

DECISION MAKING OF MARITIME JUNIOR WATCH OFFICERS:  
A PHENOMENOLOGICAL STUDY

by

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Liberty University

A Dissertation Presented in Partial Fulfillment  
Of the Requirements for the EDUC 990 Course

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## ABSTRACT

The tanker *Exxon Valdez* and cruise ship *Empress of the North* were each involved in a major incident involving poor decision making by the junior officer on watch, resulting in the grounding of their vessels. The purpose of this hermeneutic phenomenological qualitative study was to describe the decision-making process of 15 maritime junior watch officers in a high-resolution simulation in adverse-condition scenarios. Data collection utilized observations, interviews and a self-efficacy assessment. For data analysis I used the constant comparative method applied to the data, developing codes, which were analyzed and reduced to 3 key themes: (a) the Decision-Making Process, (b) Factors in Decision Making, and (c) Motivations and Solutions to Decision Making. The findings suggested that working or short-term memory; emotional intelligence; self-efficacy; and skills, rules and knowledge were major factors of how successfully novice decision makers made their decisions. At least 2 of these factors are within the affective domain. The results indicated that maritime educators who utilize teaching aids and methods that stimulate the affective domain as early as possible in the education process will be promoting growth in the decision-making skills of students. The results also indicated that implementation of a mentoring program within the maritime industry and making it a part of the normal practice for new officers will continue to foster strong decision-making skills. To that end, curriculum for leadership and managerial skills courses required in maritime education should include benefits of a mentoring program and how such a program should be implemented.

*Keywords:* maritime junior watch officers, novice decision making, self-efficacy, emotional intelligence, working memory, maritime education, affective learning objectives, mentoring.

## **Dedication**

To the following:

My wife Paula

My sons John and Joshua

My daughter Jennifer and her very special children Kaitlyn and Ronnie

And to my best two friends:

T. L. Ward

Arthur H. Goldman Jr.

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### List of Abbreviations

Assistant Reactor Operator (ARO)

Bridge Resource Management (BRM)

Closest Point of Approach (CPA)

Critical Decision Method (CDM)

Crystallized Intelligence (*gC*)

Electronic Chart Display and Information System (ECDIS)

Emotional Competency Inventory (ECI)

Emotional and Social Competency Inventory (ESCI)

Emotional Intelligence (EI)

General Fluid Intelligence (*gF*)

General Intelligence (*g*)

General Self-Efficacy Questionnaire (GSE)

Institutional Review Board (IRB)

International Maritime Organization (IMO)

International Regulations for Preventing Collisions at Sea, also known as Rules of the Road  
(COLREGS)

Naturalistic Decision Making (NDM)

National Transportation Safety Board (NTSB)

Officer-In-Charge of an Engineering Watch (OICEW)

Officer-In-Charge of a Navigation Watch (OICNW)

On the Job Training (OJT)

Protection and Indemnity Insurance (P&I)

Reactor Operator (RO)

Recognition Primed Decision (RPD)

Salivary Amylase Activity (SAA)

Short Term Memory (STM)

Situation awareness (SA)

Standards of Training, Certification and Watchkeeping (STCW)

Supervisor Reactor Operator (SRO)

United Kingdom (UK)

United States (US)

United States Coast Guard (USCG)

Working Memory (WM)

## CHAPTER ONE: INTRODUCTION

### Overview

John Konrad (2007), an experienced deck officer, posed some poignant questions in a blog comparing the groundings of the Exxon Valdez and the Empress of the North. Konrad pondered:

- Did the mate attempt to contact the captain when he first sensed trouble and if not why was the captain not on the bridge at the time of the grounding?
- Was the mate experienced in this turn and if not why the captain did not wake up for the maneuver? (para. 9)

According to the National Transportation Safety Board (NTSB, 1990) investigation, fatigue was the major contributing factor in the grounding of the *Exxon Valdez*. However, Konrad (2007), like many other experienced deck officers, wondered why no one inquired more deeply into the problem resulting from the decision that was made by the third officer. “Maybe if the journalists and public had determined the true cause of the *Exxon Valdez* different regulations would have been in place and the *Empress of the North* incident would not have happened” (Konrad, 2007, para. 10).

Gladwell (2008) suggested that for anyone to become an expert at anything would take 10,000 hours or 10 years of experience in a particular field. Numerous studies have been conducted on experienced decision makers and how they rely on their previous knowledge and experience to formulate a good decision (Brezovic, Klein, & Thordsen, 1987; Calderwood & Macgregor, 1989; Dane, Pratt, & Rockmann, 2012; Dhillon, 2007; Feltz & Hepler, 2012a; Feltz & Hepler, 2012b; Hall, 2010; Hoy & Tarter, 2010; Klein, 1998; Klein, 2008; Klein, Calderwood, & Macgregor, 1989; Nara, 2010; Randel & Pugh, 1996; Watson, 2010; Wiggins & Boliwerk,

2006). However, at the time of this study, there was a paucity of studies that focused on the novice or inexperienced decision makers in an unfamiliar, complex, and time-critical situation (Amel, 1995; Chalko, Ebright, Patterson, & Urden, 2004; Gillespie & Paterson, 2009; Hoffman, Aitken, & Duffield, 2009; Kosowski & Roberts, 2003). Furthermore, there were no empirical studies exploring decisions made by novice individuals in the maritime domain. This study focused on and described the experiences of junior deck watch officers with less than two years of experience performing as the sole decision maker in a high-resolution, full bridge simulator.

### **Background**

Cargo and passengers are typically transported by one of four methods: (a) by trucks or buses on roads; (b) by rail; (c) by air on passenger or cargo planes; and (d) by water on passenger or cargo ships (Dhillon, 2007). The focus of this study was on waterborne transportation, better known as the commercial maritime industry. Establishing an understanding of the organization of the maritime industry, personnel, and vessels provides essential background information for this study.

The maritime industry is broken down into three major categories. The first category is dockside or logistic operations of the loading or unloading of passenger or cargo ships. These operations include occupations such as longshoremen, truck drivers, and rail services. The second category is shipyards operations, where ships are built and repaired (Dhillon, 2007). The third part of this industry is shipboard operations, which was the focus of this study. Vessel operations vary depending on the occupation or service provided by the vessel and on the size of the vessel. This category includes a variety of ships from as small as 12-foot harbor tugs, to as large as 6000-passenger cruise ships, 18,000-unit capacity container ships, or 1600-foot super tankers (Greenman, 2013).

Most ships have three major personnel departments: (a) the engineering department that operates and repairs the ship's machinery; (b) the steward department where meals are cooked for passengers and crew; and (c) the deck department, which is responsible for the overall operations and safe navigation of the ship (Meurn, 2014). The ship's master, also known as the ship's captain, is the person who has the overall responsibility for the vessel. Those who are immediately under the captain in the deck department are known as the deck officers or mates (Schröder-Hinrichs, Hollnagel, & Baldauf, 2012). The senior deck officer is known as the chief mate or first officer and is considered second in command. If in the event the captain is incapacitated and unable to perform his or her duties, then the chief mate will become the shipmaster. Under the chief mate is the second officer or mate who is recognized as the ship's navigator and is responsible to the captain for the planning and execution of the ship's navigation and route. Finally, the most junior officer is the third officer or mate whose primary responsibility is to the chief mate for the maintenance and care of the ship's lifesaving gear (Meurn, 2014). All three deck officers are the actual watchstanders and the primary decision makers when the captain is not on the bridge (Hayler, 1989; Meurn, 2014; Schröder-Hinrichs et al., 2012).

The lowest members of the deck hierarchy are the individuals who are unlicensed deckhands. These members of the deck department are the able seamen, who are considered skilled workers, and the ordinary seamen who are known as the unskilled workers. The seamen's foreman on deck is the ship's boson, who is a seasoned and experienced senior able seaman. While the ship is at sea, the able seamen stand watch as the ship's helmsman, and if required, the ordinary seaman may stand a watch on the bridge as the ship's lookout (Hayler, 1989; Meurn, 2014; Schröder-Hinrichs et al., 2012).



In addition to the organization of the industry and personnel, the organization of the vessels is important to understand. The bridge of most commercial ships has numerous computerized displays and controls that can make the bridge of the ship as complex as a cockpit of a modern day passenger plane. The purpose behind these various displays and controls is to assist the deck officer in the safe operation of the vessel and to safely navigate the vessel in a variety of weather and traffic conditions (Meurn, 2014). In spite of all the available technology, training, and regulations, groundings and collisions, otherwise known as maritime incidents, continue to occur (Giziakis, Goulielmos, & Lathouraki, 2012; Hetherington, Flin, & Mearns, 2006; UK P&I Club, 1990; UK P&I Club, 1996).

Several research studies (Dhillon, 2007; Giziakis et al., 2012; Grech, Horberry, & Koester, 2008; Hetherington et al., 2006; Lin, 2006; Rothblum, 2000; UK P&I Club, 1996; Wang & Zhang, 2000) have suggested that an estimated 80% of maritime incidents are attributed to human error. An analysis by Giziakis et al. (2012) proposed that, despite the development of international standards in maritime education and assessment, the numbers of marine incidents attributed to the human element have not declined. Researchers (Grech et al., 2008; Lin, 2006; Rothblum, 2000; Wang & Zhang, 2000) have identified several factors pertaining to the human element that could be causes of maritime casualties including (a) lack of training, (b) lack of experience overall or with the particular vessel, (c) fatigue, (d) stress, and (e) excessive workload. These danger factors are important to consider when assigning personnel to standing watch, whether on the bridge or in the engine room.

The ship's bridge is the command and control center of the vessel. When a ship is at sea, the bridge is operated 24 hours a day with a sole officer on watch. A *watch*, also referred to as *standing a watch*, *watchstanding*, or *watchkeeping*, is a nautical term that involves a group of

qualified personnel performing a duty at an assigned place and controlling the operations of a ship during a specified time period. A typical seagoing vessel has qualified personnel performing a watch on the bridge and in the engine room. A bridge watch usually consists of a lookout, a helmsman, and an officer, who are responsible for the safe navigation of the ship (Hayler, 1989; Meurn, 2014). The term *safe navigation* means keeping the vessel on a planned course and away from dangers, such as collision with other vessels. Engineering watchstanders on the other hand, ensure the continuous operation of the mechanical and electrical power of the vessel (Hayler, 1989; Meurn, 2014).

Those who serve as deck watch officers are the decision makers during their watch. If necessary, the officer on watch seeks assistance from the captain. Of these watch officers, the second and third mates often have less than five years of decision-making experience at sea. This inexperience is caused by the fact that the sea time requirement for promotion from third mate to second mate is one year and from second mate to chief mate is one year (Requirements for Officer Endorsements, 2014). For the purpose of this study, officers with less than two years' sea experience are considered inexperienced and are referred to as junior watch officers.

Failing to make the right critical decision in a timely manner may result in serious consequences for both the vessel and the crew, and has been the focus of investigations conducted by the NTSB. The board focused on two major incidents that involved the questionable decisions of two junior officers. Because of the junior officers' poor decision making, the tanker *Exxon Valdez* (NTSB, 1990) and the cruise ship *Empress of the North* (NTSB, 2008) both ran aground and, in the case of the *Exxon Valdez*, caused a major environmental disaster occurred (Grech et al., 2008; Konrad, 2007; Lin, 2006; Rothblum, 2000; Wang & Zhang, 2000).

### **Situation to Self**

I have been part of the maritime industry for over 30 years, and during this period, I have acquired a Master's degree in Professional Counseling. This educational background provides me new opportunities to explore human behaviors and interactions. This knowledge has been an asset when it comes to educating mariners, especially those who are struggling with difficult and unfamiliar concepts. As a counselor and educator, it is natural for me to get close to individuals in their environments and study their behaviors. Such individuals studying to become officers are educated and trained to make critical decisions, and it is this common experience and the phenomenon of decision making that draws me to this area of research. My goal is to improve education for newly minted officers, thereby potentially reducing maritime incidents.

Research was conducted using a qualitative, hermeneutic phenomenological approach. The interpretive framework was based upon social constructivism and a philosophical belief system of epistemological research (Creswell, 2013; van Manen, 1990). Through hermeneutic phenomenology, the research design put participants in a common scenario to include decision making in the maritime domain while experiencing a complex, ill-defined, time-critical situation, and later inquired into the meaning of the descriptions of their experiences. The experiences of the participants are subjective in that it is their understanding of the events. My job was to extrapolate meaning from these descriptions and create themes or a story of the collective experiences (Creswell, 2013; van Manen, 1990).

The study's orientation was an epistemological, philosophical assumption. An epistemological, philosophical method requires the researcher to get as close as possible to the participants in order to assemble evidence based upon the participants' experiences. Therefore, I tried to learn what the individuals understood about their experiences. (Belbase, 2011; Creswell,

2013; Levering, 2006).

### **Problem Statement**

The problem is human error accounts for as much as 80% of maritime incidents. There is a need for both the maritime industry and education to seek ways to reduce these incidents. Reducing maritime incidents, will save lives, the environment, and help the industry in reducing the costs in doing business (Dhillon, 2007; Grech et al., 2008; Hetherington et al., 2006; Lin, 2006; Rothblum, 2000; UK P&I Club, 1996; Wang & Zhang, 2000). Of the maritime incidents attributed to human error, 44% were ascribed to the ship's crew. Furthermore, of the ship's crew, deck officers were responsible for 25% of those incidents (UK P&I Club, 1996). The data was similar to the findings by Giziakis et al. (2012), who found that 32% of incidents were caused by the ship's officers and 16% by the ship's crew for a total of 48%. The UK P&I Club (1996) reported that 20% of second officers had less than five years of sea time experience. Additionally, of those second officers, 70% had less than five years in their present rank.

Another report by the UK P&I Club (1990) focusing on major claims that were paid out, suggested that pertaining to maritime collisions, the seniority of the bridge officers played an important factor in the collision of the vessel. The report indicated that the captain was only involved in 33% of the incidents while the second officer was twice as likely to be involved in the collision of the vessel (UK P&I Club, 1990). The report recommended that the industry seriously reexamine the training process of junior officers, specifically second officers. Oddly, the UK P&I Club reports do not address third officers, even though they make up one third of the bridge watch officers' team. It was the intent of this study to examine the decision-making process of all bridge officers with less than two years of sea-going experience.

Investigation teams cited various reasons for the human-error-related incidents. Yet,

none of these investigative teams went into the deeper question concerning why the poor critical decisions were made (Giziakis et al., 2012; Konrad, 2007). Currently, empirical research on shipboard operations has come from outside the United States. This lack of research warrants that decision-making studies related to the maritime domain should be conducted in the United States (U.S.), where there are numerous studies investigating and pertaining to unfamiliar, complex, and time-critical decision making in nuclear reactor operators (Lina, Shiangb, Chuangb, & Lioud, 2014), sports players (Feltz & Hepler, 2012a; Feltz & Hepler, 2012b;), medical care (Chalko et al., 2004; Gillespie & Paterson, 2009; Hoffman et al., 2009; Kosowski & Roberts, 2003;), the military (Azuma, Daily, & Furmanski; 2006, Brezovic et al., 1987; Klein, 1998; Klein, 2008; Klein et al., 1989), firefighting (Hall, 2010; Klein, 1998; Klein, 2008; Klein et al., 1989; Useem, Cook, & Sutton, 2005), and aviation (Amel, 1995; Dhillon, 2007; Klein, 1998; Klein, 2008; Klein et al., 1989; Nara, 2010; Prince, Hanel, & Salas, 1993; Wiggins & Boliwerk, 2006). Unfortunately, there has been little empirical research on maritime decision making (Hockey, Healey, Crawshaw, Wastell, & Sauer, 2003; Lin, 2006) and none on novice decision makers, such as junior deck officers who are in environments that are unfamiliar, complex, and time-critical.

### **Purpose Statement**

The purpose of this phenomenological study was to describe the decision-making process of maritime junior watch officers navigating a vessel in adverse situations on a high-resolution, full mission bridge simulator. By understanding the underlying reasoning behind the decision-making process, maritime educators may devise new teaching methods to reduce the tendency toward poor decision making, which often results in maritime incidents. Some research has suggested that self-efficacy plays a role in the decision-making process (Boscardin, O'Sullivan,

Plant, Sliwka, & van Schaik, 2011; Feltz & Helper, 2012a; Feltz & Hepler, 2012b). Bandura (1977) defined self-efficacy as a level of confidence that an individual has in his or her ability to execute certain courses of action or achieve specific outcomes. Additionally, the purpose of this study was to explore the role of self-efficacy of the participants' performances in the simulator by what they described about their experiences and their decisions.

### **Significance of the Study**

Because most decision-making theories are based upon prior experiences in making good decisions, this study adds to the body of knowledge regarding novice decision making in an isolated environment (Chalko et al., 2004; Feltz & Hepler, 2012a; Feltz & Hepler, 2012b; Gigerenzer & Gaissmaier, 2011; Hoy & Tarter, 2010; Klein, 2008; Klein, personal communication, March 14, 2014). It is important to know how novice decision makers describe their decision-making experiences in unfamiliar, ill-defined, and time-critical environments. The themes developed from this research have contributed to improved procedures and curriculum in maritime education, fostering new decision-making methods. In addition, this study has implications in other fields that employ novice decision makers in isolated environments that are unfamiliar, complex, and time-critical (Grech et al., 2008).

Maritime education can glean valuable information from the insights and reflections of junior officers. This information can be utilized for developing or adapting education techniques and curriculum, specifically with the use of simulated experiences, targeted to reduce errors in decision-making. Furthermore, these simulated experiences assist junior deck officers in gaining critical experience prior to standing their next watch on the bridge. Additionally, the maritime community benefits from this study through a reduction in the human error percentage factor resulting from inexperienced deck officers, which in turn leads to a reduction in costs of

shipboard operations, decreases chances of damage to the environment, and saves lives (Dhillon, 2007; Giziakis et al., 2012; Grech et al., 2008; Lin, 2006; Rothblum, 2000; UK P&I Club, 1996; Wang & Zhang, 2000).

### **Research Questions**

The phenomenon in focus for this study was the critical decision making of junior deck officers with less than two years of experience. Given a special situation and environment, an inquiry was made based upon the participants' understanding and descriptions of their decisions (Creswell, 2013; Levering, 2006). Furthermore, the study examined factors and motivations of the decision-making process of junior officers.

This qualitative hermeneutic phenomenological study was guided by the following three research questions (RQ):

*RQ1: While navigating their vessel, how do maritime junior watch officers describe their decision-making process in an adverse situation?* This was the main question of the study. The phenomenon being studied was how the participants described their experience with the situations presented and how well they understood the reasons for their decision making within an adverse, simulated environment (Gillespie & Paterson, 2009).

*RQ2: What factors do participants identify as affecting (positively or negatively) their critical decision-making process?* A decision made, whether good or bad, by a novice decision maker reveals insights into the process used to come to the decision (e.g. intellect, epiphany, imagination, or dumb luck). The participants described their thoughts and subsequent actions which led to a particular decision (Klein et al., 1989).

*RQ3: What motivated the participant's decision when choosing one solution over another?* This question is an adaptation of the Critical Decision Model by Klein et al. (1989),

developed as a structured interview method for eliciting expert knowledge. When novice decision makers have made a decision, why did they choose one option over another or what motivated one decision over another (Klein et al., 1989)?

### **Research Plan**

The international community recognizes that human error is one of the primary reasons for maritime incidents. Both international and federal laws have been made to enforce safety management systems and require education and hands-on training; nevertheless, there is little evidence that these laws have brought about positive changes in the number of maritime incidents (Giziakis et al., 2012). This study has the potential to shed light into a portion of the transportation industry that currently has a scant amount of empirical research. It would be impossible to study all of the issues regarding the human elements; therefore, this investigation focused on a small segment of the industry with the greatest potential for incidents, the junior officer (UK P&I Club, 1996). The study was hermeneutic phenomenology conducted from an epistemology assumption and social constructivism framework describing the decision making of junior officers.

Creswell (2013) discussed two types of phenomenological research primarily used by researchers: transcendental phenomenology, which is purely descriptive; and hermeneutic phenomenology, which is considered interpretive. Van Manen (2011), discussing Martin Heidegger, a disciple of Husserl, considered that all description is interpretive or that every form of human awareness is interpretive. Hans-Georg Gadamer, (van Manen, 2011) a student of Heidegger, explored the role of language, the nature of questioning, and the phenomenology of human conversation. He also studied the significance of prejudice and tradition in the project of human understanding (Moustakas, 1994; van Manen, 2011).



According to van Manen (2011), Paul Ricoeur did not subscribe to the transparency of the self-reflective cogito of Husserl. Ricoeur argued that meanings are not given directly to us, and that we must therefore make a hermeneutic deviation through the symbolic apparatus of the culture. His hermeneutic phenomenology identified “how human meanings are deposited and mediated through myth, religion, art, and language” (van Manen, 2011, para. 3).

According to Moustakas (1994), hermeneutic phenomenology is concerned with understanding the contexts in which the researcher aims to create a rich and deep account of a phenomenon through intuition. This study focused on uncovering and amplifying the data while avoiding prior knowledge. Research often reveals details that have seemingly trivial aspects within experience and thus may be taken for granted. The goal was to create meaning and achieve a sense of understanding of decision making. Moustakas stated, “In the hermeneutic circle, prejudgments are corrected in view of the text, the understanding of which leads to new prejudgments. The prejudgments that lead to pre-understanding are constantly ‘at stake;’ their surrender could also be called a transformation” (Moustakas, 1994, p. 10). As the researcher, I reflected deeply on what the texts of the field had to say. I poured over the texts to become immersed within the dialogue. It is the goal of hermeneutic phenomenology research not to clone the texts for the reader, but to invite the reader to enter the world that the texts have developed before them (Creswell, 2013; Moustakas, 1994; van Manen, 1990).

Belbase (2011), in discussing constructivist epistemological assumption, considered: (a) the individual actively constructs knowledge, (b) knowledge and the individual are interconnected and the world is subjective, and (c) knowledge is built upon our personal experiences. Mental construction continues to change over time, due to the process of adapting new knowledge and individual gains through experience. Therefore, constructivist epistemology

considers that knowledge is self-adaptive and based upon new experiences. Consequently, what one person knows of an event might be very different from what another person knows about the same event at the same time and in the same context (Belbase, 2011).

Because the participants' experiences were subjective, this study sought to discover a pattern of meaning of those experiences; therefore, the study framework was social constructivism (Creswell, 2013). The framework of social constructivism seeks to understand the world around us. Belbase (2011), in discussing social constructivism, proposed that scientific knowledge begins with personal constructs of the individual researcher in a raw form. In other words, personal biases are also a part of the research. This raw knowledge is then brought to the scientific community where it may be discussed among members of the community through publications, oral presentations, and group discussions. It is in the scientific community where this processed information becomes new knowledge (Belbase, 2011).

