5	5	5	5	5	4	4	3	3	2	2	2	4
24	5	5	5	5	5	5	5	5	5	5	3	3	3	2	4	3	2
25	5	5	5	5	5	5	5	5	5	5	5	3	2	4	4	3	5
26	2	5	5	4	4	3	4	3	4	4	4	2	2	2	2	4	2
27	4	4	5	4	5	5	4	5	5	4	2	2	1	2	2	2	4
28	3	4	5	4	5	4	4	4	4	3	2	2	2	2	3	3	2
29	4	5	5	2	4	5	5	4	5	4	3	1	2	2	2	2	4
30	5	4	5	5	5	5	5	5	5	5	1	1	1	1	2	2	3
31	4	4	4	4	5	4	4	5	5	4	3	2	4	4	4	4	4
32	5	4	5	3	3	4	3	4	5	4	3	3	1	1	1	3	3
33	4	4	5	4	5	4	4	3	4	3	5	4	5	2	2	2	3
34	4	5	5	5	5	4	5	3	5	4	4	4	3	3	4	2	4
35	4	4	4	2	4	4	4	4	4	4	4	3	2	1	1	2	2

Evaluation questions, ID 1 – 35

ID	After taking the BRM course, I gained a better understanding of Bridge Management.	After taking the BRM course, I gained a better understanding of Teamwork.	After taking the BRM course, I gained a better understanding of Leadership.	After taking the BRM course, I gained a better understanding of Situational Awareness.	After taking the BRM course, I gained a better understanding of Decision Making.	After taking the BRM course, I gained a better understanding of Managing Fatigue and Stress
1	4	4	4	4	4	4
2	4	4	4	4	4	4
3	4	4	2	4	4	4
4	4	4	4	3	3	4
5	4	4	4	4	5	4
6	4	3	3	3	3	4
7	5	5	5	5	5	4
8	4	4	4	4	4	4
9	5	4	4	4	4	4
10	3	3	3	3	3	3
11	4	4	4	4	4	4
12	3	3	3	3	3	3
13	5	5	4	5	5	5
14	3	2	1	3	2	4
15	4	4	4	4	4	4
16	4	4	4	4	4	4
17	5	4	3	5	5	4
18	4	4	5	4	4	4
19	3	3	3	3	3	4
20	5	5	5	5	5	4
21	5	4	5	5	5	5
22	4	3	3	4	3	4
23	4	4	3	3	4	4
24	4	5	4	5	5	5
25	3	4	3	4	3	4
26	1	1	1	1	1	1
27	5	5	5	5	5	5
28	4	4	3	4	3	3
29	5	4	4	4	5	5
30	4	4	4	4	4	4
31	4	4	4	4	4	3
32	4	4	3	3	3	3
33	4	3	3	4	4	4
34	5	4	5	4	5	4
35	4	4	4	4	4	4