### **Delimitations and Limitations**

#### **Delimitations**

This research utilized a simulated environment rather than a real-life experience. Certainly, being at sea could present greater distractions than what could actually be simulated, such as fatigue and walking on an unstable platform; however, the simulation allowed the participants to reenact hazardous conditions without risk of any real harm (Emad, 2011; Emad & Roth, 2008; Grech et al., 2008; Hall, 2010; Lin, 2006). In the decision-making scenarios, the officer of the watch was assigned both a helmsman to steer the ship and a radar operator to assist the officer on watch in monitoring traffic. A potential limitation to the study could have occurred if one of the two individuals assigned to the officer on watch failed to obey orders. However, it was the responsibility of the officer on watch to catch their mistakes and take

appropriate action as part of the decision-making process.

Because the participants were using a simulator as part of their task, a concern could have been that the participants' performance was impacted because they were conscious that they were being observed. However, measures were taken to reduce the likelihood that participant performance was affected. For example, the instructor was located in a separate control room, conducting the observations of the participants through the instructor monitors. The camera in the simulator was located in the overhead ceiling and was inconspicuous. Furthermore, the participants had already participated in simulation exercises four times before the study commenced. Therefore, even though the participants were aware that they were being observed by their instructor, that knowledge was no longer novel. Likewise, my research observations were conducted from the instructor's control station and I was not visible to the participants until I approached them about volunteering to participate in a study.

In addition, this study utilized select participants from the U.S. The demographics of the study were limited to new junior officers in the U.S. The demographic numbers were drawn from public records posted on the web by the seven maritime universities, six of which are state owned: Maine Maritime Academy, Massachusetts Maritime Academy, State University of New York Maritime College, Great Lakes Maritime Academy, Texas Maritime Academy, and California Maritime Academy. The one that is federally owned is the U.S. Merchant Marine Academy ("United States Merchant Marine," 2014).

### **Limitations**

The maritime domain is a truly globalized industry. Worldwide commercial shipping has a diversity of officers and crews, with most of the officers coming from Europe and the crews, which are sometimes unlicensed, often coming from South and Southeast Asia (UK P&I, 1996).

This study utilized U.S. mariners from both genders and from various ethnic backgrounds. However, it is impossible to determine if this is an accurate sampling of the broader mariner population, because the U.S. Coast Guard (USCG) does not keep records of that type of information (Dutra, personal communication, March, 14, 2014). Therefore, caution must be taken in generalizing the results of this study to a broader population, indicating the need for further research.

### **Definitions**

1. *Deck department* – Deck department refers to the department aboard a ship responsible for navigation, cargo, command, and control functions (Merchant Mariner Credential, 46 C.F.R. Part 10, 2014).
2. *Decision making* – Decision making means applying logical and sound judgment based on the information available (United States Coast Guard Auxiliary, 1998).
3. *Expert* – Expert refers to individuals who have over 10 years of experience and would be recognized as having achieved proficiency in their domain (Gladwell, 2008; Klein et al., 1989).
4. *Human error* – Human error means either the failure to carry out a specific task or the performance of a forbidden action that could lead to the disruption of scheduled operations or result in damage to property or equipment (Dhillon, 2007).
5. *Marine casualty* – Marine casualty refers to an event, or a sequence of events, which have occurred directly in connection with the operations of a ship, that have resulted in any of the following:
  - a. The death of, or serious injury to, a person;
  - b. The loss of a person from a ship;

- c. The loss, presumed loss, or abandonment of a ship;
- d. Material damage to a ship;
- e. The stranding or disabling of a ship, or the involvement of a ship in a collision;
- f. Material damage to marine infrastructure external to a ship, that could seriously endanger the safety of the ship, another ship, or an individual;
- g. Severe damage to the environment, or the potential for severe damage to the environment, brought about by the damage of a ship.

However, a marine casualty does not include a deliberate act or omission, with the intention to cause harm to the safety of a ship, an individual or the environment (International Maritime Organization [IMO], 2008).

6. *Marine incident* – Marine incident refers to an event, or sequence of events, other than a marine casualty, which has occurred directly in connection with the operations of a ship that endangered, or, if not corrected, would endanger the safety of the ship, its occupants or any other person or the environment. However, a marine incident does not include a deliberate act or omission, with the intent to cause harm to the safety of a ship, an individual or the environment (IMO, 2008).
7. *Master or Captain* – Master or captain refers to the officer having command of a vessel (Merchant Mariner Credential, 46 C.F.R. Part 10, 2014).
8. *Mate or Deck Officer* – Mate or deck officer refers to a qualified officer in the deck department other than the master (Merchant Mariner Credential, 46 C.F.R. Part 10, 2014).
9. *Novice* – Novice is a term that is used strictly in the relative sense to a person who has had significantly less experience than the experts (Klein et al., 1989).
10. *Officer in charge of a navigational watch (OICNW)* – OICNW refers to a deck officer

qualified at the operational level (Merchant Mariner Credential, 46 C.F.R. Part 10, 2014).

11. *Operational level* – Operational level means the level of responsibility associated with:

- a. Serving as officer in charge of a navigational or engineering watch, or as designated duty engineer for periodically unmanned machinery spaces, or as radio operator onboard a seagoing ship; and
- b. Maintaining direct control over the performance of all functions within the designated area of responsibility in accordance with proper procedures and under the direction of an individual serving in the management level for that area of responsibility  
(Merchant Mariner Credential, 46 C.F.R. Part 10, 2014).

12. *Seafarer or Mariner* – Seafarer or mariner means any person who is employed or engaged in any capacity on board a ship (IMO, 2008).

13. *Situation or situational awareness (SA)* – Situation or SA means the ability to identify, process, and comprehend the critical elements of information about what is happening to the team in regard to the mission. More simply, it is individuals knowing what is going on around them (United States Coast Guard Auxiliary, 1998).

### **Summary**

In as much as 80% of maritime incidents, human error has been suggested to be the primary cause. Of that number, 25% are attributed to deck officers and watchstanders, of whom one third are considered junior and inexperienced decision makers. It was the purpose of this study to describe the decision-making process of these junior officers. By examining that process, this study has implications for those who conduct education and training for these junior officers. This study has implications in future designs for ships' bridges and for policy makers responsible for the policies and procedures pertaining to manning and watchstanding.

This chapter presented the problem and purpose statements, as well as the significance of the study. Furthermore it presented the research questions and plan for this study. The next chapter will review the body of literature related to this study.

## **CHAPTER TWO: LITERATURE REVIEW**

### **Overview**

New deck officers may have sea-time experience, but they do not have the experience of time on their side when it comes to making critical and time-sensitive decisions. This chapter examined the literature on decision making as it relates to the real or natural world and to maritime education. The goal of the study was not just to describe the novice or junior officers' decision-making process, but to ultimately develop training and education methods to assist these new officers in their future endeavors as responsible and safe watchstanders. To that end, an examination of various theories was needed for establishing a theoretical framework for this study. Theories related to the following topics were explored: memory; skills, rules and knowledge; and various aspects of decision making.

### **Theoretical Framework**

This study focused on junior officer decision making. No one is quite sure what a person is thinking when coming to one conclusion or another. Because the mind is where decisions are formulated, understanding how memory affects a person's ability to arrive at a particular decision is necessary, and related memory theory was examined. Exploring various decision-making theories, including how one's emotions are a part of a person's decision making, is also important to this study and therefore was examined. Finally, recent research particular to decision making in the maritime was examined.

### **Short-Term Memory, Working Memory, and Intelligence**

Theories of memory and how it affects both learning and making decisions were important for this study. Novice decision makers may be hampered by the limitation of their brains' ability to process multiple tasks. These limitations could be further exasperated when



conditions become time sensitive and complex. Miller (1994) proposed that an average person can hold between five and nine objects in immediate memory. By conducting an analysis on several studies that used various stimuli such as pitch, loudness, taste, points of lines, and points of squares, Miller concluded that in a one-dimensional absolute-judgment task, a person can perform at almost perfect recollection up to five or six different stimuli, but recollection declines as the number of different stimuli is increased. Miller stated:

You may have noticed that I have been careful to say that this magical number seven applies to one-dimensional judgments. Everyday experience teaches us that we can identify accurately any one of several hundred faces, any one of several thousand words, any one of several thousand objects, etc. (p. 346)

Miller (1994) went on to point out techniques to increase one's immediate memory span by making relative judgments rather than absolute ones. In cases where making relative judgments is not possible, Miller recommended increasing the number of dimensions on which the stimuli differs, or arranging the task in such a way that a person makes a sequence of several absolute judgments in a row. Miller stated that, "Since the memory span is a fixed number of chunks, we can increase the number of bits of information that it contains simply by building larger and larger chunks, each chunk containing more information than before" (p. 349).

Short-term memory is used to retain information for a short period of time; therefore, a person can think about or manipulate that information for only a short period of time. Several studies (Dang, Braeken, Ferrer, & Liu, 2012; Engle, Tuholski, Laughlin, & Conway, 1999; Gozzi & Papagno, 2007) suggested that short-term memory (STM) and working memory (WM) are one in the same, and a relationship exists between general fluid intelligence ( $gF$ ) to both STM and WM. Engle et al. (1999) conducted research to determine if STM and WM were

indeed different constructs, and if there was a three-way relationship between STM, WM, and *gF*. Research by Engle et al., as well as by Dang et al. (2012) and Gozzi and Papagno (2007), suggested that studies have provided insufficient definitions to both WM and STM. Engle et al. defined STM “as completely and purely a subset of the WM system” (p. 311). Meanwhile, Engle et al. asserted that WM “reflects the amount of activation that can be applied to memory representations that are currently active to either bring them into focus or maintain them in focus or possibly, in the case of suppression, to dampen them from focus” (p. 312). Furthermore, Engle et al. defined *gF* as:

...the ability to solve novel problems and adapt to new situations and is thought to be nonverbal and relatively culture free. Crystallized intelligence, *gC*, alternatively refers to acquired skills and knowledge and depends on educational and cultural background.

Tests that measure *gF* include, but are not limited to, matrices and figural analyses... (p. 313)

In the discussion, Engle et al. (1999) implied that STM manages the phonological loop, which maintains and manipulates verbal information, while WM performs better with the visuospatial sketchpad, which deals with visuospatial information. The results of their findings supported the notion that WM and STM should be considered distinct, but highly related. Engle et al. stated STM relies on central executive-based controlled processing and, although WM does rely on the same memory system, STM is a sub-subsystem of WM. WM requires more demands on the central executive or controlled-attention component than does STM. In the second part of the study investigating relationships between STM, WM, and *gF*, Engle et al. offered that WM showed a strong connection to *gF*, but STM did not. The data indicated the relationship of WM and *gF* is driven by the central executive component (Engle et al., 1999). What this means for

novice decision makers is that WM should predict performance on a wide variety of cognitive tasks.

Gozzi and Papagno (2007) conducted a study involving decision making and WM with a goal to investigate the role of the phonological loop in decision making. The authors recognized that “verbal WM was active during the visual reasoning process as the articulatory suppression caused interference when problems were presented in graphical form” (Gozzi & Papagno, 2007, p. 117). The test involved a gambling task being administered to one group with a phonological loop impaired due to a brain injury and a control group with fully intact brain functions (Gozzi & Papagno, 2007). Findings suggested that the phonological loop does not play a pivotal role in decision making and the selection phonological loop did not affect the participants’ choices or the efficiency of their decision making while performing the gambling task (Gozzi & Papagno, 2007).

When conducting the memory load conditions of the test, both groups in Gozzi and Papagno (2007) showed a decline in performance; however, each group adapted different strategies to deal with the task. The study used three decks of cards from which the control and impaired groups were to select to maximize their winnings. One deck was considered a bad selection, one deck was neutral, and the third deck was considered the good selection. Although both groups did make selections from all three decks, the impaired group picked the good selection deck less often than the control group. When implementing the WM load condition in the gambling task, which involved a good deck and a bad deck, the control the group was able to determine which deck was bad, whereas participants in the memory-impaired group were uncertain about which deck was good or bad. This suggests that the participants in the memory-impaired group used consciously accessible knowledge to perform the task. Therefore, the

impaired group was unable to learn new strategies because they were using additional executive functions to maintain concurrent memory load (Gozzi & Papagno, 2007).

Martinez et al. (2011) researched the relationship between *gF* and STM in updating and processing speed in WM. One of their findings proposed that STM, WM, and executive updating is hardly distinguishable from *gF*, and another finding showed a very high relationship between *gF* and memory span. Finally, there was a highly significant correlation among STM, WM, updating, and *gF* (Martinez et al., 2011). To improve memory Martinez et al. stated that research showed “that fluid intelligence can be improved by training aimed at increasing memory span” (p. 476).

Research conducted by Dang et al. (2012) explored a debated topic on the nature of working memory and whether or not it was based in the unitary system providing general purpose resources or a more differentiated system with domain specific sub-components. The unitary system proposes that working memory is used to measure general intelligence (*g*) or general fluid intelligence (*gF*) of a single pool of general purpose WM resources. Dang et al. suggested that WM and *g* are closely related to higher cognition constructs and may be identical. The differentiation perspective proposed that:

... distinct and separable spatial and verbal systems serve as ‘slaves’ for a central control structure called ‘central executive.’ The visuo-spatial sketchpad is the slave system responsible for generating and maintaining visuo-spatial information and mental imagery. The second slave system is the phonological or articulatory loop which is specialized in the maintenance of speech based verbal information. (Dang et al., 2012, p.500)

Dang et al. (2012) demonstrated that *gF* was more strongly correlated with visuo-spatial WM than with verbal-numerical WM, and vice versa for *gC*. Additionally, the findings

suggested that patterns of relationships support the argument that WM is not a simple unitary system; rather it can be differentiated in domain-specific components which are visuo-spatial WM and verbal-numerical WM (Dang et al., 2012). The results showed a strong correlation between visuo-spatial working memory and general fluid intelligence rather than  $gC$ , and vice versa for verbal-numerical WM. Therefore, it was possible to focus training on content-specific memory components. Dang et al. suggested, “This route sounds more promising than when WM would only be a unitary resource system, and should be beneficial to certain jobs such as in air traffic control” (p. 506).

### **Skills, Rules and Knowledge**

In addition to theories on memory, the inter-relationships of skills, rules and knowledge are important to this study. For example, with mariners, the deck officer interfaces with the various complex displays and equipment on the bridge. Human operators are not passive input-output devices; instead, they are people who actively seek and select relevant information for decision making. In other words, humans are goal-oriented creatures. In the emerging field of man-machine interface, engineers have formulated a theoretical framework to explain human behavior.

Rasmussen (1983) created the Skill, Rule, and Knowledge-based Behaviors (SRK) model to describe human behavior during a variety of events, from everyday routine activities to situations that are unexpected and novel. This model is used in multiple domains to analyze human interaction with systems by not only observing their overt and covert processes, but by measuring the degree a person’s attention and conscious thought are given to specific activities (Rasmussen, 1983).

Skill-based behaviors are considered acts or activities that utilize a sensory input and

response. These behaviors are usually unconscious, routine activities that have been well rehearsed. Occasionally, the behavior or performance of an action is corrected through feedback from sensory input, which results in the development of unconscious, smooth, and deliberately improved behavior (Rasmussen, 1983). An example of a skill-based behavior is when a deck officer is maintaining a plotted course or manipulating the controls on autopilot or on radar.

In contrast to skill-based behaviors, rule-based behaviors generally involve behaviors that are guided through such things as rules, procedures, official guidelines, and instructions. This goal-oriented activity occurs when a given event happens and a corresponding action is executed. For a person to perform an appropriate action, the rule could be implied if no explicit rule is found (Rasmussen, 1983). An illustration of a rule-based behavior is when a deck officer encounters another vessel head-on; the rules of the road require that both vessels should pass on each other's portside (left side of the ship).

When a person encounters an unfamiliar environment where no known rules apply, the resulting reaction would be described as the use of knowledge-based behaviors. To solve the problem, a mental model is created through a process of selection of different plans or objectives, followed by the testing of the effect of those plans or objectives through trial and error, and finally the review and assessment of the situation before further steps are taken. Knowledge-based behaviors have a tendency to be measured and cognitively challenging (Rasmussen, 1983). A deck officer would experience this behavior if the same vessel encountered head-on goes to the starboard side (right side of the ship) instead of the recommended left side.

Using the SRK framework, Lina, Shiangb, Chuangb, and Lioud (2014), studied the performance behaviors of the supervisor reactor operator (SRO), reactor operator (RO), and

assistant reactor operator (ARO) in an advanced main control room. The findings of their research suggested that the ARO spent most of the time performing skill-based behaviors rather than rule- and knowledge-based behaviors (Lina et al., 2014). The RO demonstrated no significant difference among all three behaviors, but did show a slight increase in use of rule-based behaviors versus skill-based behaviors. The SRO followed both the rule-based and the knowledge-based behaviors, which was the main source for the SRO's problem-solving and decision-making cognitive workload (Lina et al., 2014). The results of Lina et al.'s (2014) study seem as though they could be generalized and applied to what a deck officer on the bridge would experience when placed in similar situations. For example, because both the SRO and the deck officer are the senior individuals on watch, when faced with an unfamiliar situation, they may engage in similar behavior responses. Application of the SRK model shows how officers' decisions are affected. Therefore, examining additional theories related to decision making may further contribute to establishing a theoretical framework for the present study.

### **Decision-Making Theory**

David Valentine Tiedeman first suggested the decision-making theory in 1963 in a publication of *Career Development: Choice and Adjustment* (Briddick & Briddick, 2008). Tiedeman's theory was based upon Erikson's psychosocial theory that healthy ego development resulted from maintaining mastery of crises. This allowed an individual to achieve a favorable view of the self, the larger world around, and eventually the world of work (Briddick & Briddick, 2008). Traditional problem solving is usually done in a mechanical fashion from one stage to another using a set of rules such as a simplified generic four-stage approach of (a) defining the problem; (b) generating a course of action; (c) evaluating a proposed action; and (d) carrying out the action. Although the majority of the research on problem solving uses well-

defined goals, most real problems are ill-defined (Klein, 1998).

Azuma, Daily, and Furmanski (2006) conducted a review of time-critical decision-making models and cognitive processes. Most decision-making models are based in the cognitive process as their underlying framework. These theories focus on the cognitive process of human memory that has the capacity to encode information, store information, and retrieve information. This memory has specialized subdivisions; short-term auditory working memory, visual iconic memory, and long-term memory. Short-term auditory memory maintains mental information in a highly accessible state. Yet, the auditory working memory has limitations of accessibility, specifically when the spatial, temporal, and effort-related characteristics of attention are also being utilized. The short-term memory is considered a “temporary store where conscious, effortful (requiring attention) internal computations are performed” (Azuma et al., 2006, p. 2).

Azuma et al. (2006) studied eight models used by the military: (a) the OODA Loop model, (b) the kill chain model, (c) the triage model, (d) the SHOR model, (e) the rational decision-making model, (f) the control theory based model, (g) the naturalistic decision making model, and (h) the team-based model. To be effective, the first model, the OODA Loop, must be expeditious and appropriate to the situation to achieve the desired effect. The OODA Loop consists of:

1. “Observation: take in observations of the overall situation;
2. Orientation: make judgments of the situation to understand what it means;
3. Decision;
4. Action: execute and monitor the decision” (Azuma et al., 2006, p. 2).

The benefit of the second decision-making model used by the military, the kill chain



model, is to reduce the time needed to complete the kill chain cycle, because if execution is too slow, then the kill chain will not work (Azuma et al., 2006). The military also uses the triage model, which divides a problem into key questions to answer, such as goals and obstacles, familiarity with the situation, time, and effort required, and what is important (Azuma et al., 2006). This division of the problem assists the decision makers by providing relevant ways to think of the problem.

A fourth model, the SHOR (Stimulus, Hypothesis, Option, and Response) model, is a non-linear, decision-making model (Azuma et al., 2006). In this model, the decision maker is not forced to work in a particular cycle and repeat steps in a fixed order. In contrast to the SHOR model, the rational decision-making model is dependent on a clear set of alternate choices, and their outcomes are predicted with a significant degree of confidence (Azuma et al., 2006). This model relies heavily on experience or past results to generate predicted outcomes. The rational decision-making model is objective “by establishing criteria, weighting them, and then choosing the best ‘score’ or highest utility” (Azuma et al., 2006, p. 4). A variation of the rational decision-making model is the Multi-Attribute Utility Analysis (MAUA), which formulates decision matrices and decision analyses (Azuma et al., 2006).

Yet another model used by the military, the control theory based model is, in essence, when a decision maker reacts to signals rather than anticipating them (Azuma et al., 2006). The control theory based process assumes that the environment provides some signals or information that must be sensed, then evaluated and compared against some desired state, so that relevance can be determined on whether to act or not. In comparison to the control theory based model, the naturalistic model is also considered action-based, but is proactive rather than reactive (Azuma et al., 2006). The assumption is that action and knowledge are linked and that knowledge results

from actions and then observation of the results. There is no attempt to obtain the ideal or best solution; rather, if there is a mistake, the mistake can be rectified and refined later. This model is different from all the other models in that it can be used on situations that are unique. Finally, the team based model is less developed than the previous individual decision-making models. The tasks and applications require either decision making by a team or that the team members work in tight synchronization and interdependence (Azuma et al., 2006).

### **Novice Decision Makers**

In addition to decision-making theories and models, an examination of the literature focusing on individuals new to the decision-making process is important to this study. Chalko, Ebright, Patterson, and Urden (2004) conducted a study to identify human performance factors that characterized novice registered nurses. The participants in their study were working within the first year after completion of a nursing program and were interviewed to examine near miss and adverse-event situations in acute care settings. Chalko et al. interviewed 12 novice nurses using the Critical Decision Method (CDM), an interview technique based on the recognition-primed decision-making model (Klein, 1998; Klein, 2008; Klein, Calderwood, & Macgregor, 1989). Multiple discussions and reviews of cases resulted in nine themes being identified. Seven of the themes were present in at least seven of the eight cases, and included environmental and social issues, as well as novice lack of expertise. The nine themes by Chalko et al. were: (a) clinically-focused critical thinking; (b) seeking assistance from experienced nurses; (c) knowledge of unit and workflow patterns; (d) first-time experiences; (e) time constraints; (f) hand-offs; (g) influence of peer pressure and social norms; (h) losing the big picture; and (i) novice assisting novice.

Chalko et al. (2004) identified in each case that novice nurses reported some level of

critical thinking that guided their decision making and performance. Nevertheless, the novice nurses' critical thinking did not achieve a level to prevent the near-miss or adverse event, because of lack of adequate information to manage the total picture, time pressures that hindered prioritizing, or reasons suggested by the other themes identified in the cases. In more than half of the cases, the nurses became so involved in trying to manage the situation that they lost the big picture and consequently missed important cues (Chalko et al., 2004). These findings suggested that in order for novice nurses to be successful, expertise from experienced registered nurses should be readily available to advise and assist when the workload becomes unpredictable (Chalko et al., 2004). Second, a social climate should exist with reasonable and realistic expectation regarding a novice nurse's experience. Third, the social climate should be extended to at least a year after the nurse's graduation to facilitate a rapid transition in making error-free decisions. There needs to be realistic expectations of novice decision-making ability during complex situations, and strategies to recognize and intervene when novices are at risk for error (Chalko et al., 2004).