## Demographics, ID 36 – 72

ID	Sex	Name of vessel	Highest Certificate	Current position	Number of years at current position in [Company]	Years serving at [Company]	Years serving at sea	How many BRM courses have you taken in your career?
36	Male	*	Klass II	Chief Officer, 2nd Officer	6	10	15	1
37	Male	***	master	Chief Officer	4	11	16	3
38	Male	*	Sjökapten klass II	2nd Officer	22	33	34	1
39	Male	*	Master all ships	Chief Officer	2	8	20	4
40	Male	*	Class II	Chief Officer	2	10	13	1
41	Male	***	Master unlimited	Shore-based	4	4	10	2
42	Male	*	Master	Chief Officer	6	8	13	2
43	Male	*	chief officer	2nd Officer	3	3	3	1
44	Male	*	Klass 5	2nd Officer	2	10	12	2
45	Male	*	Master	Master	1	9	13	2
46	Male	*	Chief mate	2nd Officer	4	4	4	2
47	Male	*	F2	2nd Officer	18	20	30	2
48	Male	*	Master	Master, Chief Officer	10	23	33	5
<del>49</del>	<del>Male</del>	<del>*</del>	<del>Master all ships</del>	<del>Master</del>	<del>3</del>	<del>23</del>	<del>33</del>	<del>3</del>
50	Male	*	Klass I	2nd Officer	5	7	14	1
51	Male	*	chief mate unlimited	2nd Officer	12	12	27	3
52	Male	*	Master all chips	Master	12	25	35	4
53	Male	*	Fartygsbefäl klass II	2nd Officer	12	16	16	2
54	Male	*	Dk II	2nd Officer	3	3	12	3
55	Male	*	Chief officer coc	2nd Officer	4	4	10	1
56	Male	*	Master	2nd Officer	9	9	17	2
57	Male	*	Master	Master	4	23	35	3
58	Male	*	Master Unlimited	Chief Officer, 2nd Officer	5	5	10	More than 5
59	Male	*	Master Mariner	Master	19	24	33	2
60	Male	*	Master All Ships	2nd Officer	6 years	6 years	12 years	3
61	Male	*	Oow	2nd Officer	10	10	15	2
62	Male	*	Captain	Chief Officer	4	15	15	2
63	Male	***	Class 1	2nd Officer	0	12	43	4
64	Male	*	5	2nd Officer	2	2	2	1
65	Male	*	Master All Ships	Master	5	25	32	4
66	Male	*	Master all ships	Chief Officer	2	7	25	More than 5
67	Male	*	master all ships	Chief Officer	8	8	22	3
68	Male	*	Officer Class II	2nd Officer	3	4	4	2
69	Male	*	Master	Master	2007	12	48	3
70	Male	*	Chief Officer	2nd Officer	6	8	9	2
71	Male	*	Sjökapten	2nd Officer	4	4	15	2
<del>72</del>	<del>Male</del>	<del>*</del>	<del>Master all ship</del>	<del>Chief Officer</del>	<del>10</del>	<del>14</del>	<del>17</del>	<del>3</del>