Gillespie and Paterson (2009) suggested that decision making by novice nurses has a tendency to be linear, based on limited knowledge and experience in the profession, and focused on single tasks or problems. These novice decision makers tend to view decision making as responding to patient complaints and following protocols or documented care plans. They lean toward doing rather than thinking and reflecting, and do not recognize or appreciate the relevance of deviations from the textbook in a clinical situation. Gillespie and Patterson also suggested that when these novice nurses were confronted with complex or unfamiliar clinical situations, they frequently responded by drawing on theoretical knowledge and psychomotor skills. These novices lacked confidence and relied excessively on more experienced nurses, thus

avoiding situations that required them to make decisions (Gillespie & Paterson, 2009).

Gillespie and Paterson (2009) developed a framework for assisting novice nurses in developing their decision-making skills, and then applied the new framework in nursing education. The situated clinical decision-making framework helped novice nurses reflect on the decisions they made in their clinical practice and develop features of expert clinicians. The foundation of the decision-making framework has its basis in the situated learning theory and the premise that learning is social and is situated within a greater context. Parts of Gillespie and Paterson's framework include the context factors that influence clinical decision making about a situation as it comes into focus. Foundational knowledge includes not just having prior knowledge, but acquisition of new knowledge and competencies, skills, and roles of nurses, into clinical decision making. Gillespie and Paterson's clinical decision-making process is comprised of:

1. Cues in which processes are triggered by recognition of a cue from the patient;
2. Judgment, defined as the best conclusion a nurse can reach at a point in time, given the information available;
3. Decision(s) by determining a course of action, a phase that requires consideration of both what should be done and how that should occur;
4. Evaluation, which assesses the outcomes as nurses consider the effectiveness of their decisions; and
5. Thinking, which is considered the framework that makes a critical contribution of critical, systematic, creative, and anticipatory thinking to clinical decision making.

In addition to nurses as novice decision makers, Amel (1995) conducted a two-part quantitative study on the decision-making processes of expert airplane pilots and on teaching

expert decision-making strategies to novice airplane pilots. The purpose of Amel's study was to examine the usefulness of the cognitive process theory in aviation and to link this theory to the training needs of pilots. Amel's findings suggested that the evidence is not clear regarding the independence of features within the decision-making situation. However, expert decisions appeared to be one-dimensional in nature and cognitive categorization provided viable mechanisms in understanding the decision-making process. Expert diversion decisions did not map equally on the risk scale, in that individuals overestimated or underestimated risk and assessment of consequences. As for the novice pilot, Amel suggested, "that providing individuals with extra practice after demonstrated learning enhances retention especially for tasks which are not performed often" (p. 50).

Still another study focusing on novice decision makers was an interpretive phenomenological study by Kosowski and Roberts (2003), conducted to discover, describe, and analyze the stories of 10 novice nurse practitioners who used intuition in clinical decision making. Kosowski and Roberts considered intuition to be a component of complex judgment and understanding. In the nursing field, intuition is considered a legitimate way of knowing and is related to empathy, nursing art, sustained nurse-patient relationships, and holism. It is a means to make decisions, to act based on sudden awareness of knowledge related to previous experience (Kosowski & Roberts, 2003).

From Kosowski and Roberts's (2003) hermeneutic data analysis, six themes and constitutive processes were identified that had implications for nurse practitioner education and practice. The first theme was *Reflecting*, in which the participants, while telling their stories, would look back and remember numerous details and a variety of dramatic sensations. The second theme was *Backing it Up*, where the practitioners had a gut feeling but used additional

data to support their feeling. The third was *Knowing the Rules*. This theme was used when the practitioners acted on instinct but had additional information on which they still relied to follow the clinic's rules and practices. The fourth theme of *Playing the Game* was similar to *Knowing the Rules* except focused on how a practitioner interacts with doctors and other superiors. This dynamic is important because nurses have not always been considered by physicians to have the same expertise as the doctor, yet it is the nurse who has frequent interaction with the patient and is usually the first to observe any abnormalities of a patient. The fifth theme was *Learning Lessons*, where the participants used intuitive decision making that was either confirmed or obstructed by other colleagues. The sixth theme mentioned in the results did not pertain to decision-making but instead focused on *Taking Care*, in which participants were taking personal care of themselves and their patients (Kosowski & Roberts, 2003).

The study by Kosowski and Roberts (2003) focused on novice nurse practitioners with less than two and a half years of experience in their current positions; however, these participants had a mean average of 13 years of experience as registered nurses. Nevertheless, they were considered novices because their roles were considered to be potential leaders, but their capacity for making decisions in their new positions had not fully developed (Kosowski & Roberts, 2003). One of the findings for education of nurse practitioners was that it should include experiences that provide opportunities to practice reflective dialogue, critical thinking, and intuitive decision making. These important skills should be nurtured and modeled by faculty and clinical supervisors. Kosowski and Roberts found that, "As their intuitive decision-making was repeatedly engaged and validated, their trust and confidence in intuition as a valid way of knowing evolved and grew stronger" (p. 68).

Still focused on novice decision makers, an empirical descriptive study by Hoffman,

Aitken, and Duffield (2009) was conducted to determine if there were differences between novice and expert nurses in the range and type of cues selected, as well as how cues were clustered together when making clinical decisions while caring for post-operative patients in an Intensive Care Unit. The research was part of a larger study to examine real world decision-making processes and cues collected and used by novice and expert nurses while caring for patients who were being treated for post abdominal aortic aneurysm in an intensive care setting. The study involved four novice and four expert nurses. The data collection used the think aloud process while participants cared for patients, followed by retrospective interviewing, which finally produced verbal protocols (Hoffman et al., 2009).

The findings by Hoffman et al. (2009) identified several factors concerning the differences between expert and novice nurses. The expert nurses appeared to use more proactive planning which could prevent problems, while novice nurses were more often reactive and thus made decisions after a problem had already occurred. Expert nurses collected a wider range and twice as many cues as novice nurses and also clustered more cues together to identify patient status when making decisions. Additionally, the expert nurses used more complex cue clusters than novice nurses. Novices in a discipline often have a simpler depiction of situations, which may lead to a reliance on fewer cues, while experts collect a wider range of cues and have greater linkages between cues and concepts. Experts hold chunks of domain-specific knowledge in the long term memory, which allows them to recognize a wide range of cues and patterns of cues (Hoffman et al., 2009).

### **Emotions in Decision Making**

Experts and novices can also be compared in their emotions experienced during decision making, whether in a hospital, on a sailing vessel, or in a combat situation. Cannon-Bowers and

Salas (1998) stated, “Modern combat scenarios are often characterized by rapidly evolving and changing conditions, severe time compression, and high degrees of ambiguity and uncertainty” (p.18). They went on to state, “A variety of other stressors (both physical and psychological) also existed in the operational setting, not the least of which is the catastrophic costs of making an error, which mitigate against effective individual and group performance” (p.18). Although novice decision makers such as junior officers are not usually put into modern combat environments, they are, nonetheless, put into situations that are just as complex, ill-defined, and time sensitive. These situations could cause them significant stress when making decisions. The question then becomes to what degree do emotions affect rational thought in a person’s decision making when decisions are made in difficult situations?

Most of the research in decision making has focused on the cognitive and behavioral aspects (Kong-Hee, 2012; Lakomski & Evers, 2010). Lakomski and Evers (2010) wrote a conceptual paper contending that emotions have a central role to play in rational decision making based upon recent research in neuroanatomy. The theory of emotional decision does not focus on decisions as being emotional in themselves, rather that emotions have a proper place in the decision-making process. Emotions are a source of motivation; emotions affect what a person regards as desirable. The problem with emotions is that they fluctuate and change with each passing experience. Emotions can render values inconsistent. If individuals are given a situation with all alternatives equal, they may select a choice based upon how strongly they feel about the object or situation. Life has a tendency to inflate emotions (Lakomski & Evers, 2010).

Lakomski and Evers (2010) cited the neuroscience case study of Phineas Gage, who lived despite having a rod accidentally blown through his lower jaw and out the top of his head. After the accident, Gage was not the same man as before. His personality changed, which made him



indifferent to others. He showed no regard for social conventions and displayed poor decision-making behaviors. The damage was done to his ventromedial prefrontal cortex, which is the underbelly of the frontal lobe directly behind the eyebrows. The role of the ventromedial prefrontal cortex is to inhibit emotional responses and aid in the process of decision making. The same behaviors were also found in other patients with brain damage in the same area. These individuals were impulsive. They did not learn from their mistakes and made decisions that were not considered to be in their best interests. Lakomski and Evers reported that neuroscientific evidence indicated the necessity of emotion in the process of reasoning and decision making, and when emotion was absent, rationality had been shown to break down. Their findings suggested that the theory of emotional decisions was biologically more realistic than the traditional rationalist-cognitive model (Lakomski & Evers, 2010).

**Kong-Hee's proposed affect and cognitive functions of strategic decision maker.**

Kong-Hee (2012) posited that emotions are the black box in strategic decision making, meaning they are considered the human mental functions that are a very complex integrative system of cognitive computation and affective perception. Furthermore, he proposed a theoretical model to address how emotions affect the cognitive functions of strategic decision making. Behavioral decision theorists have suggested that positive feelings lead to favorable evaluation of a situation or object, and negative feelings lead to unfavorable evaluations. When it comes to an unconscious or automatic response to stimuli, emotions play an essential role within cognition. When formulating theory on emotions and strategic decision making, Kong-Hee considered "emotions as transient feelings or affective responses to an event, object, or person" (p.106). Kong-Hee differentiated between emotions and temperament such as happiness or grumpiness. Kong-Hee also differentiated emotions from moods, which are the presence or absence of a

feeling concerning an event or object. Kong-Hee stated, “The structure of emotion is conceptualized fairly broadly but consistently: emotions as being characterized by a two-dimensional structure (pleasant/positive to unpleasant/negative; activated/engaged to deactivated/disengaged).” (p. 106).

The model that Kong-Hee (2012) proposed was the Affect and Cognitive Functions of Strategic Decision-Maker Mechanism, which consists of the following:

1. Cognitive assimilation: The decision maker’s mental representation of strategic environment, such as mentally labeling a threat or opportunity;
2. Emotional experience: The decision maker’s automatic and unconscious emotional experience, such as the intensity of positive and negative affectivity;
3. Cognitive complexity: Mental capacity in perceiving options and processing information;
4. Cognitive simplification behavior: Behavior in strategic information searching and processing, which includes anchoring, analogy, and referencing;
5. Strategic decision comprehensiveness: The extent to which individual decision makers are exhaustive and inclusive in information processing, which may be considered analytical comprehensiveness, or integrative comprehensiveness. (Kong-Hee, 2012. p. 107)

Cognitive assimilation presupposes that a person’s decision-making experience, regardless of whether it comes from an external or internal environment, labels the experience as positive, such as an opportunity, or as negative, as in a threat. Cognitive complexity assumes that cognitive assimilation has a tendency to increase cognitive simplification which reduces decision comprehensiveness. Cognitive complexity moderates relationships between the

affective experience and the cognitive simplification. This complexity suggests that “a decision maker with limited cognitive resources would be expected to engage in less analytical complexity under condition of emotional states” (Kong-Hee, 2012, p. 110). From a training point of view, Kong-Hee suggested that it would be necessary to incorporate ways to reduce the emotional impact on decision making. Simulation training would be useful by indirectly exposing diverse strategic circumstances to trainees in order to help them manage their emotions and mitigate the influence of emotions on their decision making (Kong-Hee, 2012).

**Goleman’s theory on emotional intelligence.** Emotions can get in the way of the working memory, which in turn, affects the ability to make decisions. If a deck officer is fearful or anxious, then the potential for delayed decision-making or indecision is greater. As such, especially in time-critical situations, the results could be disastrous. Daniel Goleman (1995) devised a mixed model on Emotional Intelligence (EI) to explain and categorize people’s ability to recognize their own emotions, as well as the emotions of others, through a wide arrangement of competencies and skills. According to Goleman, once individuals recognize weakness in areas of emotional competencies and skills, they can adopt strategies which assist them to improve their overall EI. Goleman’s model featured five distinct constructs:

1. Knowing one’s emotions;
2. Managing emotions;
3. Motivating oneself;
4. Recognizing emotions in others;
5. Handling relationships.

Goleman’s (1995) first construct, knowing one’s emotions, means possessing self-awareness of mood and the thoughts of moods. To know one’s emotions means that in the midst

of turmoil, a person can internally step back and reflect on one's behavior. A person's personality traits and past experiences typically determine where a person falls on the emotional awareness spectrum. On one end of the spectrum are individuals who become so overwhelmed by their emotions that they may feel helpless and out of control. On the other end of the spectrum, there are those individuals who are completely unaware of what they feel and who seem to lack passion about anything or anyone (Goleman, 1995).

In his second construct, managing emotions, Goleman (1995) referred to a person's ability to appropriately handle one's emotions. Life has its shares of joy, excitement, anger, sadness, and anxiety. As a norm, the expression of extreme and intense feelings is rare. However, when these intense feelings overwhelm a person, how successfully that person handles these emotions determines how quickly a person returns to a normal emotional state (Goleman, 1995). Unexpected events can create what is called an *emotional hijacking*, in which intense or extreme emotions overwhelm a normal emotional response. For example, when a driver is suddenly cut off by another driver on the highway, the first driver may experience a sudden increase in the degree of anger and anxiety. The problem then becomes multiplied if not stemmed soon. Due to the increase flood of hormone levels in the brain, such as cortisol and catecholamines, the persistent anxiety does not have time to settle down immediately, which continues to add to the previous hormone levels in place, thus creating an out-of-control event or cognitive incapacitation. Catecholamines suppress activity in the frontal part of the brain that is concerned with STM, concentration, inhibition, and rational thought. If faced with a similar instance of emotional hijacking, a mariner would need to engage in methods to decrease his or her emotional state such as taking deep breaths and muscle relaxation, going for a walk, or picking up the phone and asking the captain for help (Goleman, 1995).

Goleman's (1995) third construct, motivating oneself, is being able to direct one's emotions to be moving towards the mastery of a goal. Individuals who are successful at this skill are more likely to be effective and highly productive in whatever they pursue. There are those individuals who when taking a test, develop test anxiety. This emotion paralyzes the brain. When emotions overwhelm concentration, the cognitive processes of WM are overwhelmed, which basically means a person cannot think effectively, thereby reducing the likelihood of success. Conversely, the emotions of enthusiasm and self-confidence can enhance success. Self-confidence can be considered a feeling of one's ability to achieve a goal (Goleman, 1995). Self-confidence is sometimes confused with self-efficacy in decision making, but Bandura (1997) suggested that there is a difference between self-confidence and self-efficacy:

...the construct of self-efficacy differs from the colloquial term 'confidence.' Confidence is a nonspecific term that refers to strength of belief but does not necessarily specify what the certainty is about. I can be supremely confident that I will fail at an endeavor. Perceived self-efficacy refers to belief in one's agentive capabilities that one can produce given levels of attainment. A self-efficacy belief, therefore, includes both an affirmation of a capability level and the strength of that belief. Confidence is a catchword rather than a construct embedded in a theoretical system. (p. 382)

Goleman's (1995) fourth construct, recognizing emotions in others, is the ability to recognize emotional upset in others and to demonstrate empathy for those individuals based on their emotions. For example, researchers studying infants observed that they seem to share an emotional relationship with each other when they are hurt or sad (Geangu, Benga, Stahl, & Striano, 2011; Goleman, 1995; McGaha, Cummings, Lippard, & Dallas, 2011; Miller, 2011; Wittmer, 2012). Specifically, one infant will mimic or respond similarly to another infant who is

crying. Additionally, it has been observed that toddlers react empathetically when seeing another toddler in pain and will attempt to soothe the other's pain or fears (Geangu et al., 2011; Goleman, 1995; McGaha et al., 2011; Miller, 2011; Wittmer, 2012). Despite the existence of empathetic tendencies in young children, there are some adults who are devoid of empathy, which may result in the demonstration of sociopathic tendencies or the performance of acts of cruelty without remorse, and would make these individuals undesirable leaders. Those adults with appropriate empathetic skills are better attuned to subtle social signals and emotional cues, which generally results in the making of a more caring professional or teacher (Goleman, 1995).

Goleman's (1995) final construct, handling relationships, is the ability to recognize other people's emotions and manage them. People who are adept in this skill make good leaders, and are usually popular. Those who are not attuned to this skill are considered socially inept, awkward, and sometimes strange. Being able to recognize and manage the emotions of others would be a valuable tool for the junior officer who works with a small team of people. By being sensitive to verbal and nonverbal cues, the officer is able to recognize emotions in others and manage them to produce a successful outcome (Goleman, 1995).

### **Self-Efficacy and Decision Making**

Moving from emotions in general, to a more specific examination of self-efficacy and its impact on decision making warrants a closer look at Bandura's (1997) work and at the social cognitive theory. The social cognitive theory has as one of its tenets the concept by Albert Bandura of self-efficacy (Miller, 2011; Ponton & Rhea, 2006). Self-efficacy is defined as a person's belief in his or her ability to succeed in specific situations. It is believed that people generally avoid a task when their self-efficacy is low. When self-efficacy is considered high, individuals believe they can achieve the task (Bandura, 2006). Studies have observed that people

with low self-efficacy can become erratic and unpredictable when engaging in a task (Brown, 1999; Bruce, Sachin, Srivastava, & Stellern, 2007; Ely & Sitzmann, 2011).

People have little incentive to act or persevere in the face of difficulties unless they believe their actions will produce the desired effect. Other reasons that serve as guides or motivators are rooted in the core belief that people have the power to effect change by their actions. According to Bandura (2006), self-efficacy is the key to personal change and resource development. Efficacy has an impact on cognitive, affective, motivational, and decision-making processes. Self-efficacy determines whether an individual will think optimistically or pessimistically in self-enhancing or debilitating ways (Bandura, 2006).

Feltz and Hepler (2012a) examined the relationship between self-efficacy and decision-making speed and accuracy on a simulated sport task. Their study was based on previous research that supported the link between self-efficacy and physical performance in sports. They predicted that decision-making self-efficacy would significantly influence decisions with regard to speed and accuracy after controlling for past performances. Their findings concluded that self-efficacy was a significant constant predictor of decision-making speed and that self-efficacy was beyond the influence of past performance (Feltz & Hepler, 2012a).

Feltz and Hepler (2012b) also conducted research on heuristic, time-sensitive decision making and self-efficacy on the sports field. Their findings suggested that when people made time-sensitive decisions, those decisions were not random but purposeful. The study went on to suggest that self-efficacy was a significant and positive predictor of the time needed to make their first decision. “In other words, participants with low self-efficacy took longer to make their decisions than those confident in their decision-making capabilities” (Feltz & Hepler, 2012b, p. 160). They recognized that their study had implications for pressure, dynamic conditions, and

risk allowance situations outside of the sports domain. Feltz and Hepler suggested the medical field as an example where doctors and nurses with intuitive expertise perform better than other doctors and nurses of similar levels of experience (Feltz & Hepler, 2012b).

Boscardin, O'Sullivan, Plant, Sliwka, and van Schaik (2011) conducted an analysis on four factors: (a) situation awareness (SA); (b) team management; (c) environment management; and (d) decision making. Their findings suggested a positive correlation between self-efficacy in SA, environment management and overall performance of crisis resource management skills in residential doctors (Boscardin et al., 2011). Nevertheless, they went on to say: "We found correlation with performance for self-efficacy in situation awareness and environment management, but not for team management and decision making" (Boscardin et al., 2011, p. 587). Therefore, it is clear that self-efficacy assists with SA and environmental management but does not necessarily affect successful decision making. The results of Boscardin et al.'s study would suggest that a deck officer with good self-efficacy could manage a complex and time pressured situation, but may not necessarily make a good or right decision.

### **Heuristic Decision Making**

Self-efficacy is well defined and may be a factor in decision making. Other decision-making theories, such as natural decision making, also have well-defined characteristics like the Recognition Primed Decision model (RPD), which will be discussed later in this chapter. In contrast, another type of decision-making theory, heuristic decision making, is lesser defined as a theory since because heuristic means to discover. Heuristic decision making is a process, conscious or unconscious, that ignores some of the information, with the goal of making decisions quickly, frugally, and more accurately than other more complex methods (Gigerenzer & Gaissmaier, 2011; Hoy & Tarter, 2010). The term *heuristic* has its origins in ancient Greek,



meaning serving to find out or discover. It can also be translated as *looking around* to guide the search for information (Gigerenzer & Gaissmaier, 2011). The term *frugal* indicates the number of cues by which a heuristic search is measured. Making a correct heuristic decision fast and frugally is only possible if one's core capacities of experiences, knowledge, and skills are already in place.

Gigerenzer and Gaissmaier (2011) conducted a review of the four classes of heuristic methods. The first class is recognition-based decisions, which is a class of heuristics that bases judgments on recognition of information only, ignoring other cues. This includes fluency heuristic theory, which states that if both alternatives are recognized but one is recognized faster, then it is assumed that this alternative has the higher value with respect to the criterion. The second class is the one-reason decision, which bases the judgment solely on one good reason, while ignoring all other cues (Hoy & Tarter, 2010). One example described some police officers, professional burglars, and lay people who determined which of two residential properties was more likely to be burglarized. The lay people needed to explore all the information while the two expert groups knew what was relevant, which was consistent with findings of the literature on expertise (Gigerenzer & Gaissmaier, 2011).

The third class of heuristic decision making gives weight to all cues or alternatives equally. For example, *take-the-first heuristic* means to choose the first alternative that comes to mind. *The trade-offs* is a method of heuristics that differentiates all cues or alternatives equally and consequently makes some trade-offs. *The tallying* method weights all cues equally, is simply counting the number of cues and favoring one alternative over another (Gigerenzer & Gaissmaier, 2011). Finally the fourth class of heuristic decision making relies on social information (Gigerenzer & Gaissmaier, 2011).

At some point, heuristics became associated with errors, contrasted with logical and statistical rules, giving heuristics a negative connotation. However, Gigerenzer and Gaissmaier (2011) believed that “decisions by individuals and institutions, including business, medical, and legal decision-making, showed that heuristics can often be more accurate than complex ‘rational’ strategies” (p. 473). One of the key points was that “with sufficient experience, people learn to select proper heuristics from their adaptive toolbox (Gigerenzer & Gaissmaier, 2011, p. 474). Although Gigerenzer and Gaissmaier discussed four classes of heuristic decision making, this type of decision making relies on one’s core capacities of experiences, knowledge, and skills already being in place (Gigerenzer & Gaissmaier, 2011). Junior officers have yet to develop these abilities. Nevertheless, the intent of this chapter was to review the current literature on decision making in environments that are time sensitive, complex and ill defined.

Wiggins and Boliwerk (2006) conducted a quantitative research project on the impact of heuristic-based approaches on the acquisition of task-related information in the selection of an optimal alternative during simulated in-flight decision making. Their research cited a study by Prince, Hanel, and Salas (1993), which concluded that the differences between the heuristic strategies used by experienced versus those used by inexperienced pilots. They found that pilots’ experience within an environment could alter the nature of their decision-making.

Prince et al.’s (1993) study consisted of two stages. The first stage provided participants with an opportunity to utilize each of three information acquisition strategies during a simulated in-flight decision-related task. The intent of this stage was to establish a process of familiarization, rather than a process of training, which would allow participants using each of the information acquisition strategies to develop some degree of knowledge and skill pertaining to the performance of the activity (Wiggins & Boliwerk, 2006). The second stage of the study

was to identify the extent to which pilot experience, license category, and performance during the familiarization scenarios predicted the selection of the optimal option in the choice scenario (Prince et al., 1993). In addition, the second stage identified the extent to which pilot experience and their subjective perceptions of the strategies engaged during the familiarization scenarios predicted the selection of a particular strategy during the choice scenario (Wiggins & Boliwerk, 2006).

The participants consisted of 58 pilots, 47 men and 11 women (Prince et al., 1993). They ranged between the ages of 18 and 66 years, with a mean age of 28 (SD = 12.23) years (Prince et al., 1993). All of the pilots held a minimum of a private pilot's license. Their mean total flying experience was 1150.65 hours (SD = 3806.17 hours); their mean time as pilot in command was 997.38 hours (SD = 3735.59), and in the past 90 days they had a mean of 41.73 hours (SD = 54.15 hours) flight experience (Wiggins & Boliwerk, 2006). The findings suggested that task-oriented experience, rather than information-acquisition strategies, predicted the selection of the optimal alternative. Additionally, of the three strategies available, most participants preferred the elimination-by-aspects information-acquisition strategy. The pilots preferred one particular approach to information acquisition. In addition, the researchers also found that task-oriented experience, rather than the process of information acquisition, predicted task accuracy during the decision-making task (Wiggins & Boliwerk, 2006). Wiggins and Boliwerk (2006) suggested that future research should examine “the impact of time constraints and increases in workload on the selection of optimal alternatives and will broaden the research into different domains, including medicine and policing” (p. 745).

### **Naturalistic Decision Making**

Heuristic decision making is not the sole theory of decision making. There have been

many traditional decision-making theories such as Mental Accounting, Multi-Attribute Utility Theory (MAUT), Elimination by Aspects (EBA), and Satisficing (Azuma et al., 2006; Grech, Horberry, & Koester, 2008). Nevertheless, according to Grech et al. (2008) those theories have very little ecological validity or no real-world application. One theory that has been studied for real world application is the naturalistic decision-making model (NDM). This theory has been used and studied by the military, NASA, fire departments, healthcare providers, and the aviation field (Brezovic, Klein, & Thordsen, 1987; Klein, 1998; Klein, 2008; Klein et al., 1989).

The NDM theory considers how proficiently experienced individuals deal with ill-structured issues in emergent situations, which are often in fast-paced environments, and how effective their decisions and consequences are to them and to their organizations (Klein, 1998). The foundation of the NDM theory for interpreting the on-the-spot decision-making process is the RPD model (Klein, 1998; Klein, 2008; Klein et al., 1989). The RPD proposes that people can make quick, effective decisions when faced with difficult situations and choose the best solution from the wealth of practical knowledge they have acquired from their experience in the past (Nara, 2010). RPD reveals a critical difference between experts and novices when they are presented with recurring situations. Experienced officers, for example, should be able to come up with quicker decisions because the scenario may match a classical situation they have previously encountered (Klein, 1998; Klein, 2008; Klein et al., 1989).

Nara (2010) used a qualitative research case study to examine the NDM theory and meta-cognition. Nara also employed the CDM interview technique. The CDM is a type of structured interview technique used to obtain information from an expert decision maker while performing a task that is unusual, non-routine, during difficult situations otherwise known as critical incidents. The findings suggested that the RPD model in the NDM theory was valuable for

interpreting the process of on-the-spot decision making of airline professionals. The data showed that the decision-making styles followed the RPD model completely and that simulation exercise was an effective training method (Nara, 2010).

A final finding in Nara's (2010) study suggested that future training should strive to create more difficult conditions and stressful situations for on-the-spot decision making to encourage problem solving. Nara also recommended that students should deal with two different problems simultaneously and solve those two problems in a very short time. This type of training should improve a student's intuition for problem solving onboard the aircraft (Nara, 2010). The study recognized the need for future research on how people experience their decision making, particularly "how a person reflects on the problem and other solutions while dealing with the problem" (Nara, 2010, p. 5).

One specific application of the NDM theory surfaced in a fire situation. Useem, Cook, and Sutton (2005) conducted a study that dissected the under-stress decision-making process of those in leadership positions with regard to a fire that took place on July 5-6, 1996, at Storm King Mountain, in the South Canyon, Montana. The analysis considered 10 significant decisions that the incident commander, Donald Mackey, made. Mackey parachuted into a fire zone as a crew member, and became the jumper-in-charge. Then overnight, he assumed the duties of the multi-crew, firefighting incident commander. The previous incident commander Butch Blanco, was the experienced incident commander, but he left the mountain on the night of July 5th. Blanco did not reestablish his authority when he returned the next day. Tom Shepard, another experienced incident commander, arrived the following day but he neither took charge nor checked to determine who actually was in charge.

As a result of this situation, 14 firefighters lost their lives (Useem et al., 2005). It was

later discovered that five of the 10 decisions that had been made were optimal. The others were considered less than optimal, suggesting that Mackey was underprepared and working under acute stress, while there was ongoing ambiguity of who was in authority. Experienced incident commanders draw upon intuition that is built upon their lengthy experiences as practiced commanders and the feedback from what they have learned from those experiences. This means that new firefighters striving to gain experience need to attend leadership training, take leadership assignments, and go on staff rides to help accelerate their acquisition of knowledge and experience (Useem et al., 2005).

As a result of the South Canyon Mountain incident, federal laws were changed to set policy and procedure for establishing resources, training, and chain of command when directed to deal with multiple agencies. An 80-hour Fire Leadership Development Program was established. The curriculum included SA, decision making with an emphasis in managing personal stress, recognition of the error chain and interrupting that chain. The training included field work review with an onsite walk through at the original site where the students develop an emotional connection and apperception for what previously happened. The authors suggested that connecting with an event that arouses emotions, vividly and specifically, will have a greater impact on an individual's memory than an average event. This emotion-arousing event will be more informative of one's future decisions (Useem et al., 2005).

Experienced incident commanders understand the importance of SA, which is critical for effective and safe management of resources in dynamic, time-sensitive, and complex environments. Incident commanders' trainings are being adapted to focus on proper decision making and proper incident mitigation techniques, with the goals of reducing the risk to firefighters and decreasing municipal liability (Hall, 2010). Computer-based simulations are

used to create realistic and dynamic virtual environments where the trainee can gain knowledge and experience without the associated safety hazards of live-fire incidents. Hall (2010) conducted a study to establish a statistical correlation between a computer-based simulation training program and increases in the decision making efficiency or accuracy of fire ground incident commanders using a nonequivalent (pre-test and post-test) control-group design (Hall, 2010). Hall's findings offered evidence for a positive correlation between the computer-based simulation training programs and the efficiency and accuracy of decision making of fire ground incident commanders in the simulated environment.

Hall (2010) incorporated into his research the theory of NDM theory, which suggested a correlation between knowledge and experience gained from actual emergencies and that of realistic and dynamic simulations. Experienced commanders look for familiar patterns to determine their initial goals, based upon past experiences in similar situations. NDM strategies differ from traditional decision-making theory, because the traditional decision maker evaluates alternatives, while the naturalistic decision maker uses the initial information obtained through assessment processes and on-going situation awareness to achieve the most desirable option (Hall, 2010).

NDM has been utilized and empirically studied by the Department of Defense, because it addresses decision making in an ill-defined, complex and time-sensitive situation. Theories of decision making such as heuristics and NDM have primarily focused on individuals who have previous experiences from which to draw inferences in order to make what they believe is the correct or best decision. The studies that have addressed novice decision makers were from the medical domain. In most of those studies, the novice was under the instruction or supervision of an experienced decision maker. Research conducted on emotional intelligence and self-efficacy

could potentially affect a junior officer's decision making, but these topics have not been studied in the maritime domain. The current study focused on a domain in which very little empirical research has been conducted. This research examined novice decision makers when they make time-sensitive, critical decisions without the assistance of an immediate supervisor. This study sought to shed additional light into a field of decision making and into a domain that would benefit from identifying what could be done to improve education and safety in shipboard operations.

### **Related Literature**

The majority of decision-making studies have focused on areas outside the commercial maritime domain. Studies that have been conducted in the maritime domain have focused on experienced decision-makers' performance, the effectiveness of simulators, stress level of watchstanders, and the status of maritime education throughout the world. This section discusses decision making and the differences between novice and expert decision makers. Then, it reviews maritime literature as it relates to the research and maritime education.

Black, Krieshok, and McKay (2009) conducted a literature review on current vocational decision making. They observed that there was a paradigm shift in the field of vocational decision making. Career decision making, which was primarily based on matching a person to a career, evolved into individuals adapting their career decisions based upon a changing global market. Their focus was the application of judgment and decision making on an individual's decision, primarily comparing the two-system models of decisional thought process of the role of non-conscious intuitive processes in decision making and a rational conscious process (Black et al., 2009).

Black et al. (2009) concluded that both rational and intuitive processes seem dialectically



intertwined in effective decision making and that they were kept in check by the person's occupational engagement, which means taking part in behaviors that contribute to the career decision. However, making a decision from exclusively a rational or intuitive process may not be successful. Black et al. proceeded to suggest decision making is not an exclusively rational practice, and that direct introspective access to higher order cognitive processes is limited. Individuals rarely have all the relevant information when making a rational decision. Because of its bias and ignoring the intuitive solution, the conscious rational thought would tend to over-reach its bounds leading to a decision less suited to the given problem scenario. Black et al. went on to state, "Clearly, there are many conditions under which conscious processing can lead to poor choices" (p. 282).

In another area of decision-making research, Watson (2010) conducted a qualitative study using a grounded theory that studied secondary students' decision-making processes and their perceptions of the relevance and reliability of those decisions. The findings suggested that students consider reliability of a decision as directly related to how reliable their source of information was. The metadata results indicated that the participants made pre-relevance judgments of information sources that were based on their preconceptions of the usefulness of that information. In addition, Watson found that relevance decisions had a snowballing effect, in which one piece of relevant information led to another. However, constantly looking back on previous decisions can lead to a maladaptive problem solving strategy. Nevertheless, to the decision maker, a maladaptive problem-solving strategy may lead to a more acceptable outcome. One of the key findings of Watson's study suggested, "The comparison of information in one source with that in another forms part of naturalistic decision-making and should be encouraged in information evaluation" (p. 12).

## Differences Between Experienced and Novice Decision Makers

A review of the literature identified some common themes about experienced or expert decision makers. Experienced problem solvers are able to distinguish genuine anomalies from transient ones. They can use mental simulation; however, it takes a fair amount of experience to contrast meaningful scenarios. Experienced decision makers also develop new insights to a situation by drawing on prior experience and lessons learned from their mistakes. They have an extensive bank or history of experiences from which to draw. They are able to use leverage points, which are fragmented sequences or kernels of ideas, which allow them to formulate new solutions (Dane, Pratt, & Rockmann, 2012; Hall, 2010; Hoy & Tarter, 2010; Klein, 1998; Klein, 2008; Klein et al., 1989; Randel & Pugh, 1996).

A skilled decision maker knows how to depend on intuition. Klein (1998) defined intuition as, “the use of experience to recognize key patterns in the dynamics of the situation” (p. 31). Experts are able to improvise, generate counter facts, explanations, and predictions that are inconsistent with the situation. An experienced person:

- Has learned not to over rely on the data;
- Knows the limitations of existing skills and abilities;
- Can perceive the invisible to seek fine discrimination, patterns;
- Looks for cues, alternative perspectives, or missing events; and
- Is able to envision the past, the future, and the process of managing decision making (Dane et al., 2012; Hall, 2010; Hoy & Tarter, 2010; Klein, 1998; Klein, 2008; Klein et al., 1989; Randel & Pugh, 1996).

The literature also described some common characteristics of novice or inexperienced decision makers. Because of their lack of experience, they have a difficult time maintaining the

big picture and situation awareness when situations become complex, ill-defined, and time sensitive. Novice decision makers:

- Cycle through different possibilities;
- Are not able to detect patterns and anomalies;
- Usually use the first course of action that they believe will work;
- Have a tendency to use trial and error through their imagination (Brezovic et al., 1987; Chalko et al., 2004; Dane et al., 2012; Gillespie & Paterson, 2009; Hall, 2010; Hoffman et al., 2009; Klein, 1998; Klein, 2008; Klein et al., 1989; Kosowski & Roberts, 2003).

### **Studies in Maritime Decision Making**

Chauvin, Clostermann, and Hoc (2008) conducted a quantitative study of 90 cadet officers in their sixth year of training at a French maritime academy. The goal was to study the impact of SA in the decision-making process. The study was conducted in six phases that included the use of a questionnaire and a bridge simulator. The participants were briefed on the activities and were given short scenarios. Then at specific points, the simulation was paused and the cadets were required to fill out the questionnaire (Chauvin et al., 2008).

The findings in their Level 1 SA (perception of the elements in the environment) showed to be of lesser importance in decision making, and the statistical results did not provide any information that could explain the trainees' decisions (Chauvin et al., 2008). With Levels 2 and 3 SA, the results suggested that 55% performed a maneuver that was against regulations, and 34% did so in an unsafe manner. Chauvin et al. (2008) also discovered that four different participant profiles had emerged. The main difference between the profiles depended on:

1. The distance at which they decided to change course;

2. The direction of this maneuver (port/left or starboard/right);
3. The way in which they interpreted the other vessel's intentions (is it going to change course?);
4. Whether the trainees referred to the rules.

Chauvin et al. (2008) suggested that the information from their study should inform maritime educators to rethink the training course. They recommended putting more stress on recognizing prototypical situations, to acquire expertise through exercises that must allow them to define cue patterns, and to build schemata (Chauvin et al., 2008). Chauvin et al. in discussing the limitations of their study, stated,

This study is obviously incomplete because it was not possible to question the trainees several times on their SA. It does, however, point out the importance, in the analysis of a situation and the decision making process, of the interpretation of the rules, the interpretation of the other vessel's intentions, and the evaluation of an external risk. (p. 20)

Lin (2006) researched the decision-making process of senior officers when maneuvering the ship and whether or not they obeyed the rules of the regulations, and what were the reasons for navigational faults. He wanted to know why a ship officer's behavior contravenes the regulations, resulting in a collision. The maritime goal is to stay out of the way of an approaching ship as far as possible. Therefore, if there are any failures by human actions or ship's equipment, the possibility of a collision increases significantly due to late avoiding action (Lin, 2006).

The participants were 40 qualified ship officers, including 10 master mariners, seven chief mates, and 23 senior mates (Lin, 2006). Gender and nationality were not specified. This

study ascertained that, although no collisions occurred, 17.5% of the total tracks in good visibility exercises had a Closest Point of Approach (CPA) of less than 0.2 miles, which were classified as near misses (Lin, 2006).

Lin (2006) made several points in his conclusion. One of the points he observed was, "...how ship officers make their decision to avoid collision is related to their personal characteristics" (p. 230). Even when the officers had sufficient sea room, there were no obstacles within a large safety margin and early action or a large change of course was possible, subjects decided to avoid action, resulting in a CPA of less than one mile in all the exercises.

Lin asked the following question:

So why did their behavior contravene the regulations, resulting in a collision? There must be an underlying reason why so many make these errors. Besides, in addition to these incidents because of noncompliance with the regulations that resulted in a collision, obviously many more resulted in near misses. (p. 227)

He then answered his question as follows:

But some ship officers did not realize the regulations very well resulting in improper, and in some cases illegal behaviors. Sometimes their behavior was illegal due to lack of discipline and care. Some officers disobeyed regulations simply because in certain situations they considered the expediency of their action and disregarded the maneuvering behavior of the other mariners. (Lin, 2006, p.230)

Lin's (2006) research studied the decision making of experienced senior officers. His conclusion suggested that these officers made inappropriate maneuvers because of insufficient training, lack of discipline, or a blatant disregard of the rules. Lin's study with experienced officer decision making differs from this study, which focused on inexperienced junior officer

decision making. One of the goals of this study was to reduce or prevent those behaviors displayed by the senior officers in Lin's study.

Fukushi et al. (2009) conducted a quantitative experimental research study measuring a ship navigator's stress based on salivary amylase activity (SAA). The study's goals were (a) to confirm the efficiency of SAA index for the professional mates using a ship handling simulator and a real ship, and (b) to evaluate the cadet's and the instructor's stress using the SAA index together to confirm whether the SAA value is an efficient index for on-board training evaluation using a real ship.

The participants were cadets who were senior students at Kobe University, Japan. The subjects included 26 mates and 22 cadets. No gender or race was given. Fukushi et al.'s (2009) findings suggested that the SAA value increased in response to stressful situations during safe navigation. Regardless, some captains showed little change at leaving a port. Fukushi et al. also concluded that the cadets and mates demonstrated stress at the same time. Fukushi et al. stated:

The officer was under stress during the cadet's real ship practice to keep safe navigation, and the cadet was also under stress during his responsibility for safe navigation while learning new and difficult navigational methods. Perhaps, we can evaluate the cadet's stress level by comparing it with the measured stress of the mate (instructor). (p. 302)

**Maritime education and training.** Prior to 1978, all standards of education and training were set by individual nations regardless of any existing practices in other countries. In fact, many poor nations did not have *any* requirements for certification and education with regard to obtaining a license or rating. This lack created situations for ship owners to hire mariners from poorer countries for lower wages in order to operate their vessels at a lower overall cost. In turn, this cost-saving practice usually resulted in serious incidents that caused numerous deaths, loss

of cargo, and damage to the environment. As a consequence of financial losses, many insurance and indemnity organizations demanded that nations set standards for certifying and educating mariners (Giziakis, Goulielmos, & Lathouraki, 2012; Sampson, 2004).

The Inter-Governmental Maritime Consultative Organization, which became the International Maritime Organization (IMO) in 1982, under the aegis of the United Nations, set up a committee to establish international standards for mariner training and certification. The 1978 International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) set minimum standards relating to training, certification, and watchkeeping for seafarers, which countries are obliged to meet or exceed. The 1978 convention came into effect in 1984. In 1995, an IMO committee, responding to criticism of both its ineffectiveness in training and its many vague phrases that could be misinterpreted by various countries, made major revisions to the original Convention. In addition, the STCW 1995 amendments entered into effect in 1997 (Emad & Roth, 2008; Giziakis et al., 2012; Sampson, 2004; Wang & Zhang, 2000). Finally, to keep up with the latest technologies and developments in training, a second major revision took place in June 2010. The Manila Amendments to the STCW Convention and Code included such changes as improved procedures to prevent fraudulent practices associated with certificates of competency, and procedures that strengthen the evaluation process, along with new requirements for training in leadership and teamwork (IMO, 2011; Implementation of the Amendments, 2013).

It is the understanding of the United States Coast Guard (USCG) that STCW is a competency-based system. This system achieves its goals by differing combinations of exposure to training and self-study. Mariners may independently achieve their competencies while on board vessels; however, onboard assessments do not contain a training component beyond the

feedback needed by the new officers (Implementation of the Amendments, 2013).

This increase in On the Job Training (OJT), permitted as an alternative to previously implemented policy on classroom training, has raised concerns in the industry because of possible degradation of the competence and proficiency of United States (U.S.) mariners. Furthermore, OJT may not always be practical for many vessels because of companies' minimal manning practices/trends, and because senior officers or assessors may not have time to provide more OJT (Emad & Roth, 2008; Wang & Zhang, 2000). The intent of the new regulations was to include in-service training and formal training (Implementation of the Amendments, 2013).

The Coast Guard recognized concerns raised by public comments that shipboard factors, including reduced manning, higher mariner workload, and mariner fatigue issues, could make it a challenge for seafarers onboard vessels to train others. The Coast Guard also recognized that not all STCW competencies, individual knowledge, understanding and proficiencies must be accomplished as part of structured training because there are areas where in-service experience may fulfill the competency requirement. For these reasons, the Coast Guard reviewed the tables of competencies and identified the training topics that must be accomplished as part of approved formal training (Implementation of the Amendments, 2013. para 77872).

The 46 CFR §11.309 (2014) required training for new officers in areas such as terrestrial and coastal navigation, electronic navigation, meteorology, cargo handling and stowage, stability, shiphandling and most importantly bridge resource management, leadership and teamwork, and watchkeeping. The leadership and watchkeeping requirement usually requires three to four weeks of classroom instruction (Requirements for Officer Endorsements, 46 C.F.R. Part 11, 2014). Even with all the required training and assessments, it has yet to be determined if this is enough for junior officers to be prepared to stand a bridge watch as the solitary officer and



decision maker on the bridge of a modern ship.

**Current research in maritime education.** Hontved, and Arnseth (2013) conducted a qualitative study using students training in a ship simulator. The study examined issues concerning learning opportunities present while participating in professional practices and whether such practices may be simulated in sensible ways. A group of students, together with a professional maritime pilot, enacted professional roles and simulated scenarios for learning to navigate. They questioned how students' enactment of professional roles and construction of relevant activity contexts in a ship simulator environment offered opportunities for learning and instruction (Hontvedt & Arnseth, 2013).

This research was conducted at a Norwegian university and the participants were mariners in a nautical studies bachelor's degree program. The findings of the research demonstrated that structuring exchanges in the form of enacting professional roles and responding to a simulated activity scenario affected opportunities for the students to learn. It was also shown that managing a credible role-play takes considerable effort and could come into conflict with other objectives for training, such as instruction and asking for help. Hontvedt and Arnseth (2013) concluded, "This analysis has made salient some of the complexities of simulating, which may be useful for further research and developmental work on creating scenarios, considering fidelity, or facilitating simulator training in general" (p. 110).

The study did posit itself in the socio-cultural learning perspective to examine not just the benefit of use of simulators in education, but also the provision of better learning opportunities in professional practices. By using role-playing, members were given the chance to learn about themselves and the other professionals with whom they worked or interacted. Role-playing in a simulator gave the participants opportunities to enact behaviors and actions that would otherwise

not be safe or appropriate onboard a real vessel. This furnished the participants an occasion to play *what if* while learning from their failures and successes (Hontvedt & Arnseth, 2013).

In another study looking at training, Emad and Roth (2008) conducted a qualitative case study on training and assessments in the maritime domain. The study focused on a Canadian maritime institute for individuals moving from a formal education setting to an everyday work setting. The study discussed the state of maritime education and training based on the STCW as amended in 1995. Due to the human element in marine incidents, the standards were revised from the original 1978 standards to a new set of standards to be implemented in 1995 (IMO, 1996). These revised standards required new officers to demonstrate competencies prescribed in the STCW convention (Emad & Roth, 2008).