Statements 1 – 17, ID 36 – 72

ID	S. 1	S. 2	S. 3	S. 4	S. 5	S. 6	S. 7	S. 8	S. 9	S. 10	S. 11	S. 12	S. 13	S. 14	S. 15	S. 16	S. 17
36	3	3	4	2	4	3	3	5	5	3	4	4	4	1	3	5	2
37	4	4	5	4	4	4	3	2	2	4	1	1	1	3	4	2	4
38	4	4	5	4	4	4	5	5	4	4	5	5	4	4	4	3	3
39	2	5	3	3	4	5	5	4	4	3	5	1	1	1	1	1	4
40	4	3	4	4	3	3	3	4	4	4	4	4	2	3	2	3	4
41	5	5	5	4	5	5	5	4	4	4	5	5	3	3	4	5	4
42	4	4	5	5	5	4	4	5	5	5	4	4	4	2	2	2	1
43	4	4	4	3	4	4	3	3	3	3	3	4	3	4	3	5	5
44	5	5	5	3	5	4	4	4	5	5	5	4	3	4	2	5	4
45	5	5	5	3	5	5	5	5	5	4	3	2	4	1	2	3	1
46	2	3	4	2	3	4	3	4	4	4	4	3	2	4	2	3	3
47	5	5	5	3	5	5	5	5	5	5	2	1	1	2	2	2	2
48	5	5	5	4	5	5	5	5	5	4	4	1	5	3	2	2	3
<del>49</del>	<del>5</del>	<del>5</del>	<del>5</del>	<del>5</del>	<del>5</del>	<del>5</del>	<del>4</del>	<del>4</del>	<del>4</del>	<del>5</del>	<del>5</del>	<del>4</del>	<del>3</del>	<del>4</del>	<del>4</del>	<del>4</del>	<del>4</del>
50	4	4	5	4	5	5	5	4	4	5	3	2	1	3	4	4	5
51	4	4	4	1	4	5	4	4	4	4	3	3	1	1	2	2	2
52	4	4	4	4	5	4	4	4	4	4	5	2	2	3	1	1	4
53	1	1	5	1	5	1	5	3	5	1	1	1	1	3	5	3	5
54	3	5	5	4	5	5	4	5	4	2	3	1	1	3	3	3	4
55	4	5	4	4	5	4	4	5	4	4	2	4	3	4	2	3	3
56	5	5	5	5	5	5	5	5	5	5	2	1	1	2	3	2	4
57	2	4	5	1	5	4	5	5	5	4	3	2	3	1	2	4	4
58	5	5	5	3	4	4	3	5	4	5	5	5	2	2	1	4	2
59	5	5	5	5	5	5	4	5	5	4	5	4	4	2	2	4	4
60	4	5	5	4	5	4	4	5	5	4	3	1	3	4	3	4	4
61	3	5	5	4	5	4	3	4	4	3	4	2	3	4	4	3	4
62	5	5	5	4	5	4	5	5	5	4	4	3	3	1	2	3	4
63	4	5	5	4	5	5	5	4	4	4	4	1	3	4	3	5	4
64	3	4	5	2	5	4	5	3	4	4	4	2	2	3	3	3	2
65	5	5	5	5	5	5	5	4	4	4	5	4	4	3	4	4	4
66	5	5	5	5	5	5	5	5	5	5	5	1	3	1	1	1	1
67	4	4	4	3	4	4	4	4	4	5	4	4	3	2	2	2	2
68	4	4	4	4	5	4	4	4	4	4	2	2	4	2	3	4	4
69	5	5	5	5	5	5	5	5	5	4	5	2	2	2	4	2	5
70	5	5	3	4	5	5	4	5	5	3	2	2	1	3	3	2	5
71	4	4	4	3	3	3	3	3	3	3	5	4	5	2	2	4	2
<del>72</del>	<del>5</del>	<del>5</del>	<del>5</del>	<del>5</del>	<del>5</del>	<del>5</del>	<del>4</del>	<del>5</del>	<del>5</del>	<del>5</del>	<del>5</del>	<del>2</del>	<del>4</del>	<del>4</del>	<del>4</del>	<del>4</del>	<del>5</del>

Evaluation questions, ID 36 – 72

ID	After taking the BRM course, I gained a better understanding of Bridge Management.	After taking the BRM course, I gained a better understanding of Teamwork.	After taking the BRM course, I gained a better understanding of Leadership.	After taking the BRM course, I gained a better understanding of Situational Awareness.	After taking the BRM course, I gained a better understanding of Decision Making.	After taking the BRM course, I gained a better understanding of Managing Fatigue and Stress
36	4	4	2	4	2	4
37	2	2	2	2	2	2
38	4	4	4	4	4	3
39	3	3	3	3	3	3
40	2	2	2	2	2	2
41	4	4	4	4	4	4
42	5	4	4	4	4	4
43	4	4	3	4	4	4
44	3	3	3	3	3	3
45	5	5	5	5	4	5
46	3	3	3	3	3	3
47	3	3	3	3	3	3
48	4	3	3	4	3	3
<del>49</del>	<del>4</del>	<del>4</del>	<del>4</del>	<del>4</del>	<del>4</del>	<del>4</del>
50	3	3	3	3	3	3
51	3	2	2	2	2	2
52	3	3	3	3	3	3
53	5	5	3	5	5	5
54	4	4	3	3	4	4
55	4	4	4	3	4	5
56	4	4	4	4	4	4
57	4	4	4	4	4	4
58	3	5	5	4	5	5
59	5	4	4	5	5	5
60	4	4	4	4	4	4
61	4	4	4	3	4	3
62	5	4	4	4	5	4
63	3	3	3	3	3	2
64	4	4	4	4	4	3
65	5	5	5	5	5	5
66	5	5	5	5	5	5
67	4	4	4	4	4	4
68	4	3	4	4	4	4
69	5	5	5	5	5	5
70	4	4	4	4	5	3
71	4	4	4	4	4	4
<del>72</del>	<del>4</del>	<del>4</del>	<del>3</del>	<del>4</del>	<del>4</del>	<del>3</del>