The Emad and Roth (2008) study also reviewed why some members of the maritime industry attended college and why some did not. While college education provided students a theoretical background and the knowledge base required to work onboard ships, it was not mandated to meet the required competencies and exams. Still, some mariners find that they preferred to take college courses, because the exams involve difficult concepts such as mathematical calculation (Emad & Roth, 2008).

### **Summary**

New junior officers should have been taught situation awareness in their watchkeeping classes. However, situation awareness is a process that, according to Grech et al. (2008), involves a feedback loop with a sequence of perception, comprehension, and execution that drives the feedback loop. Officers on watch must first be able to perceive the condition of all the vessels around them, the relationship of their vessel to any hazards, their vessel's operational condition, and the comprehension of those perceptions and executions of actions to avoid the

hazard or collision. This process is an ongoing cycle of reassessing the situation and the environment. New officers may not have the experience to recognize and react to a developing situation in a timely manner. Recognizing shortcomings in human behavior and applying them to new or revised educational techniques may assist in reducing the high incidence of marine casualties (Emad & Roth, 2008; Giziakis et al., 2012; Iordanoaia, 2010; Wang & Zhang, 2000).

Current theories with both heuristic and naturalistic decision making, as well as intuition all depend on experienced decision makers (Azuma et al., 2006; Dane et al., 2012; Hall, 2010; Hoy & Tarter, 2010; Klein, 1998; Klein, 2008; Klein et al., 1989; Randel & Pugh, 1996). Because there are currently no studies to describe or understand the meaning in the decision making of junior officers, this would suggest a gap in the literature and need for further research. Conducting a study describing and understanding the decision making of these novice decision makers contributes knowledge and has implications for maritime educators and the maritime industry as a whole for maritime safety. This chapter reviewed the literature essential for establishing a theoretical framework for this study. The next chapter will describe the methods used to conduct the study.

## **CHAPTER THREE: METHODS**

### **Overview**

This study is an inquiry into the decision-making process of inexperienced junior officers in a maritime simulator under adverse conditions, and how they describe their experiences. The methods used, including observations and interviews, are common to hermeneutic phenomenological research (van Manen, 1990). Once the data was gathered, it was analyzed for meaning and emerging themes (Cresswell, 2013; Moustakas, 1994; van Manen, 1990). The General Self-Efficacy Questionnaire (GSE) was included in the study to deepen and enrich the data for further description of the participants' experiences.

### **Design**

This research was oriented towards individuals with a common experience, specifically deck officers who must make key decisions for the ongoing safe operation on their vessel. This qualitative study employed hermeneutic phenomenology which included interpretation of the text of the interviews. Hermeneutics is the art of reading a text so that the intention and meaning behind what is presented are fully understood (van Manen, 1990). This description of experiences and their underlying dynamics, or structures that account for the experiences, provides a central theme that enables the reader to understand the substance and essence of the experience (Moustakas, 1994; van Manen, 1990).

The philosophical assumption of the study was based upon an epistemological assumption, which suggests the researcher get close to the participants and gather data. The data collected from the participants was considered subjective. Therefore, given a special situation and environment, observation and inquiry was made based upon the description of the participants' experience regarding how and why their decisions were made. The experiences of

the participants were subjective, and this study sought to develop a theory or pattern of meaning from those experiences (Creswell, 2013; Moustakas, 1994). Furthermore, the study's interpretive framework was social constructivism. The objective was to understand and describe the decision making of junior officers. Individuals had their own interpretation of the events, and because the participants' points of view were subjective, the goal was to generate a theme or identify a pattern within these interpretations (Creswell, 2013).

### **Research Questions**

RQ1: While navigating their vessel, how do maritime junior watch officers describe their decision making process in an adverse situation?

RQ2: What factors do participants identify as affecting (positively or negatively) their critical decision-making process?

RQ3: What motivated the participant's decision when choosing one solution over another?

### **Setting**

This study was a field study conducted at a northeastern state-owned maritime academy that provides maritime education for individuals from around the globe seeking to enter the maritime profession and for professional mariners seeking to advance their careers. The pseudonym of North East Maritime Academy was used to protect the identity and locale of the setting. The university offers undergraduate and graduate degree programs as well as United States Coast Guard (USCG) approved courses (United States Coast Guard, 2014a). The research required a facility with a state-of-the-art, high fidelity, full mission, ship-handling simulator using Transas NTPRO 5000 simulation software on Windows® 7 platforms. To ensure the trustworthiness of this study, it was necessary that the research be conducted at a site having state-of-the-art equipment similar to the training facility where I work and with which I am

familiar.

The state maritime academy's organizational structure is similar to most universities. It includes a president, provost and vice president for academic affairs, and department heads. The exception is that students are organized into a pseudo-military structure consisting of cadets (students), a commandant (head) of cadets, and the organization of cadets into battalions, companies, and platoons. The university has an enrollment of over 1,850 students, including 1,250 members of the Regiment of Cadets.

This study involved participants enrolled in an undergraduate course NAUT 416, which falls under the marine transportation department. The chairperson of the department granted permission to conduct the study, to observe the participants from the control room, and to ask the participants if they wished to volunteer to be interviewed. Many of the faculty were interested in the study and were willing to assist as needed.

### **Participants**

A study by Giziakis, Goulielmos, and Lathouraki (2012) identified that the majority of maritime incidents are due to the deck officer on the bridge. The USCG (2005) determined that there are 204,835 mariners in the United States. Of these, only 5,107 are considered junior watch officers. These officers, whether coming up through the ranks or graduating from a maritime university, have minimal experience and possess only a few of the necessary skills for engaging in a decision-making position such as standing a bridge watch. The data for this study was collected from 15 participants, who were junior watch officers attending the North East Maritime Academy. Cresswell (2013) indicated acceptable sample sizes for this research design ranges from three to 15 individuals. The maximum variation sampling method of the school's population was used for this study. Participants were recruited from students participating in

NAUT 416 who were in the process of completing their Officer-in-Charge of a Navigation Watch (OICNW) assessments (United States Coast Guard, 2014b; Servidio, 2014). Upon completion of their class, the mariners were approached and asked if they would like to participate in this study. The selection was based upon various U.S. maritime universities' demographics of deck officers and students. Participation was voluntary.

The USCG stated that they do not track the demographics of their maritime population (Dutra, L. M., personal communication, March 14, 2014). The demographics for this study came from Collegedata.com, which lists demographics data for most universities and colleges in the U.S. When reviewing the demographics of maritime universities, a cross-section of the maritime population was determined. The population of the North East Maritime Academy is made up of 89.3% males and 10.7% females, with ethnic representations of 4.4% Asian/Pacific, 0.1% Indian/Alaskan, 9.2% Hispanics, 4% Black, 74.1% Caucasians, and 7.9% unknown or did not report (“United States Merchant Marine,” 2014). The participants were students attending classes at the North East Maritime Academy who were preparing for, or had already tested for third officer. The goal was to understand the experiences of 15 participants, an appropriate sample size for phenomenology according to Cresswell (2013). Of those participants, there were 14 males and one female. The ethnicity of the participants was one Asian/Pacific, two Black, and 12 Caucasians. The participants came from a variety of social-economic backgrounds and cultures. It took three weeks to collect data from a sufficient number of participants for this study.

### **Procedures**

The first step in this study was to secure Institutional Review Board (IRB) approval from Liberty University and the participating academy (see Appendix A). Upon approval, the

research was conducted at the appropriate time in the maritime course, when the participants were conducting Puget Sound Exercises 2 and 3 (see Appendix B). The participants were exposed to over 11 simulations in this class. Because the intent of the study was to observe and describe novice decision makers, I chose to observe the behaviors in the earlier simulation exercises. Frequent exposure to problem solving scenarios would create in the participants a behavior to treat simulation like a game rather than a possible real life experience, perhaps affecting the results, so earlier experiences were chosen.

Knowing the technical requirements for the setting of this study, a colleague recommended the chosen site. I contacted the North East Maritime Academy and provided copies of all necessary documents to the administration, department chair, and instructors. With permission from all these, I conducted a passive observation of the class's simulation exercises from an observation booth, to prevent the presence of a stranger influencing students' behaviors during the simulation exercises. At this point I had no direct interaction with the students. I utilized the Observational Protocol Form (see Appendix C) to note significant events such as collisions or groundings, along with personal thoughts, opinions, and student activity. Specific activity notes focused on decisions that were made or were neglected to be made, and verbal and non-verbal activity. After the simulation exercise, as arranged with the academy, I approached the students and requested volunteers to be interviewed. The gift of a \$20 Visa card was offered to each interviewee.

I selected 15 participants from among those who volunteered. Every effort was made to have a cross section of volunteers utilizing the maximum variation sampling method of the school's population (Maykut & Morehouse, 2000; "SUNY Maritime Academy," 2014). I explained both the purpose of the research and the consent form provided to each participant and



clarified information to address any questions posed. When the participants signed the form indicating both consent to participate and understanding of monetary compensation (see Appendix D), the GSE was administered (see Appendix E). Self-efficacy is a person's belief in one's own ability to succeed in specific situations; therefore, the GSE was used to identify whether or not there was a connection between the participant's performance, self-efficacy, and decision making as suggested by previous research (Bandura, 2006; Brown, 1999; Bruce, Sachin, Srivastava, & Stellern, 2007; Ely & Sitzmann, 2011).

Finally, I interviewed each participant in person, using the questions listed in Appendix F. The interviews were audio recorded and later transcribed by a professional transcriptionist. During the interviews, I used a journal to record personal thoughts and opinions (see Appendix G). The use of the journal was to help me maintain a distance from the participants' experience, to remain as transparent as possible, and to set aside the researcher's own "prejudgments, biases, and preconceived ideas about things" (Moustakas, 1994, p. 85).

For data analysis I used a coding method of the statements that were analyzed and reduced to key themes. All data and files were stored on a password-protected computer. Files were encrypted, backed-up, and stored in a securely locked file cabinet in the researcher's office. They will remain secured until they are destroyed following the culmination of the dissertation and the time required by the IRB.

### **The Researcher's Role**

The researcher was the vice president of academics at a southeastern Virginia maritime training facility, which is unaffiliated with the research site for this study, and had served over 40 years in both the Navy and the commercial maritime industry. For more than 12 years, I have taught mariners at all levels of experience. During this time my interest in human behavior and

particularly the decision-making process has grown. Having been involved with students for many years, helping them achieve and exceed their expected levels of proficiency was a role that I sought to achieve. I believe that positive interactions with my students could have lasting, far-reaching implications.

My professional responsibilities as vice president included directing and assisting in the creation of new courses and programs and maintaining accreditation of the school and of select programs. With 95% of the school's curriculum requiring USCG certification, the continual recognition of this organization is of utmost importance. Additional responsibilities involved maintaining the integrity of the curriculum and ensuring instructor certification while providing ongoing instructor education. My administrative duties also included working with other entities for recognition and accreditations including the American Council on Education (ACE) and an international organization, Det Norske Veritas (DNV). Interaction with students was limited as my primary interactions revolved around staff, instructors, and organizations outside of the school.

While still employed at sea and during my time off, I earned a Master of Arts degree in professional counseling. It was during my internship and interactions with clients that my understanding of peoples' non-verbal communication deepened. While I was teaching full time, it became obvious when students were struggling with a subject area or were stressed during a simulation exercise. The most frequent student behaviors that I observed included failing to notify the captain when it was appropriate, or just freezing up. I never fully understood why this was happening. What is now apparent to me is that many incidents involving junior officers occurred because they repeatedly failed to notify the captain and made wrong decisions autonomously.

While operating a vessel, I have never made a critical decision which adversely affected the safety of that vessel or the lives of crew members or passengers onboard. However, like most people, I have made errors in judgment. Because of these experiences, I am better able to understand the thinking and the emotions that many students describe. These experiences were important as I inquired into the phenomenon of new officers' decision making and how they described their experiences. I was able to take their experiences and formulate them into identifiable themes and patterns. From there, as an educator, I was able to articulate the meaning to my peers for further discussions and transfer this understanding for possible realignment or revisions to the curriculum for the benefit of future students. Due to my position and the potential influence and relationship with students, the study was conducted at another school located in a state different from my own. This school had no affiliation with my place of employment. Being an invited guest of the maritime academy, I had no influence or relationship with any of the participants.

### **Data Collection**

#### **Observations**

The researcher did not participate as an instructor during the simulated activities central to this study. Instead I was an observer in the simulator control room, taking reflective notes using an observational protocol (see Appendix C). By using passive observations of the participants, I reduced the possibility of participants reacting in a certain way or changing their behavior due to awareness of being observed. The exercises occurred on a pre-determined schedule, and the instructor notified the researcher when the students would be in the simulator. The instructor did inform the students that there was an inconspicuous camera mounted in the rear portion of the simulator, permitting the instructor to view participants' performance during

their first simulation exercise. Prior to the study, the participants had already participated in two exercises in the simulator. It was usually by this period that the participants were accustomed to and complacent about being observed. The instructor took notes of participants' errors of judgment and whether they were committed by omission or by commission. The determination of the effectiveness of participants during their assessment was subjective. The instructor recorded the events for later debriefing in the classroom. The researcher was a passive observer at the simulation control station, where there were displays with video and audio feeds from the simulation bridges. I made notes focusing on those errors of judgment and concurrent behaviors, whether verbal or non-verbal that were made throughout the exercise.

### **Decision-Making Performance Task**

The normal procedure for the simulator activities was for the instructor to brief the student on the simulator controls and to discuss the requirements as set forth in the assessment. The visual system of the simulator produced a seascape of 240 degrees in a horizontal view and 40 degrees in a vertical view. Visualization of the ship's simulator-produced movement led to physical reactions mimicking those seen with true ship motion, including body swaying, and even vertigo (seasickness) among students. The simulated bridge had consoles, controls, and displays replicating the equipment used on actual vessels. The bridge team consisted of a mate, a navigator, a radar operator, and a helmsman. For this study, the observations focused solely on the mate on watch, and did not focus on the navigator, radar operator, or the helmsman

Some students were assigned both Exercise 2 and Exercise 3 from the course syllabus (see Appendix B). Although there was a navigator, radar operator, and the helmsman on the bridge, I observed the lone officer on watch making decisions on the safe navigation of the vessel. This junior officer was in control of the vessel for one hour. During the students' time in

the simulator, the course instructor evaluated activity as each student encountered various events including estimating times of arrival, safe navigation of a the channel, giving helm orders to the helmsman, coordinating traffic avoidance with the radar operator, and maintaining awareness of changing weather conditions. The instructor's assessment of the student's success was subjective. However, if the student failed to follow the captain's standing orders, failed to communicate or used inappropriate communication, or caused a critical incident such as a collision or grounding, such events caused a student to fail the exercise. Even with a critical incident of a grounding or collision, the student could still pass the assessment if the student used the checklist for dealing with the emergency.

### **Surveys/Questionnaires**

After selecting participants from those students who volunteered and obtaining their informed consent, I provided a copy of the GSE (see Appendix E) for each participant to complete. The questionnaire was used for descriptive purposes to examine if high self-efficacy or low self-efficacy had some influence on the participants' decision making while engaged in the simulation. Previous literature (Bandura, 2006; Brown, 1999; Bruce et al., 2007; Ely & Sitzmann, 2011; Lanigan, 2008; Norton, 2013) suggested that low self-efficacy could result in a failure to act or in an increased reaction time needed in a given situation.

The GSE is a self-reporting measure that was created to assess a general sense of perceived self-efficacy with the aim of predicting ability to cope with daily complexities and adapting behavior after experiencing various kinds of stressful life events (Schwarzer, 2008). The scoring of the responses was made on a four-point Likert-type scale. The scoring range was from 10 to 40 points. The responses were calculated from a sum score with 30 points being the cut-off score used to establish low self-efficacy. Schwarzer (2008) stated that on average, the

time required to complete the GSE was four minutes.

Schwarzer (2011) reported a correlation between self-efficacy and other personality traits such as failure of action orientation ( $r = 0.43$ ), decision or action orientation ( $r = 0.49$ ), and hope for success ( $r = 0.46$ ). The sample was derived from 180 university students. The correlations were considered highly significant. Test items referred to successful coping and implied an internal-stable attribution of success. The test samples came from 23 nations. Cronbach's alphas ranged from .76 to .90, with the majority in the high .80s (Schwarzer, 2008). Schwarzer (2008) indicated that the scale is unidimensional, and the "Criterion-related validity is documented in numerous correlation studies where positive coefficients were found with favorable emotions, dispositional optimism, and work satisfaction" (para 10). Schwarzer (2011) stated:

You do not need our explicit permission to utilize the scale in your research studies. We hereby grant you permission to use and reproduce the General Self-Efficacy Scale for your study, given that appropriate recognition of the source of the scale is made in the write up of your study. (p. 1)

The GSE score reflected whether or not an individual had good self-efficacy. According to Bandura (2006), those participants with a high self-efficacy would believe that they could perform their duties and make appropriate decisions regardless of the circumstance. The reverse should also be true; if participants score low on the scale, then this suggests they have low self-efficacy and may not make decisions as effectively or efficiently (Bandura, 2006; Brown, 1999; Bruce et al., 2007; Ely & Sitzmann, 2011; Norton, 2013). Therefore, junior officers may not feel confident about their performance or decisions if their GSE score was below 30. The goal of this research was to use the observations of the participants in the simulator, the GSE score, and the interview descriptions to examine consistency between actual performance and their perception

of their self-efficacy (Lanigan, 2008). Additionally, the GSE score was used to enhance those parts that were revealed from the interviews about how the participants described their expediencies, thoughts, feelings, and decisions that were made.

## **Interviews**

Upon completion of the simulator class, I contacted all potential participants in person and asked them if they would be interested in participating. For those who agreed, a time and place was arranged for the interviews. The participants were asked to read and sign a consent form before any interview was conducted. The interviews were audiotaped and transcribed verbatim by a professional transcriber for later analysis by the researcher. Open-ended interviews, lasting between 30 and 120 minutes, utilizing the following questions, were conducted with the participants (see Appendix F):

1. Describe your experience in the simulator scenarios?
2. Describe how you felt about the decision(s) you made in the simulator.
3. What rule or procedure was in your thought process that led you to a particular decision?
4. How confident were you in your decision making and why?
5. Referring to other traffic that they made a maneuver for: Was the other ship's action correct under the International Regulations for Preventing Collisions at Sea (COLREGS)? If you disagree with what the other ship did, why do you think they did it?
6. What alternatives did you have?
7. If you missed a piece of useful information, why?
8. Would you do it differently if faced with the same situation again? If so, what would

- you do and why?
9. What do you think it means to miss a critical decision?
  10. What factors do you think contribute to a good or bad decision?
  11. Why do you think officers on the bridge make good or bad decisions?
  12. What do you think would help you make better decisions?

I developed the interview questions to specifically elicit information related to the three research questions guiding this study. Before conducting the interviews, I asked three individuals to review the list of questions, to avoid having questions that seemed biased or leading, and for feedback that the wording would elicit the information intended, enhancing reliability. The three people reviewing the questions were the chair of my dissertation committee, the research consultant assigned to this study, both familiar with sound research practices, and a colleague in the maritime field, familiar with the issues being explored in this study. As listed in Appendix F, questions one and two were related to RQ1 in that the participant was describing the experience in both thoughts and feelings. Questions three, six, seven, nine, 10 and 12 were related to RQ2. Because the decision had the potential of being correct, the researcher was seeking what the participants understood about the events that made their decision legitimate. Questions four, five, eight and 11 were related to RQ3 because they delved further into how the participants saw themselves and how they could have done better. Reflection allowed the students to review the events to ascertain what they could have done differently and how they may do better the next time. The participants' feedback was helpful in formulating improvement to the curriculum.



## **Data Analysis**

### **Scoring**

The initial step in data analysis was to total the scores from the GSE of the participants to determine either high or low self-efficacy. According to Schwarzer (2008), a score over 30 is considered high self-efficacy. The questionnaire was used to identify whether any connection between the participant's performance, level of self-efficacy and decision making existed, as other studies suggested (Bandura, 2006; Brown, 1999; Bruce et al., 2007; Ely & Sitzmann, 2011; Norton 2013).

### **Categorizing**

In the second step in data analysis, I categorized into themes the in-depth description of events from the observation. My observation notes included information from non-verbal behavior; interactions with others; emotions; and statements, or lack thereof, in terms of communication. These observation data included reflective notes that were used for bracketing the researcher's biases from the observations. The observations and reflective notes were integrated with the interview transcripts as a comparison of the participants' description and how they actually performed in the simulator (Creswell, 2013; Moustakas, 1994).

For the next step I read the interview transcripts for overall understanding while making notations of every expression relevant to the experience in the process. Then, I listed and identified significant statements through a process known as horizontalization of the data. The significant statements were based upon how the participant had perceived the decision-making experience.

### **Coding**

I utilized the NVIVO 10 software in assisting with the analysis of data from the

observations, personal notes, interviews and questionnaires. I looked for patterns, repeated words or phrases or even stark contrasts, and I assigned the significant statements a heuristic code. During this process, I was constantly comparing data applicable to each code noting emerging categories or noting new data fitting into existing categories. Glaser (2008) identified this data analysis method as the constant comparative method of qualitative analysis.

I reviewed the evaluation of the statements and the coding nine times, first creating a list of significant statements, and then reducing that list to eliminate overlapping significant statements (Creswell, 2013; Moustakas, 1994). Bogdan and Biklen (2007) considered analysis of the data a process of reduction. The objective of the coding analysis was to come up with 30 to 50 different codes and reduce them. The recommended process required at least eight passes of analysis of the data. The first pass was considered the excitement period. The second through third passes were the enlightenment period. The fourth through sixth passes were found to be when the researcher became overwhelmed with the information. The seventh pass was identified as an indecisive period; however, the coding data was fixed with no more additions or subtractions. The eighth and ninth passes were the analysis stage and the dissertation reporting phase when I was able to provide my own insights and expert opinion of the data. Bogdan and Biklen suggested the following codes be used:

1. General statements the participants make describing a subject, setting, etc.;
2. Data that tell you how participants define the setting or topic;
3. Ways of thinking that are not in a general way that affect all or some of the participants;
4. The participants' understanding of objects that make up their world;
5. Codes dealing with contradictions in the participants' stories or information;
6. Tactics or methods used to accomplish or resolve the issue or task;

7. Codes of the participants' behavior;
8. Words and phrases of the participants telling a sequence of events, changes over time, passage from one thing to another.

The next major step was to formulate meaning from each of the significant statements and discern the meaning by reflecting on the verbatim statements. I identified meaning units, which clustered to create themes. These themes were verified for their essential or incidental nature through a process of free imaginative variation. Then, I asked questions about the data such as: Was the phenomenon still the same as imagined? If it was not, then it was deleted, or the theme was changed (Creswell, 2013; Moustakas, 1994). The final major step was to create a composite textural and structural description of the phenomena. Then I developed a composite description of the essence of the experience that represented the group (Creswell, 2013; Moustakas, 1994).

### **Trustworthiness**

#### **Negative Cases and Field Notes**

To maintain trustworthiness of this study, I utilized techniques such as identifying negative cases and keeping field notes. I did identify negative cases revealing contrary data, which alleviated the possibility of presumptions by the researcher (Creswell, 2013). I kept field notes during the observations, which allowed for accurate retrieval of all information with non-verbal behaviors, interactions, and decisions that were made (see Appendix G). These notes were also used during the interviews to check for accuracy between the observer and the interviewee. The notes were used during the data analysis for determining accuracy or contradictions between the descriptions of the participants' experience, what was observed, and what the participants did or said (Creswell, 2013).

## **Bracketing**

According to Newman and Tufford (2010), “Bracketing is a method used by some researchers to mitigate the potential deleterious effects of unacknowledged preconceptions related to the research and thereby to increase the rigor of the project” (p. 81). I did attempt to bracket presuppositions and experiences, which were set aside during the study (see Appendix G). Setting aside particular points of view and or biases on the subject allowed me to view in a more objective manner the data collected. It was important that I continued to suspend throughout the study my personal experiences with maritime courses and educational programs so that meaningful data could be collected (Chan, Fung, & Chien, 2013; Creswell, 2013; Newman & Tufford, 2010).

A practice that helped bracket my biases was memoing. Chan et al. (2013) suggested, “Reflexivity is the key thinking activity that helps us to identify the potential influence throughout the research process” (p. 3). I wrote memos to record reflective notes that included comments pertaining to my feelings, perceptions, and subject matter previously learned. Memoing was used during the observations and the interviews (see Appendix G). During data analysis, I used the memoing notes for reflection on how my perceptions and the perceptions of the participants compared or contrasted (Chan et al., 2013; Creswell, 2013; Newman & Tufford, 2010).

## **Triangulation**

Triangulation is a method that uses two or more methods in a study in order to create trustworthiness of the results (Creswell, 2013). For this study, I triangulated information from the observations and field notes, the GSE scores, and the interviews to document intent and support the various themes. By combining the observations, the GSE scores, and the interviews,

I was able to overcome the weakness or intrinsic biases that come from a single method.

### **Member Checking**

The participants reviewed the transcripts of their interview statements. This provided the interviewees an opportunity to check statements for completeness and accuracy. The member checks, therefore, helped ensure the accuracy of their statements while safeguarding that my personal biases were bracketed out of the data. This process promoted the reliability of the study and reflected what was stated and intended. To accurately portray the participants' comments was of utmost importance. An additional advantage to conducting member checking was that it gave the participants a feeling that they were also stakeholders in the study (Creswell, 2013).

### **Peer Review**

Colleagues from Liberty University were asked to conduct a peer review or debrief of the entire process. The research consultant, a member of the university, provided an opposing opinion, in which he critiqued the meanings and interpretations of the study. This peer review was intended to keep the researcher honest and provided an external check of the research process (Creswell, 2013).

### **Ethical Considerations**

Because I was the head of academics at a training center in Virginia, had I conducted the research at that site, participants may have voiced concern regarding whether the researcher had the ability to alter the grades of participants. This predicament created a power issue. Because the researcher's position had the potential to interfere with the trustworthiness of the study, the research was conducted at another school site. I was not an instructor of the selected class, which helped avoid the potential perception by the participants that if they did not participate in the study, their grades would be affected in some fashion. Furthermore, I was not visible during

the simulator exercises, but as an observer remained out of sight of the participants when they were in the simulator control room. In addition, I clearly explained before the interviews that participation in the study would not have any impact on their grades (Creswell, 2013).

To insure confidentiality, participants' actual names were not used. Furthermore, all interviews, videos and tape recordings were kept confidential and secure. All observational notes and written data were kept on a computer, which was encrypted. The written notes were immediately shredded once they were transcribed electronically. Any recorded data or personal information was also kept on a computer and encrypted with a password. This information was backed up to a DVD and stored in a locked file cabinet (Creswell, 2013).

### **Summary**

This chapter presented the identification of the participants as well as the methods used for data collection and analysis. The study required a school that had both a student population comparable to that of the maritime industry and a state-of-the-art simulator in which to accurately evaluate decision making as though the experiences were happening on a real ship. To collect the data I utilized observations, questionnaires, and interviews with the participants. For data analysis I used a coding method of the statements that were analyzed and reduced to key themes. To ensure the trustworthiness, the study utilized field notes, bracketing, triangulation, member checking, and peer review. Finally, the participants' private information and personal data were protected with the highest possible security. In the next chapter, discussion will focus on the findings of this study.

## **CHAPTER FOUR: FINDINGS**

### **Overview**

The research study reported here examined the problem that human error accounts for as much as 80% of maritime incidents. The purpose of this study was to describe the decision-making process of maritime junior watch officers navigating a vessel in adverse situations on a high-resolution, full mission bridge simulator. This chapter presents an analysis of the participants. The rest of the chapter is organized in themes derived from the three research questions posed in Chapter One. It first reports how the participants described their experience with the situations presented and how well they understood the reasons for the decisions they made. It then reports factors participants identified as affecting, either positively or negatively, their decision-making process. Finally, it reports what motivated the participant's decision when choosing one solution over another.

### **Participants**

The following is an individual descriptive synopsis of the participants in this study (see Table 1). All names provided in this study were pseudonyms assigned to protect the identity of the participants. These individuals were in their senior year as a cadet at the participating university. This study was conducted as part of a course that was the capstone class each participant had to pass prior to graduation. The ages of the participants ranged from 21 to 26 years. Of those participants, there were 14 males and one female. The ethnicity of the participants were: one Asian/Pacific, two Black, and 12 Caucasian. The participants came from a variety of social-economic backgrounds and cultures.

The simulator experience required the participants to safely navigate an 870-foot container ship with a deadweight of about 60,000 long tons through the Puget Sound passage at

Table 1

*Overview of the Participants*

<i>Pseudonym</i>	<i>Age</i>	<i>Gender</i>	<i>Race</i>	<i>Home of Origin</i>	<i>Completed Simulation</i>	<i>GSE Scores</i>
<i>Alan</i>	24	Male	Caucasian	Long Island, NY	<b>S</b>	<b>38 H</b>
<i>Ben</i>	24	Male	Caucasian	Long Island, NY	<b>S</b>	36 H
<i>Carl</i>	22	Male	Caucasian	U.S.	<b>U</b>	31 H
<i>Diane</i>	22	Female	Black	Jamaica	<b>U</b>	<b>24 L</b>
<i>Edward</i>	22	Male	Caucasian	U.S.	<b>U</b>	<b>29 L</b>
<i>Frank</i>	21	Male	Caucasian	Long Island, NY	<b>S</b>	35 H
<i>Gary</i>	22	Male	Caucasian	Pennsylvania	<b>S</b>	34 H
<i>Henry</i>	21	Male	Caucasian	U.S.	<b>U</b>	<b>28 L</b>
<i>Ike</i>	24	Male	Caucasian	New Jersey	<b>S</b>	32 H
<i>Jason</i>	21	Male	Asian	New York	<b>S</b>	<b>28 L</b>
<i>Ken</i>	22	Male	Caucasian	North Carolina	<b>U</b>	<b>29 L</b>
<i>Lamont</i>	22	Male	Black	Bahamas	<b>S</b>	31 H
<i>Mark</i>	22	Male	White	Long Island, NY	<b>S</b>	30 H
<i>Nat</i>	21	Male	White	Long Island, NY	<b>S</b>	32 H
<i>Oscar</i>	26	Male	White	Virginia	<b>U</b>	<b>28 L</b>
					S = Successful U = Unsuccessful	≥30 = <b>High</b> ≤29 = <b>Low</b>

**Mean**      **22.4**      **31**

**Mode**      **22**      **28**

**Median**    **22**      **31**

night with heavy traffic. Each participant served as the mate on watch with a support team of three other students. The participant was either inbound from sea heading to Seattle,



Washington, or outbound from Seattle to sea (see Appendix B). Each of the participants already had previous seagoing experience from either the school's training ship or a private company's vessel. Ten of the 15 participants had already passed their United States Coast Guard (USCG) Third Officer exams. All participants had already attended classes in radar, collision avoidance, and electronic chart plotting, as well as standard paper chart navigating techniques.

Additionally, they all had received training as both helmsman and lookout, and were knowledgeable of maritime rules. Because providing information on demographics was voluntary, three of the participants chose not to offer this specific information. On the other hand, many of the participants who did not do well in the simulation experience provided a wealth of information into the insights of their thought process, as well as solutions they felt would help improve future performance.

**Alan.** At the time of study Alan was a 24-year-old white male from north central Long Island, New York. He explained that he was unsure of what he wanted to do and why he was at a maritime university. He left for two years and returned in the spring of 2012. During the summer training cruise he was dismissed in Iceland due to a knee injury. He returned in the fall and had a different outlook. He decided an occupation in maritime industry was really what he wanted to pursue. During his back-to-back summer cruises, he developed a true love for the sea and a greater respect for himself and for other mariners.

In the fall of 2013, Alan became involved in the student government and decided he wanted to grow as a leader. He ran for vice president in his first class year and applied to be an operations officer for the Regiment of Cadets. His leadership positions motivated him to pass his USCG license exams the first time taken. He graduated in May, 2015, and began working for Military Sealift Command. His long-term goal was to become a Biscayne Pilot in Florida.

While in the simulator, his performance was outstanding; however, the instructor stated the team did not follow the standing orders and the vessel had crossed over to the opposite side of the vessel traffic scheme for 20 minutes.

**Ben.** At the time of the study, Ben was a 24-year-old white male from western Long Island, New York, who not only played football for the university as a tight end, but also had played for his high school. In high school, he had also wrestled and played both basketball and baseball. During the simulations, Ben and his team safely navigated the required passage, but the instructor stated that Ben failed to give proper helm orders.

**Carl.** At the time of the study, Carl was a 22-year-old white male who, prior to attending the university, had no maritime experience. During his freshman summer training cruise, he worked on a ferryboat, and on his sophomore cruise he worked on an articulation-towing vessel, where he would often steer under the supervision of the captain. On his senior cruise, he worked with a third mate inspecting all safety-related parts of the ship. Carl had some trouble navigating the channel. His team's behavior appeared to be a little too relaxed. However, during the latter part of his exercise, his performance improved.

**Diane.** At the time of study Diane was a 22-year old black female from the island of Jamaica. In 1992, she immigrated to the United States (U.S.). She aspired to become captain of a large cargo ship. Diane is the third child of her family and is the first to attend a maritime college. Diane was employed by a nonprofit organization where she was a program assistant in a water and environmental science department.

Diane's performance in the simulator was not successful. Nevertheless, it was observed that, in spite of her difficulties, she notified the captain nine times, regardless of his displeasure with the frequent notifications. She was one of the few participants who extensively shared

thoughts and feelings and gave a very full and rich description of her experiences.

**Edward.** Edward was one of the participants who chose not to share any personal information. He was a 22-year-old white male. Edward did not successfully navigate the channel, because his team did not have a voyage plan. This caused them to miss their destination. Instead of arriving at Seattle, they continued on toward Tacoma. Edward did have good communication skills with the Vessel Traffic Service.

**Frank.** At the time of the study, Frank was a 22-year-old white male from southern Long Island, New York. He enjoys wrestling and hockey. Even though Frank safely navigated the channel, he and his team seemed to ignore a vessel that was coming up from behind them. Frank did have some trouble with proper radio communications.

**Gary.** At the time of the study, Gary was a 21-year-old white male who grew up in eastern Pennsylvania. He played numerous sports, but he mostly enjoyed playing soccer. His family had a boat, and their vacations centered on water activities. This helped influence his decision to go to a maritime college. He felt that his experience at the college better prepared him for a post-college maritime career. Gary and his team did an outstanding job in the simulator. The only problems the team encountered were related to unfamiliarity of equipment.

**Henry.** At the time of the study, Henry was a 22-year-old white male. Henry chose not to disclose any background or personal information. Even though he felt comfortable about the decisions he made in the simulator, he said he felt out of place in his performance because it was not a real ship. Henry and his team missed their objective of entering Seattle. They also had trouble with the traffic on a couple of occasions in which they had some near misses

**Ike.** At the time of the study, Ike was a 24-year-old white male from near the New Jersey shore. He graduated high school in 2009 and worked as a commercial fisherman prior to

enrolling at the college in January of 2012. He felt his experience at the college really helped shape him into a better mariner. What he considered to be the most valuable aspects of his training were both a summer training cruise with a shipping company and the time spent in the simulators. Overall, Ike and his team did a good job in the simulation. The only major setback was that the captain had to come to the bridge to assist him in making his turn into Seattle.

**Jason.** At the time of the study, Jason was a 21-year-old Asian American who played on a college soccer team for four years. Prior to college, he also played soccer for his high school in eastern New York. He described that when he was on his senior summer cruise and assigned as Cadet Watch Officer, he made good decisions. Jason felt that his simulator experience was not real enough for training. He stated that his simulator experience was like a bunch of friends getting together to play a video game. The team had trouble navigating the channel and, at one point, the team had doubts about the location of the port of Seattle. Problems with navigation caused further communication issues with Vessel Traffic Service and his docking tug services.

**Ken.** At the time of the study, Ken was a 22-year-old white male from central North Carolina. He was a linebacker for the college's football team. He was elected to the Football Leadership Council by his teammates. He earned the Navy Level Lifting Award in the off-season program by lifting 1290 pounds. He also played football in high school. Overall, his team successfully navigated the channel. Ken did have some trouble with radio communications, but the instructor did not count that as being significant. He did express in the interview a high degree of confidence going into the simulation.

**Lamont.** At the time of the study, Lamont was a 22-year-old black male from the Bahamas. He played basketball in college, earning the Maritime College Outstanding Athlete Award for men's basketball. In the simulator, Lamont and his team did an outstanding job safely

navigating the channel in the simulator. During the interview, Lamont shared his insights about the success of his performance and what would help make others successful.

**Mark.** At the time of the study, Mark was a 22-year-old white male from southern Long Island, New York. Because he lived by the ocean, he was always fascinated by it and often surfed and fished. He often used the family boat for trips with friends. Living by the water motivated him to attend a maritime college and have a maritime career. He never regretted going to the maritime college and is proud to say so. His philosophy was that without hardship and struggle, it is hard to be proud of what you do, and adversities will always test one's ability to overcome challenges. Mark and his team did a good job of working together in the simulator. Mark safely navigated the channel and had good radio communication skills.

**Nat.** At the time of the study, Nat was a 21-year-old white male from western Long Island, New York. The maritime college was his first choice for school. He played soccer for all four years in college. He was vice president of the fishing club, secretary for the Maritime Athletic Program (MAP) club, and was also a squad leader. He felt that he had a great time at school, mostly due to having a great group of friends. He stated that he took advantage of everything the school had to offer. During his summer training cruises, he had an internship at an oil shipping company. He is now working for a tank barge company. Nat took the simulation seriously. He arrived 30 minutes early with his notes and charts to prepare for the exercise. With the exception of a couple of VHF radio communication misidentifications, he and his team did a very good job navigating the channel.

**Oscar.** At the time of the study, Oscar was is a 26-year-old white male from southeastern Virginia. Oscar chose not to disclose anything about his background. He did have some difficulty early on in the simulation. About three fourths of the way into the exercise, his

performance began to improve. As he approached Seattle, he failed to listen to his team and plan ahead. A vessel to his port prevented his turn into the harbor and he overshot the Seattle harbor.

## **Results**

The participants were a great source of information and insight. I utilized the NVIVO 10 software in assisting with the analysis of data from the observations, personal notes, questionnaires, and interviews. Although the software assisted me in the analysis of the results, my interpretations of the results were subjective. Prior to analyzing the data, I had a presumption that self-efficacy would be a factor influencing whether or not juniors would call the captain when needed. From the data collected during the simulation exercises, interviews and GSE questionnaires, this presumption was dispelled. Nonetheless, there were three themes that emerged from my interactions with the participants. These three themes were (a) the Decision-Making Process, (b) Factors in Decision Making, and (c) Motivations and Solutions to Decision Making.

### **The Decision-Making Process**

In the responses to RQ1, which focused on the decision-making process, the following three subthemes were identified through the interviews and observations: preparation, self-awareness, and simulated versus real world experience. Among the interview questions listed in Appendix F, questions one and two were related to RQ1 in that the participant was describing the experience in both thoughts and feelings.

In the interviews, the participants were identifying things they did or thought about to assist them in making decisions in the simulator. One of these helps was *preparation*, the first subtheme. For at least eight of the participants, preparation affected how decisions were made. There were, of course, numerous decisions to be made during the simulation. Having some

prepared notes and charts helped these individuals safely navigate the channel and maintain focus during the unexpected situations that arose in the exercise.

The second subtheme that emerged in the decision-making process was *self-awareness*. No individual can be certain of another person's emotions or thoughts in a given situation. What a person is thinking or feeling appears to determine how effectively that person is going to make a decision. During the observation of the participants in the simulator, I noted both audible and visual cues that indicated whether a participant was under some degree of stress or relief in a situation. In the interviews the participants described their thoughts and emotions about a decision before, during and after a given situation. Goleman's (1995) concept of self-awareness was used to help analyze these scenarios and the participants' interpretations of the events.

A high-resolution simulator is used in numerous occupations for training, educating and assessing a person's level of expertise. Simulators allow an educator to have students react to events and situations that would otherwise be too dangerous and costly. No matter how detailed a simulation is, it is up to the individuals to allow themselves to believe the simulation reflects a real-world situation. Their degree of belief seems to affect how seriously the participants take the decision-making process. *Simulated versus real world experience* is the third subtheme used to describe a participant's decision-making process.

The three subthemes of the decision-making process theme emerged from the data collected. These three subthemes were identified in the transcripts of the interviews with participants. Excerpts from the interview provide evidence of the subthemes of preparation, self-awareness, and simulation versus real world experiences.

**Preparation.** Preparation was the first subtheme identified through the interviews and observations. Regardless of being a novice or expert decision maker, voyage planning is a

critical part of the watch officer's success in making a safe passage. Eight out of 15 participants successfully navigated their assigned voyages. An example of the required voyage plan is in Appendix B, specifically in Exercises 2 and 3. Those participants who were prepared seemed ready for the exercise as they executed their plan. Those who made a successful passage suggested as much from their interviews, as seen in the following examples.

Ken:

Being prepared and knowing what to expect, you know, can lead to, like I just said, you know your initial voyage plan you realize that there's a four knot current over here or there's a ferry over here and you can see those situations before they even happen, with being prepared and uh, you know you're instantly ready to make those decisions. Being unprepared, you know as soon as those situations are presented, you start to question yourself or start to have to... it starts to become a thought process instead of, you know, second nature to you, so.

Alan:

Going up there alone and looking at the voyage plan and making notes, maybe bring a pen and paper an old pad (short laugh) and then you know, write down, hey at this time we've got this coming up, this part of the voyage plan and check the charts and just; it's all about double checking your work. Well as I said before, just understanding what you're getting into.

Lamont:

Being prepared, knowing what you have to do, uh, being aware, um, it's basically being confident basically. Even those who did not successfully navigate the required passage, did concur that preparation would have made a difference.



Diane:

In the voyage planning, I should've made sure that every single point that I needed would've been completely covered and it was clear to everyone. For example, my navigator couldn't find the pilot station, so had I taken the step to find that and point it out, then we wouldn't be delayed in the ETA, and maybe she would've been able to, you know, be of more use to me

Jason:

Yes. I would, well I would go over my information a lot more. Take my time on plotting the chart, take my time reading the chart and knowing my area. And knowing as much information I can about the area, the traffic, all the other ships around me, what they're doing, where they're going; all that stuff.

Mark:

And someone who makes a bad decision, obviously they don't know as much as they should and they should be more prepared. You know maybe it's, you know yeah like I said that maybe it's just not, they're not being prepared to take the watch.

**Self-awareness of emotions.** Self-awareness was the second subtheme identified in the interviews and observations. According to Goleman (1995), self-awareness is “the sense of an ongoing attention to an internal state” (p. 46). When dealing with unfamiliar situations in an adverse condition, people experience different levels of stress. It is this stress that can either hinder or excel a person to an effective outcome. Even those who had an increased self-awareness of emotion struggled with the simulator objective, as evidenced in the following excerpts from interview transcripts.

Alan:

I trust my gut and not my second thoughts. My second thoughts are usually (short laugh) what got me into trouble.

Carl:

I wasn't sure of myself, of course, because I am somewhat new, but, um, I felt if I wasn't as sure I would make a good decision. I wouldn't make a horrible decision, just feel like I did have good reasons behind what I did during some points.

Diane:

Well when I'm a mate I get very nervous. For some reason I can't - it's not that I don't know what I'm doing, but I'm always doubting what I'm supposed to do or I'm doubting if I'm doing, if I'm making the right decisions... And then when we were going in the wrong direction, oh my God, I felt, I felt like I didn't really know what I was doing because I didn't understand how we were going in the wrong direction when I personally plotted on the chart the waypoints and all that I needed to know was; tell me which direction we're supposed to steer and since I'm not over there.

Gary:

I know a lot of kids that get onto the ship and it's like they're like a deer in the headlights because there hasn't really been much experience... I think it comes down to the competence of the watch officer as the third mate. I guess you know graduating in May, you could see some kids who have taken an easier route in school, and haven't prepared as much. And then others who, you know gone out, done internships, have really, are here because they want to be here. And I think that really also plays a part on when you go out onto your first ship, and you know, you have that background kind of

already where you are confident, you have a little bit of experience to get you, you know, get your feet wet and stuff. And I think it also comes down to the person itself, you know you have people who are just, you know you find kids that aren't confident in themselves, and they'll second guess every decision they make, whereas other kids, you know they can look at, or get there, feel comfortable and hold a very competent watch and do that while other kids are, you know they get nervous and then like it leads to the mistakes, and then the mistakes bigger problems where they're just, it's either, whether it's lack of experience or lack of self-confidence that they're just, you know I guess shy of the situation. It's like two kind of people, either easier route, and then you have the kids who work hard for everything, and then it also comes down to personality where it's, are they a competent person, or are they kind of a little shy and uneasy in situations like that

Ike:

It's also important to have like, and I guess it sounds corny, coping mechanisms you know, don't get overwhelmed, don't get worked up, still you know look at the information you have in front of you and make a new decision. You can't get caught up in the decision you didn't make. You just gotta be, as mates you gotta be on your feet, you know what I mean?... You can't get caught up in the decision you didn't make. You just gotta be, as mates you gotta be on your feet, you know what I mean?

Oscar:

And when I did get on there, there's been stress and anxiety in there. Um, it wasn't like: oh my gosh, oh my gosh what the heck am I going to do? It's more like: okay, this needs to get done, this also needs to get done, this needs to be done.

Nat:

You know I should've definitely paid attention more to that and I should've paid attention, I feel to the information given to the radio... I think what would help me make a better decision is be a little less worked-up, more calm with it, I feel like.

Lamont:

Bad decisions, I feel like I said, you could get cross-minded, like you can be focused on one thing and then another thing might just slip your mind and you might forget to do it.