Statements 1, 3, 4, 5, 7, 8, 9, 10, 15

<b>Statement 1</b>		
	Variable 1	Variable 2
Mean	4,130081301	4,030769231
Variance	0,737038518	1,030288462
Observations	123	65
Hypothesized Mean Difference	0,000	
df	113	
t Stat	0,671967286	
P(T<=t) one-tail	0,251488045	
t Critical one-tail	1,658450216	
P(T<=t) two-tail	0,50297609	
t Critical two-tail	1,981180359	

<b>Statement 3</b>		
	Variable 1	Variable 2
Mean	4,658536585	4,630769231
Variance	0,505397841	0,330288462
Observations	123	65
Hypothesized Mean Difference	0,000	
df	156	
t Stat	0,289647632	
P(T<=t) one-tail	0,386235217	
t Critical one-tail	1,654679996	
P(T<=t) two-tail	0,772470434	
t Critical two-tail	1,975287508	

<b>Statement 4</b>		
	Variable 1	Variable 2
Mean	3,62601626	3,692307692
Variance	1,18685859	1,247596154
Observations	123	65
Hypothesized Mean Difference	0,000	
df	128	
t Stat	-0,39033443	
P(T<=t) one-tail	0,348469047	
t Critical one-tail	1,656845226	
P(T<=t) two-tail	0,696938093	
t Critical two-tail	1,97867085	

<b>Statement 5</b>		
	Variable 1	Variable 2
Mean	4,495934959	4,676923077
Variance	0,56350793	0,347115385
Observations	123	65
Hypothesized Mean Difference	0,000	
df	159	
t Stat	-1,81701772	
P(T<=t) one-tail	0,0355487	
t Critical one-tail	1,654493503	
P(T<=t) two-tail	0,0710974	
t Critical two-tail	1,974996213	

<b>Statement 7</b>		
	Variable 1	Variable 2
Mean	4,170731707	4,230769231
Variance	0,896841263	0,555288462
Observations	123	65
Hypothesized Mean Difference	0,000	
df	159	
t Stat	-0,47711541	
P(T<=t) one-tail	0,316967536	
t Critical one-tail	1,654493503	
P(T<=t) two-tail	0,633935072	
t Critical two-tail	1,974996213	

<b>Statement 8</b>		
	Variable 1	Variable 2
Mean	4,317073171	4,338461538
Variance	0,660935626	0,602403846
Observations	123	65
Hypothesized Mean Difference	0,000	
df	136	
t Stat	-0,17676209	
P(T<=t) one-tail	0,429979115	
t Critical one-tail	1,656134988	
P(T<=t) two-tail	0,860	
t Critical two-tail	1,977560777	

<b>Statement 9</b>		
	Variable 1	Variable 2
Mean	4,512195122	4,446153846
Variance	0,56337465	0,407211538
Observations	123	65
Hypothesized Mean Difference	0,000	
df	150	
t Stat	0,634160492	
P(T<=t) one-tail	0,263471006	
t Critical one-tail	1,6550755	
P(T<=t) two-tail	0,527	
t Critical two-tail	1,976	

<b>Statement 10</b>		
	Variable 1	Variable 2
Mean	4,06504065	4,061538462
Variance	0,782620285	0,652403846
Observations	123	65
Hypothesized Mean Difference	0,000	
df	141	
t Stat	0,027	
P(T<=t) one-tail	0,489110536	
t Critical one-tail	1,655732287	
P(T<=t) two-tail	0,978	
t Critical two-tail	1,977	