**Simulation versus real world.** The third subtheme identified in interviews and observations was simulation versus real world. It is a common practice for schools to utilize simulations as an effective hands-on tool for assessing and training new ideas and concepts. The most significant advantage to using simulators is that it gives an educator and students a chance to experience scenarios that would otherwise be considered dangerous or life-threatening if experienced in a real world application. Simulation comes in various formats from a desktop computer to a full-scale virtual reality experience. Many transportation industries have taken advantage of these full-scale environments, including the aviation and the maritime communities. In these full-scale, high-resolution environments, individuals can become so immersed in the experience that they believe they are actually in an aircraft or on a ship. Consequently, instructors have observed the intense stress individuals may exhibit when encountering an adverse situation.

Immersion did not occur in this study. Eight of the 15 participants felt that the unrealistic experience in their simulator hindered their decisions. For example, it was observed that one of the two simulators did not have a back window display. This lack of display required

participants to rotate a knob on the console to rotate the external view forward to look behind the vessel. This action took time and may have been disorienting because the individuals looked at an aft view of the ship while looking forward on the bridge.

Ike:

The other one is like three or four small TVs you know that you do kind of get, you feel dated and you're not making a real decision because you don't feel like you're immersed in the environment as much as in the other one... Yeah so that's been my only bad thing I see about the simulator, that the cheesy one doesn't feel like you really get to like make an actual decision because like I said; it's just three TVs like you don't get a good angle, you can't see what's going on behind you, you know what I mean?

Jason:

And on cruise I was confident in everything I did, I made perfect decisions, I would say. And the simulator is a lot different than being on a real ship. It's a simulator, it's not the real thing so it's a lot different; it's a lot different... It's - on the ship it's the real thing and the simulator it's like a, I guess some people would compare it to like a video game. You're with a bunch of friends and we're all fooling around in the simulator, we're all talking to each other and not really paying attention. And on the ship you're in charge of, well on the training ship you're in charge of hundreds of lives when you're on watch

Henry:

I'm impartial to the simulator because yes, it's a great experience, you get to do it, but at sometimes I feel like it's very not realistic on certain situations. You know it's hard to tell with the perception of things sometimes. And then certain things disappear,

where on a real ship they wouldn't really disappear between the windows, the simulated windows and it's hard to see around sometimes... Not having a natural 360 degree range of motion as you would on a ship or you know being able to move your position. Having to use a dial to change the view of the simulator, I feel severely inhibits your ability to be situationally aware of what's going on while on a bridge or in that case in a simulator.

Simulations have been around for many decades. It is not just a tool of instruction for the educator, but a tool of learning for the student who takes the simulation seriously. Not everyone felt that the simulation was ineffective or hindered decision making. Some of the participants believed it to be an excellent training aid because it tested their skills and helped them to gain experience.

Ben:

So um, overall the experience, the simulator there's nothing like it at this school. You can talk in the classroom all you want about situations and scenarios, but until you have a helmsman, you have a navigator, you have a mate, you're looking at the radar, you're doing everything at once then you got the real feeling of what it's like out at sea... Simulators, by far, are the most helpful thing at this school besides summer sea term when you're standing watch.

Ike:

Okay. I think the simulators are a good experience here, they're definitely a way for us to, like you said, to start learning how to make decisions. It's like, the, I feel - they feel real to us, to me, like you know I feel, if I were to hit something aground, although there's not physical consequences to me when I'm doing it, I treat it like there is, that way I feel like my decisions are more lifelike, you know I don't just treat it like a video

game. I treat that like if I was on the bridge of the training ship or you know cadet shipping. I think they're a good asset to the school and to us as officers and becoming officers... I think just practice and you know take opportunities where you can to learn more, and I guess broaden your horizons. And definitely just treat everything like it's real, if you go in the simulator thinking you're playing a video game and you know; well if I hit something that's when I really grow. That's how you're gonna end if that's gonna be your thought when you're out there in the real world, and you go; well it's not my ship. So I think you just gotta treat things real and take things serious, I think it's a big aspect of making the right decision; you know just take it seriously

Gary:

I think it's very realistic as in the controls and the tools you have available as far as the radar, the ECDIS [Electronic Chart Display and Information System], and that sort.

The participants' comments and actions related to the simulation experience revealed important information about the first theme identified, the decision-making process. Within that theme, three subthemes emerged. With the first subtheme of preparation, even those participants who were not prepared for the simulation described their need and desire to be prepared, not just for the simulation, but also when they actually stand watch on the bridge of a ship. The subtheme self-awareness was used to understand the participants' internal dialogue and decision making. Those who were aware of their increasing emotional state had an option to either control their feelings or allow their feelings to overtake them. Finally, although the simulator was a detailed and high-resolution depiction of the bridge of a ship, it unfortunately did not create enough realism for more than half of the participants. This perception affected the participant's decision making. Simulated versus real world experience was a subtheme that

helped participants describe how they felt during the decision-making process and how they might have made better decisions if they had the same situation in a real bridge of ship.

### **Factors in Decision Making**

A second theme identified in this study, in addition to the decision-making process, is that of factors in decision making. In describing the decision making of the junior officer, the participants acknowledged influences that either hindered or helped in their decisions and performance. To answer RQ2, which focused on factors in decision making, the researcher used a questionnaire, interviews, and observations. Three subthemes were identified as factors in the decision making process: confidence, workload, and team cooperation.

**Confidence.** The first subtheme identified related to factors in decision making was confidence. All the participants had something to say about confidence regardless of whether they felt adequate or inadequate about their decision making or performance. When discussing confidence, Bandura (1997) stated, “Confidence is a nonspecific term that refers to strength of belief but does not necessarily specify what the certainty is about. I can be supremely confident that I will fail at an endeavor” (p. 382). Those participants who were confident felt that confidence was a key factor to a successful watch, as evidenced in the following transcript excerpts.

Alan:

I was confident in my decision making because those were the first things that came to mind; I trust my gut and not my second thoughts. My second thoughts are usually (short laugh) what got me into trouble

Ben:

I was very confident in my decision making, I feel at least, because as you're



standing man on the watch, it's your word that goes; it's your watch.

Gary:

I was fairly confident the whole time. I usually, once I have it something decided and check the chart, the ECDIS and make sure there's nothing going on, I was like I did everything I wanted to and going by what I had set-up on the voyage plan and the decisions with the traffic inbound, outbound in the traffic lanes, so I was very confident with the decisions I made. Like the opening up the Closest Point of Approach (CPA), slowing down, you know I could have informed more people, but it was exactly what I wanted to do and it allowed for safe navigation of, you know, the other ships... And I think it also comes down to the person itself, you know you have people who are just, you know you find kids that aren't confident in themselves, and they'll second guess every decision they make, whereas other kids, you know they can look at, or get there, feel comfortable and hold a very competent watch and do that while other kids are, you know they get nervous and then like it leads to the mistakes, and then the mistakes - bigger problems where they're just, it's either, whether it's lack of experience or lack of self-confidence that they're just, you know I guess shy of the situation. It's like two kind of people, either easier route, and then you have the kids who work hard for everything, and then it also comes down to personality where it's, are they a competent person, or are they kind of a little shy and uneasy in situations like that.

Lamont:

I feel I was pretty confident. I feel like if you're on the bridge of a ship you have to be confident because if you're not confident then something bad is probably going to happen, so I was pretty confident. I was pretty confident because most of the things that

I've learned pretty much was in simulators head on and like rules of the road and other things, I'm pretty much confident about my decision and what I learned here.

Confidence is a strength or conviction of the belief for success. Ten of the 15 participants expressed a certain degree of lack of confidence. However, those who did not show or express confidence understood its importance.

Diane:

It might've caused me to make wrong decisions. Like had I remained calm and confident and say to myself: yeah, you know what, you messed up, but you know just take a second and breathe and think about this. Had I done that, I think that I would've been able to make better decisions. I wouldn't have to rely on, you know the captain or keep calling about something.

Carl:

I wasn't sure of myself, of course, because I am somewhat new, but um I felt if I wasn't as sure I would make a good decision. I wouldn't make a horrible decision, just feel like I did have good reasons behind what I did during some points. And if I wasn't confident then I wouldn't act on an unconfident matter.

Frank:

I honestly, believe it or not, I wasn't confident in my decisions. Because I had four guys on the bridge team and I had a guy in the radar was telling me what the CPA is, what the time of CPA is, and I just believed him. I didn't go actually over to the radar. I mean, I did, I glanced at it and saw what he was talking about, but I should've looked at the radar, looked out the window, made sure that he exactly telling me that I agree with the exact information that he's giving me, before I made that decision.

Lamont:

Bad decisions, I feel like I said, you could get cross-minded, like you can be focused on one thing and then another thing might just slip your mind and you might forget to do it. And not being confident again, it could be turned into a good or bad situation. So I always feel like you got to be confident on a bridge and if you're not confident you should call a captain like you should; like I said before

During the observations, I noted that participants' lack of confidence in a decision usually led to a delay or no decision whatsoever. On the other hand, new officers did not usually express overconfidence in their behaviors. Just the same, some of the interviewees brought up the destructive nature of overconfidence.

Jason:

I don't know. I guess in some situations new officers and they're getting a new job, they feel overconfident, over cocky, that they feel like they can try to do it on their own and they have something to prove to the crew that they're able to do it, um all by themselves; I guess, I don't know. That's what I think.

Ken:

Overconfident with like; okay, I've been here before, like I had. I know this probably will work you know, and you don't want to, you don't want to have to call the captain over every instance, even if it is really the standing orders, you don't want to have to keep calling down to the state room and have him get a call every five minutes in a narrow channel or a crowded, you know, or a crowded, congested you know lane.

Nat:

And then the bad decision, as I said earlier, I feel like for especially an

experienced mate is they get too lackadaisical with it saying, I've done this watch a million times, and they get so used to it they don't look out for certain things that they're not used to. Like they understand that? So I feel like, you got them happier between worked-up and lazy, (short laugh) you have to just a happier isn't to keep, and then I feel like that's where you need to be for it.

**Workload.** The second subtheme identified related to factors in decision making was workload. During the simulations, the participants encountered dense traffic situations in a nighttime environment. The adverse environment, which can be even more confusing at night, required greater attention to safely navigate the channel, making various essential reports along the way, and obeying international collision avoidance regulations. Some of the participants displayed a degree of tension and frustration when the simulation began to overwhelm them a bit. As many as twelve participants expressed this point in their interviews.

Frank:

I guess because I had so many other things going on at that time, that I was like, you know you're right, when I should've, you know, like I said, I should've went to the radar, spent the time, made sure his information is correct before I started making decisions because all of these decisions are based on me, not what he says.

Jason:

At first I felt like I was doing fine. And then, I don't know, something happened and I went over to the chart and I got a little flustered and I read the wrong thing. And then right then and there it just started... the error chain for me

Henry:

I'm not sure why it happened. I overlooked the uh, I guess right at the end, I was

supposed to call 15 minutes early and I guess it was just one thing that I took - I know I read it, I read it over and over again before the simulation and what was supposed to happen, but I, I know I missed it. I don't know why. I guess it was just because I was just so busy and concerned about doing everything else right you know detail... I missed one detail. And I guess that's, you know it's a learning experience because you're gonna have to learn how to be very detailed oriented... I wasn't 100% - You know on the, one of them was overtaking the one vessel that I came a little too close on and that's why; I was too close and I was, you know that would put me out of my comfort zone and I was more worried about not hitting him, and I wasn't paying attention to everything else that, you know I should have called the master at that point to let him know, and I didn't. And that's really, you know that was one of the essential things that I should have done... Uh, it kind of just left my mind. I don't know. I'm not really sure why. I guess it was just because I was so focused on the one thing. I wasn't going through my checklist of like, my mental checklist of notes to do. So I guess it's also I guess you should write things down as well as you know to keep yourself in check. You know when this happens, do this, do this, do this because you know you weren't, I wasn't 100%, I was focused on one specific thing.

**Team cooperation.** The final identified subtheme related to factors in decision making was team cooperation. One of the factors required to safely navigating an adverse situation was to have a cooperative team to assist and provide information to the mate on watch. From the observations, it appeared that eight out of 15 participant teams were effectively cooperating with the mate on watch. When observing teams that were less effective in their performance, however, I noted problems included members who did not provide the necessary data in a timely

manner or who were too relaxed within the simulation exercise itself. A few of the interviews provided information about why this occurred.

Alan:

If I were on a real bridge, I feel like I would have made much better decisions quicker, sooner, and much more thought out. I also feel having less people on the bridge makes a huge difference. I mean in our simulator we had what; it was one person on the helm, I was the mate we had a navigator and one person on radar. And instead of focusing myself in on what's going on in the radar and assessing that with what's going outside, I have to trust somebody else's judgment and, as well as the navigator too. I had put my trust in the navigator that he would let me know as, you know the simulation started at 0600, at 0610 we had a course change, he didn't tell me about a second course change at 0615 and uh, that cost me a passing grade. (short laugh) But again, it's no fault on my own, because I trusted him to make that judgment. I feel if it were just me and the helmsman, I would have, you know, I would have no choice but to look at my chart, see what's going on, I would have made note, my own.

Diane:

So, for example, there was a time when the helm guy came off the helm and I had to say, "Go back on the helm, you're not supposed to leave the helm at all." Or when I told my navigator before the simulator and inside the simulator, "I need this information, this is how you're supposed to do it," and then she doesn't really follow through and so when I'm notified by the captain or by the pilot station about certain information that I need; for example, ETAs, I don't really know what to tell them and so I have to, you know put them on hold and ask for that information. But then 10 minutes later the

information still isn't there because she's doing something else. And I know that you're supposed to multitask and you know, I did ask her to take fixes and to do something...you know to do other things like take fixes, give me updated ETAs, which are the only two things I asked her to do to make sure that we're on track.

Frank:

Because I had four guys on the bridge team and I had a guy in the radar was telling me what the CPA is, what the time of CPA is, and I just believed him. I didn't go actually over to the radar. I mean, I did, I glanced at it and saw what he was talking about, but I should've looked at the radar, looked out the window, made sure that he exactly telling me that.

Regardless, there were teams that did have good communication and teamwork. Ken was a good example of the benefit of communication and teamwork. Ken did listen to the recommendation of his team and he was able to complete his voyage.

Ken:

Oh well that's why I think that you know, for every watch house you need to have that sort of, that extra little bit of, you know that loyalty or whatever it is that, you know because this is a pretty dynamic job. So I mean if you get rattled, you just sort of have people around you that can help you make those decisions, or you just have to have that ability to, you know take a step back real quick and then just let your training and everything that you do sort of help you observe the situation and then, you know come back to making the best possible decisions... And just sort of, you know being involved in that four-man bridge team to increase your confidence and your level of comfort in there so, you know like I said when situations do happen or you do get rattled that you

can sort of dial it down, absorb everything, you know a little bit at a time to make those right decisions.

Lamont:

Um, my bridge team helped me out a lot, telling me my targets, what I have coming up, what light I saw on whichever side; but we use landmarks. Like my radar guy, he was really good on telling me; oh, you have a target up there; you have a target two miles away; CPA is 0.3 miles in about ten minutes. So I feel like my bridge team is my alternatives. If I wasn't sure, I'd ask my bridge team about something

Oscar:

The two guys that were with me were being very helpful. They were notifying me of stuff that was going on that I probably would've missed, and there's some things that they were notifying me of that I already knew of, but I wasn't mad at them or anything. It's like hey, they probably didn't think I noticed this so, it's like okay cool, yeah, I know about that... And really it ended up being a team effort because a lot of my decisions I couldn't have made without the information that I got from just seeing stuff because there's a lot of things that's like; okay, he's doing this, and I noticed that before it even showed up on the radar, and for the ECDIS, I mean I just looked at the ECDIS to see where everybody was and relative to the traffic lanes.

Oscar's performance was not very successful in the simulator, because he missed the turn into Seattle. However, he did have a good team that did a good job and had effective communication among them. Oscar was very informative and descriptive about his performance and also in regard to his thoughts of what happen during the simulation.

Confidence was mentioned by all of the participants in describing their success or failure



as a factor in their decision making. Even those participants who felt that they had low self-confidence realized that they could have made better decisions if their confidence had been higher. Twelve participants expressed the subtheme workload as a factor that hindered their effectiveness as decision makers. Eight participants showed themselves to be good examples of teamwork. The subtheme team cooperation was, therefore, a factor that was observed for successful decisions in the simulation exercise.

### **Motivations and Solutions to Decision Making**

Interviews and observations were used to examine motivations and solutions to decision making as posed in RQ3. By using the interview questions listed in Appendix F, specifically questions four, five, eight, and 11, information needed for RQ3 was obtained. These questions sought to delve further into how the participants saw themselves and how they could have performed better. The following three subthemes emerged: rules; knowledge and equipment proficiency; and self-motivation. The interview process allowed the participants to reflect on the events, to consider what they could have done differently, and to evaluate what they might do better in future exercises and when on the bridge of an actual vessel.

**Rules.** The first subtheme that emerged related to motivations and solutions to decision making was rules. In general, whether encountering heavy traffic or making a call as prescribed by the standing orders, participants usually followed the guidelines and rules that they were taught. According to Rasmussen (1983), rule-based behaviors generally involve behaviors that are guided through such things as rules, procedures, official guidelines, and instructions. This goal-oriented activity was characterized by an action that was executed in a given event or situation. Regardless of the participants' understanding of the rules, the observations showed that 10 of the participants overlooked vessels coming up behind them. Their focus, it appeared,

was forward of the bridge.

Alan:

It was really the standing orders that led me to most of the decisions I made.

Ben:

So uh, my rule of thumb; if you stick to the rules of the road, call people when you're supposed to, you know just do everything by the book and platform then there shouldn't be any problems that you shouldn't be able to overcome.

Jason:

With, there is one scenario in the simulator, where a ship was overtaking me on my port side and you just had to think about everything you learned in class, what you learned on the ship, all that hands-on experience, and all that knowledge from class, all the rules of the road; all that stuff comes into mind.

Ike:

Because first of all standing orders are; if we're passing less than a half a mile even in a separation scheme with a vessel, captain should know.

Mark:

I didn't make a whole lot of decisions, but I did try to remember some of the important things that were written in the standing orders, such as calling the captain when the CPA was within 0.5 miles. And I did try to remember that.

Oscar:

We know he's gonna be overtaking us. So by the rules and regs we have to maintain course and speed. And I also have these other guys that are closer to me that, I'll most likely gonna be overtaking one, plus there's a few ships that are doing

maneuvers so I have to watch out for them.

Before any simulation exercise, students were given a set of instructions similar to those listed in Appendix B. Additionally, they were exposed to the rules of the road and the captain's standing order from previous classes and summer cruises. Those who failed to follow the rules and guidelines realized in the interviews that this may have led to disastrous results.

Ken:

Well the main thing for the standing orders for to go by in this simulator is the half mile CPA in the narrow channels. And if there is under a half mile CPA, you call the captain, being unfamiliar with those, with the standing orders for this watch. Some situations... or some situations uh, I just didn't call the captain in time or didn't understand the CPA limit and things like that, so.

Mark:

I could (short laugh) touch the ship, so that was definitely not okay. I should have clarified how and how far away he should have been from me and I should have also waited till I was past his buoy, because I was making a maneuvering turn. So that was not good. And also I was on the, I did recognize I was on the left side of the channel. And I should have been on the right and maybe if I was on the right side, he might have been able to pass me. And I remember in the rules you're supposed to be on, all the way as far as possible to the port, to the starboard side of the channel.

Oscar:

I don't think I'm really afraid of calling him, it's more like I don't know when to call him because there's probably a couple of times where I could've called him to the bridge and asked him for his advice, and that probably could've helped things out. But I

didn't because it didn't really like click that it's like; hey, maybe I should call the captain. That's just something I think having a bit more experience would help out with where it's like; yeah, this situation is putting me in over my head, I should probably get the captain or something.

**Knowledge and equipment proficiency.** The second theme that emerged related to motivations and solutions to decision making was knowledge and equipment proficiency. The simulation was a training aid that mimicked a realistic environment as closely as possible. In these simulated situations, participants were provided with a realistic scenario with the instructor able to train and test their decision-making participant ability in abnormal conditions and adverse situations. Rasmussen (1983) suggested that knowledge-based behaviors, where no known rules apply to solve a problem, result in the creation of a mental model by incorporating a process to select different plans or objectives. These plans and objectives are often tested through trial and error and are then reviewed and assessed before further steps are taken. The novice deck officers used the knowledge gained from their classroom experience to assist them in making decisions in an unfamiliar situation.

Ben:

The second I walked into the simulator...The second I walked into the simulator, I made sure my uh, radios were on the correct stations, my courses were plotted out, my GPS was on because I knew the previous time we did the simulation somebody got in trouble because they didn't originally check if the GPS was on. So immediately after the previous class I went right to my room and made a checklist about; okay, the stuff, the last I did wrong I have to make sure I do right because he's gonna be looking for those mistakes again and I want to make sure I cover those. So I turned the GPS on, I hailed

ships on 13, did a monitor 16, because we were in VTS area so I put the second radio on 14... I felt the decisions I made were correct, to my knowledge at least, and uh, (pause) you know using my eyes looking out the window I feel as if I did a good enough job with my decision making.

Edward:

It's having a good knowledge of everything that's, um, like on the bridge and what you can use to make the good decisions... Getting the most out of being in school. (short laugh) That's actually, I think about that a lot too. Like a lot of people that graduate from here, I feel like aren't qualified to graduate and to work on ships, and I don't want to be one of those people so I'm trying to get the most out of these classes that we take by knowing everything I can know because to me that's the most important thing.

Lamont:

I think they make good decisions because that's what they're trained to do. I mean they don't want to collide with another ship. They want to be the best seaman out there. They go from what they learned.

Those who made improper decisions discussed in their interviews what when went wrong in their performance. For those who struggled with successful decision making, there was insightful knowledge and understanding gained from what was taking place in their minds. For many of those being interviewed, this was an opportunity to consider how they will do better the next time they are given similar experiences.

Alan:

Not being familiar with the equipment definitely hinders my ability to make good

decisions or better decisions. Uh, (pause) being familiar with those you're working with definitely would help.

Diane:

Now what I feel like I didn't really do so well, is provide accurate information, information that he needs regarding certain things. For example, during the first four calls that I made about a vessel that's in our CPA, I didn't really give him all the proper information. And even if I did have the proper information, by then I was already very frustrated with myself so I wasn't sure if it was the right information or I wasn't delivering it in the proper way.

Ike:

I think we grew up, my generation you know, and I'll be 24, so like I have like two or three years on the seniors that I'm with right now. So like I did a little more hands-on stuff like the millennials, like you have the freshmen that are here now; the sophomores grew up in such a computer age, that's what we know. And so where the older mates might not know how to work the ECDIS, some of them don't use it all the time; we get to, we grew up on computers, we can figure it out on our own, we don't need the manual. So I guess you just get too comfortable in the fact that you know how to do everything with it. And you know like just, you are, humans are creatures of habit so you kind of gravitate where you're comfortable, but you can't do that because stuff fails all the time, computers fail.

Mark:

But the one thing that got me the most I think was talking on the radio because I've never really, I've never really done that before, so I really don't know the exact

language to use, I don't, I'm not experienced with you know communications as well as I should be.