<b>Statement 15</b>		
	Variable 1	Variable 2
Mean	2,805	2,630769231
Variance	1,142	0,955288462
Observations	123,000	65
Hypothesized Mean Difference	0,000	
df	141,000	
t Stat	1,124	
P(T<=t) one-tail	0,131	
t Critical one-tail	1,656	
P(T<=t) two-tail	0,263	
t Critical two-tail	1,977	

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**Managing fatigue & stress**

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Statements 2, 6, 14, 16

<b>Statement 2</b>		
	Variable 1	Variable 2
Mean	4,243902439	4,4
Variance	0,628548581	0,525
Observations	123	65
Hypothesized Mean Difference	0,000	
df	141	
t Stat	-1,35932058	
P(T<=t) one-tail	0,088107545	
t Critical one-tail	1,655732287	
P(T<=t) two-tail	0,17621509	
t Critical two-tail	1,976931489	

<b>Statement 6</b>		
	Variable 1	Variable 2
Mean	4,308943089	4,338461538
Variance	0,657870185	0,539903846
Observations	123	65
Hypothesized Mean Difference	0,000	
df	142	
t Stat	-0,25261064	
P(T<=t) one-tail	0,400467202	
t Critical one-tail	1,655655173	
P(T<=t) two-tail	0,800934405	
t Critical two-tail	1,976810994	



<b>Statement 14</b>		
	Variable 1	Variable 2
Mean	2,585	2,384615385
Variance	1,245	1,084134615
Observations	123,000	65
Hypothesized Mean Difference	0,000	
df	138,000	
t Stat	1,226	
P(T<=t) one-tail	0,111	
t Critical one-tail	1,656	
P(T<=t) two-tail	0,222	
t Critical two-tail	1,977	

<b>Statement 16</b>		
	Variable 1	Variable 2
Mean	3,016	2,861538462
Variance	1,213	1,246153846
Observations	123,000	65
Hypothesized Mean Difference	0,000	
df	129,000	
t Stat	0,908	
P(T<=t) one-tail	0,183	
t Critical one-tail	1,657	
P(T<=t) two-tail	0,366	
t Critical two-tail	1,979	

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## Leadership

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Statement 11, 12, 13

<b>Statement 11</b>		
	Variable 1	Variable 2
Mean	3,528	3,6
Variance	1,333	1,30625
Observations	123,000	65
Hypothesized Mean Difference	0,000	
df	132,000	
t Stat	-0,407	
P(T<=t) one-tail	0,342	
t Critical one-tail	1,656	
P(T<=t) two-tail	0,685	
t Critical two-tail	1,978	

<b>Statement 12</b>		
	Variable 1	Variable 2
Mean	2,846	2,553846154
Variance	1,361	1,563461538
Observations	123,000	65
Hypothesized Mean Difference	0,000	
df	123,000	
t Stat	1,556	
P(T<=t) one-tail	0,061	
t Critical one-tail	1,657	
P(T<=t) two-tail	0,122	
t Critical two-tail	1,979	

<b>Statement 13</b>		
	Variable 1	Variable 2
Mean	2,675	2,584615385
Variance	1,713	1,527884615
Observations	123,000	65
Hypothesized Mean Difference	0,000	
df	137,000	
t Stat	0,466	
P(T<=t) one-tail	0,321	
t Critical one-tail	1,656	
P(T<=t) two-tail	0,642	
t Critical two-tail	1,977	

Statement 17

<b>Statement 17</b>		
	Variable 1	Variable 2
Mean	3,138	3,246153846
Variance	1,218	1,375961538
Observations	123,000	65
Hypothesized Mean Difference	0,000	
df	124,000	
t Stat	-0,612	
P(T<=t) one-tail	0,271	
t Critical one-tail	1,657	
P(T<=t) two-tail	0,541	
t Critical two-tail	1,979	