During the observation, 11 out of 15 participants had trouble identifying other vessels and reporting the location of the vessel on the VHF radio. In the control room the instructor expressed disappointment to me of the student lack of proper radio etiquette. Radio etiquette would have been learned and developed during the students' summer cruises and the Global Maritime Distress and Safety System class.

**Self-motivation.** The final theme that emerged related to motivations and solutions to decision making was self-motivation. Goleman (1995) indicated that motivating oneself is an emotional skill likely to help individuals to be effective and highly productive in whatever they pursue. Eleven of the 15 participants discussed the importance of preparation and having a physical or mental checklist. Self-motivation was a personal decision to create an environment of success based upon self-control and willingness to be proactive, as evidenced in the following transition excerpts.

Alan:

Going up there alone and looking at the voyage plan and making notes, maybe bring a pen and paper an old pad (short laugh) and then you know, write down, hey at this time we've got this coming up, this part of the voyage plan and check the charts and just; it's all about double checking your work. Well as I said before, just understanding what you're getting into. And if I were immediate coming onto a watch on a real ship, I would go up earlier, you know talk to the mate on watch. I'd get a briefing from him and look at the next courses, the tracks, everything, and maybe walk out a couple of ETAs to be ahead of the game; and you know, so I know from getting on launch at such and such a

time I've got a course change maybe 35 minutes after that at that particular speed. See if any conditions have changed. Definitely look over weather conditions, traffic conditions if you're coming into traffic separations; and again, just do as much as you possibly can to be aware and try to organize everything so you can keep track of it all.

Ben:

The second I walked into the simulator... The second I walked into the simulator, I made sure my uh, radios were on the correct stations, my courses were plotted out, my GPS was on because I knew the previous time we did the simulation somebody got in trouble because they didn't originally check if the GPS was on. So immediately after the previous class I went right to my room and made a checklist about; okay, the stuff, the last I did wrong I have to make sure I do right because he's gonna be looking for those mistakes again and I want to make sure I cover those. So I turned the GPS on, I hailed ships on 13, did a monitor 16, because we were in VTS area so I put the second radio on 14...

They make a good decision because they have a checklist either written down or in their mind and that checklist also includes not only stuff that's supposed to happen, but maybe even it covers; okay if I do this, if this happens I have a backup plan, you know.

Gary:

I was happy with how the voyage plan fit with how we actually brought it into Seattle and how it worked and the way points, the turn, turning in the scheme, moving further vessels of traffic. Um it was, I thought it went very smoothly for my first time running as the mate.



Henry:

I would definitely, on the chart itself, I would definitely plot the chart a little bit more detail, giving myself better note, key notes on the chart, as well as having a list next to me of making sure I'm supposed to do this at this time, this at this time and this at this time just to keep myself in check and you know, on the safe side that everything went correctly. And you know um, (pause) I would definitely be more detail oriented in knowing, you know I'd have to go this way, this way. Because it was, you know it was really the first time that I was really running a bridge by myself. Because even on the ship you know you have real mates on there. It's not like the simulator where captain normally says, he comes in and says; alright we're starting and doesn't give you anything. You kind of have to prepare it all yourself. So I definitely think there should be... I would definitely prepare myself a little bit better. Because I didn't know exactly what I was walking into and I thought I was prepared for it all and I definitely learned that there was a few things I needed to do.

Ken:

Uh just, I would say never being satisfied with training. Honestly like this is, you know or making the most out of my time here and the time I'm on the training ship, because I mean for most of the cadets here like you know this is, and for really all watch officers that come out of the maritime school, you know this is the place where you're here to learn, you're here to, you know in an educational environment to soak up as much as you can, and uh you know and you'll learn stuff in the classroom and then you try to apply it on the training ship; or on the simulator here which is, you know this is a pretty exciting class to be able to, yeah combine your navigation, your rules of the road, your

communications classes and be able to be a fully functioning bridge team on there, so.

While some participants expressed the importance of preparation and self-motivation, others expressed the opposite. Those interviewees who did not have a successful performance during their exercise expressed a desire to have been better prepared or to at least have had some kind of checklist. The following transcript excerpts provide evidence of the regret of lack of self-motivation.

Henry:

I wasn't going through my checklist of like, my mental checklist of notes to do. So I guess it's also I guess you should write things down as well as you know to keep yourself in check. You know when this happens, do this, do this, do this because you know you weren't, I wasn't 100%, I was focused on one specific thing.

Jason:

Yes. I would, well I would go over my information a lot more. Take my time on plotting the chart, take my time reading the chart and knowing my area. And knowing as much information I can about the area, the traffic, all the other ships around me, what they're doing, where they're going; all that stuff.

Ken:

I would say above all preparation or lack of preparation. Being prepared and knowing what to expect you know can lead to; like I just said, you know your initial voyage plan you realize that there's a four knot current over here or there's a ferry over here and you can see those situations before they even happen, with being prepared and uh, you know you're instantly ready to make those decisions. Being unprepared, you know as soon as those situations are presented, you start to question yourself or start to

have to - it starts to become a thought process instead of, you know second nature to you, so.

Within the third theme, motivations and solutions to decision making, three subthemes emerged: rules; knowledge and equipment proficiency; and self-motivation. All the participants described their decision making as being based upon some given rule, rules of the road, or the captain's standing orders. Despite having knowledge of the rules, 10 of the participants overlooked traffic rules that in real life would have had disastrous effects. During the participants' four year education, they are exposed to and trained on equipment such as radar, VHF radio, and electronic charting displays. Nevertheless, most of the participants struggled with knowledge and equipment proficiency that might have assisted them in their decision making. Lacking equipment proficiency likely hindered their decision-making effectiveness. Finally, self-motivation is a personal desire to create an environment for success. Eleven participants described the significance of needing to be more effective and productive, and by doing so, they understood this as a link to making better decisions.

### **Summary**

Phenomenological qualitative research was used to study the decision-making process of inexperienced junior officers in a maritime simulator under adverse conditions, focusing particularly on how they described their experiences. The utilization of the hermeneutic phenomenology research design allowed me to study the participants in a common experience that included decision making in the maritime domain, while experiencing a complex, ill-defined, time-critical situation. Furthermore, the design provided opportunity for inquiry into the meaning of the participants' descriptions of their experiences.

The participants were students from a northeastern maritime college. They participated

in the NAUT 416 Bridge Watch Standing class, which included simulation exercises. During the simulation, more than half of the participants safely navigated the channel. However, 11 of the 15 participants had trouble communicating on the VHF radio with the other vessels, and identifying the positions of those vessels. With the purpose of addressing the elements within each of the three research questions, three themes were identified: (a) the decision making process, (b) factors in decision making, and (c) motivations, and solutions. The discovery of these themes required an analysis of the observations, personal notes, and transcripts of interviews with the participants. This chapter presented those results. In the next chapter, these results will be discussed, conclusions drawn, and recommendations made both for the maritime industry and for future research.

## CHAPTER FIVE: DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

### Overview

This study was an investigation into the decision-making process of inexperienced junior officers in a maritime simulator under adverse conditions, and how they described their experiences. This chapter presents a discussion of the findings from Chapter Four and their implications. The chapter also presents the limitations of the study, as well as suggestions for future research.

### Summary of Findings

The analysis of data collected through observations and interviews revealed three main themes: the Decision Making Process, Factors in Decision Making, and Motivations and Solutions to Decision Making. Of the three main themes, nine key points or subthemes were identified. The first Research Question (RQ) required the junior watch officers to describe their decision-making process in an adverse situation. The decision-making process was based on how well they were prepared for the exercise, how well they knew themselves and their abilities, and whether or not they took the simulation seriously.

### The Decision-Making Process

**Preparation.** The first subtheme identified for contributing to the decision-making process was preparation. Participants were required to be prepared with a voyage plan that had their personal notes, required calls, course and speed changes, and list of navigational aids (see Appendix B). Price (2013) recommended that watch officers during their watch turnover, “must follow a formal checklist to avoid missing important details,” and while on watch continue to, “use checklists, state boards and memory aids” (p. 5). The participants recognized the importance of preparing for the watch and then using a checklist, whether a mental or an actual

list. Nonetheless, at least six participants were not ready for the simulation. Each participant had access to the same material in Appendix B. The reasons that were given for lack of preparation were that they were rushed between one group and another, the other team members did not prepare their part for the exercises, or they were not motivated to put any effort into preparing for the simulation.

Those participants who did have a plan used it to assist them in their decision making. When they encountered unexpected traffic, the plan assisted those participants to know what radio frequency should be used to make the appropriate call, to be aware of their current location, and to understand what course they needed to use to get back on their original track. The voyage plan is required both by most shipping companies and by the Standards of Training, Certification and Watchkeeping for Seafarers (STCW).

The voyage plan is created by the navigator, approved by the captain, and disseminated to the ship's officers. This is a comprehensive plan that takes the ship from the dock of departure to the dock at the arrival destination. Each officer is responsible to know the information in the plan. Additionally, while underway at sea, the mate, prior to taking over the watch, is required to get the current status of the engineering plant, their current location in the voyage, and any events expected during their watch, as well as the current meteorological conditions and forecast. At least three participants recognized that regardless of the existence of a voyage plan, a checklist for their watch would have benefited their performance and decision making.

**Self-awareness.** The second subtheme identified for contributing to the decision-making process was self-awareness. People with good self-awareness are cognizant of their own moods. This awareness allows a person in the midst of turmoil to take an internal step back and to reflect

on one's behavior. Personality traits and past experiences typically determine where people are on an emotional awareness range. People can be so overwhelmed by their emotions that they may feel helpless and out of control. When decisions cannot be made through rationalization or formal logic, these decisions are made through what Goleman (1995) calls a *gut feeling*, which is emotional wisdom that is based upon past understandings. Even when humans do not recall a specific experience, the emotions associated with that experience can become an intuitive signal, which guides a person's emotions in a specific direction. Subsequently, that person can choose to attend to the emotion or ignore it. Mariners on the bridge of a ship, while trying to formulate a decision, may use their gut feelings if nothing comes to mind when dealing with an unfamiliar event (Goleman, 1995).

Self-awareness is similar to situation awareness in that they are both internal behaviors of the watchstanders: however, this is where the similarities end, because situation awareness is more global in its construct. It is a term used in resource management that means that people know what is going on around them. This type of awareness considers all the visual cues, displays, communications, traffic, navigation, personal availability, and capabilities of the vessel to prioritize and formulate a possible solution (Chauvin, Clostermann, & Hoc, 2008; United States Coast Guard Auxiliary, 1998). Self-awareness describes how the person will react to the information that situation awareness provides.

A voyage plan gives the participant specific information on where to go and what to expect during the voyage: however, it does not help with unexpected obstacles such as traffic and the prevailing meteorological conditions. In the simulation, the weather conditions were controlled, and even though the traffic was on planned routes, what was unplanned was where the participants were in their voyage and how they reacted to the events that occurred during the

simulation. More than two thirds of the participants were aware of the traffic around them: however, less than half of that traffic was observed and described. Their interviews revealed some indecisiveness in the maneuvers. Four observed maneuvers were either delayed or missed because of indecisiveness. Five participants appeared to have good self-awareness, because when encountering unexpected traffic, they were able to communicate effectively and maneuver their ships for a safe passage between vessels.

**Simulated versus real world experience.** The third subtheme identified for contributing to the decision-making process was the extent to which the participants took the simulated experience seriously, as if it was a real experience. High resolution, full-scale bridge simulators have been used in maritime education for over 25 years as an effective tool for training bridge personnel. These simulators have been used to teach new mariners how to stand a watch at sea or at anchorage. They also have been used to assess and provide experience for mariners in critical and adverse situations. Simulation gives the mariner a chance to react and experience a scenario that would otherwise be life threatening or catastrophic to the vessel or environment.

Seven of the 15 participants accepted the simulation as a real world experience. Those who did not take the simulation seriously felt that it was too much like a video game or the visuals and the controls were not effective. They explained that the simulator used was unable to give a proper feel for depth perception and a sensation of actual motion. Another problem experienced was the limitation of the simulator's console and equipment. The participants indicated that looking aft or around obstructions required the operator to use visual controls to rotate the view which would not be an option in a real world scenario.

### **Factors in Decision Making**

RQ2 inquired about which factors could be identified as affecting (positively or



negatively) the participants' critical decision-making process. The participants were quite descriptive of what influenced their decisions. From the interviews, three subthemes were identified: confidence, workload, and team cooperation.

**Confidence.** The first subtheme identified as a key factor influencing decision making was confidence. Bandura (1997) contrasted confidence and self-efficacy in that confidence was a strength of a belief rather than an affirmation of abilities and belief. To more closely investigate this contrast, this study included a self-efficacy questionnaire, the results of which were compared with participants' statements about confidence. Interviews for this study presented confidence as a factor that was expressed by all of the participants. Six participants with high self-efficacy and who expressed confidence had a successful voyage. Two participants who had high self-efficacy and little or no confidence completed their voyage. One with high self-efficacy expressing little self-confidence failed his voyage. Three with low self-efficacy expressing their confidence failed to complete their voyage. Two with no confidence and low self-efficacy failed to complete their voyage. Only one with low self-efficacy and with high self-confidence completed his voyage.

Seven participants who expressed some degree of confidence did complete their voyage. This number does not suggest that confidence was as significant a factor in completion of the voyage as self-efficacy. Nevertheless, all the participants expressed that confidence was a factor in their decision making. Three of the participants who did not complete their voyage expressed their poor performance was due to not being confident in their decisions. They realized that their lack of confidence caused them to waiver in decisions that caused them to either overlook or delay a critical decision.

**Workload.** A second key factor influencing decision making was workload. Price

(2013) recognized the importance of effectively managing workload and suggested some tricks of the trade for avoiding traffic, particularly that time is of the essence and mariners should not waste it. Additionally, he noted that mariners should never assume that any other vessel will comply with the rules and nowhere in the rules does it state that a vessel should stand into danger. He considered anticipation to be the key to success. Nevertheless, for this to occur would necessitate the officer on watch to be aware of the surroundings, the direction and flow of the traffic. The scenario in the simulator had the participants confined to a vessel traffic separation scheme with defined boundaries of traffic flow in the Puget Sound. The exercise was conducted at night with dense traffic. Even for a seasoned, experienced deck officer, this scenario can prove to be challenging. The mate was not only required to navigate the channel safely, but also to avoid traffic and make appropriate calls to other vessels and to the captain as required by the standing orders.

Situation awareness required the participants to balance a multi-tasking workload by being aware of the traffic around them, determining if a chance of collision existed, communicating with other entities outside the vessel, and keeping the captain informed, as required by standing orders, to be able to safely navigate the channel. With multi-tasking Miller (1994) suggested that the most information an average person can hold in immediate memory is between five and nine items, with more items being a more overwhelming workload. Coupling this fact with the notion that novice decision makers did not have sufficient experience to prioritize the situation, some failures of decision making were to be expected.

Twelve of the 16 participants felt that workload was a factor in whether they overlooked or delayed making a decision. They described that they became focused on traffic in front of the ship but practically ignored those vessels that came from behind the ship. Workload also became

a factor in the navigation. When the mate was focused on traffic, in many cases navigation was overlooked, and turns were delayed or forgotten. The same issue arose when calling the captain at specific points or responding to other vessels calling the ship. The mate on watch often was preoccupied and did not seem to properly prioritize the necessary responses to the situation.

**Team Cooperation.** How well a team cooperated emerged to be another factor in the decision making of the junior officer. When a team or a team member was not forthcoming in giving information or ignored the information, the mate on watch failed to make a good decision. Seven of the 15 participants had effective teams assist them in their decision making regardless of the success of the voyage. Two participants who had good communication with their teams, but who had low self-efficacy, failed their voyage. These participants were wavering in their decision making regardless of team recommendations and input. Five participants' teams had good teamwork and a successful voyage, while three teams with seemingly ineffective teamwork still completed their voyages. Those three participants with poor teamwork described in the interview that they decided to make their own decisions in spite of the lack of information or communication from the other team members. Four participants who had poor teamwork and failed the voyage explained their team was neither prepared, nor familiar with the equipment, or they just outright failed to communicate.

### **Motivations and Solutions to Decision Making**

RQ3 examined the motivations and solutions of participants in their decision making. The observations and the interviews suggested that three subthemes motivated the participants to a particular solution: rules, knowledge, and self-motivation. The three subthemes described how a participant decided on a solution and the motivation behind the decision.

**Rules.** The primary action to solving a problem was to use some rule or guideline. The use of rules was indicated by behaviors that were directly guided by procedures, official guidelines, instructions, and other rules. Given an event or situation that occurred, the participant used a rule-based behavior and then executed an action based upon that rule or guideline. This action was observed in the simulations when the participants made a collision-avoidance maneuver or made calls as prescribed by the standing orders.

In the interviews, the participants discussed rules affecting their decision making, such as the captain's standing order and collision avoidance rules. Even when questioning the participants on why they made the call to the captain knowing that they may incur the captain's ire, they based their decisions on the captain's standing orders. When maneuvering the vessel in close quarters situations, all of the participants cited the collision avoidance regulation.

**Knowledge.** Another subtheme motivating participants to a solution was knowledge. When rules did not apply, the knowledge that they had learned in class or from other sources was employed. Like rules which served as a guideline to making a decision, the participants' knowledge, whether gained from classroom experiences or from the summer cruises, was a factor in making decisions in the simulator. Participants understood that if a person was focused and dedicated to his or her studies, that person would be a better officer on the bridge. This was apparent in the simulation when mates or team members failed to demonstrate their abilities or knowledge of navigation, collision avoidance, or radio communication. This lack of knowledge of the equipment, the collision avoidance rules, or the captain's standing orders did adversely affect the participant's decision making and the success of the voyage.

**Self-Motivation.** The final subtheme contributing to overall motivation in decision making is that of self-motivation. Those participants who appeared to have good self-motivation

had a less stressful time when they encountered unexpected traffic and events. Goleman's (1995) theory suggested that motivating oneself allows an individual to direct one's emotions in order to master a goal. A person who is successful at this skill is more likely to be effective and productive. Emotions can paralyze the brain and overwhelm concentration, which in turn can overpower the cognitive processes of working memory, resulting in a failure to think effectively. Motivating oneself is immensely more than preparation, because it involves personal motivation in every aspect of one's life. More than half of the interviewees discussed the importance of a voyage plan and a checklist for preparation; however, two of the participants discussed self-motivation in that preparations and getting the most out of their educational experience should continue throughout their maritime careers.

### **Discussion**

The previous section summarized results from Chapter Four. Because no previous study has been conducted with junior officer decision making, this section will focus on the relationship of the empirical literature reviewed under the theoretical framework from Chapter Two and how it relates to the findings. This study does add to the body of knowledge of those researchers studying novice decision makers.

### **Working Memory**

Even though short-term or working memory (WM), was not measured directly in this study, intense looks on the faces of the participants were evident during the simulations when events such as dense traffic and the operation of safe navigation were in progress. During these episodes participants' WM was processing high amounts of information, which resulted in decisions being delayed or overlooked. Miller (1994) suggested that an average person could hold between five and nine items in immediate memory. Engle, Tuholski, Laughlin, and

Conway (1999) suggested that novice decision makers' WM can be predictive of performance on a wide variety of cognitive tasks.

Two themes, workload and self-awareness, were identified to reflect the issue of WM within this study. During the simulation, the following workload demands were made: (a) traffic density increased, (b) other vessels were communicating with each other, (c) the voyage plan had required reporting points, and (d) the standing order had equipment for specific reports to make to the captain or the engineers. Nine of the 15 participants expressed their frustration with the workload, and six of the participants did not complete their voyage. Many of those who did not complete the voyage were distracted with collision avoidance, communication, or other issues of navigation. Stressful workload has been documented as one of the key reasons for maritime incidents (Grech, Horberry, & Koester, 2008; Lin, 2006; Rothblum, 2000; Wang & Zhang, 2000). Additionally, one of the components of improper self-awareness became evident when participants faced a stressful situation and were less able to reason because of emotional hijacking, which arrested the cognitive processes and potentially restricted or shut down WM (Goleman, 1995).

Also related to WM, general fluid intelligence ( $gF$ ) is a person's capacity to think logically and solve problems in novel situations. Utilizing  $gF$ , a person would be able to analyze novel problems, identify patterns and their relationships, and use logic to come to a solution (Engle et al., 1999). Dang, Braeken, Ferrer, and Liu (2012) showed a strong correlation between visuo-spatial WM and  $gF$ . They felt that it was possible to focus training on content-specific memory components. Dang et al. stated, "This route sounds more promising than when WM would only be a unitary resource system, and should be beneficial to certain jobs such as in air traffic control" (p. 506). This notion suggested that as the participants continue to utilize the

simulator (visuo-spatial) training, they could experience an increase in the capacity of the WM, which could improve the participants' decision-making ability.

### **Skills, Rules and Knowledge**

To describe human behavior from a variety of events such as everyday routine activities to situations that are unexpected and novel, Rasmussen (1983) created the skill, rule, and knowledge-based behaviors (SRK) model. Skill-based behaviors are those that are usually unconscious, routine activities that have been well rehearsed. Those operations performed, such as by the team member who served as the helmsman, would be a demonstration of routine behaviors that have been well rehearsed. In this study, the participants, who were the mates on watch, did incorporate some well-rehearsed activities that were devolved in previous classes and performed during their summer cruises. The skills of operating radar or talking on the VHF radio would be considered skilled behavior.

Continuing with Rasmussen's (1983) model, the use of rules was recognized by all of the participants, who also noted the rules affected their decision making. Rasmussen explained that this behavior was based upon an established set of rules or guidelines. An illustration of the use of rules was when the participants, in their decision making, obeyed the standing orders or followed collision avoidance regulations, such as the rules of the road. Price (2013) described the rules of the road as, "a logical protocol designed to keep vessels apart and to provide a complete and sufficient framework, within which to defend yourself, your vessel and the lives of others", and to "think of the COLREGS as 'ship separation rules'" (p. 4).

As a deviation appeared, some participants made a corrective action based upon a set of rules. However, when rules no longer applied and a novel situation developed, then according to Rasmussen (1983), the participant used knowledge-based behaviors. The participants who were

able to effectively cope with a new situation referred back to previous knowledge gained in their class, created a plan, and then through trial and error were able to come to a satisfactory conclusion. Even though all the participants primarily used rules to avoid a collision, several traffic situations did not fall under the typical rules. Nonetheless, those participants who successfully completed their voyage were considered to have demonstrated good, knowledge-based behaviors, because they were able to effectively cope with new, time-sensitive, unpredictable, and stressful situations.

### **Novice Decision Makers**

The literature pertaining to novice decision makers is sparse. Related studies could only be found in the medical domain, particularly in the nursing field. Kosowski and Roberts (2003) conducted an interpretive phenomenological study to discover, describe, and analyze the stories of 10 novice nurse practitioners who used intuition in clinical decision making. Their study was not based upon real time decision making but utilized after-the-fact reflective interviews about the decisions the nurse practitioners made based upon intuition or their gut feelings. Even though there was very little relationship to this maritime study, there were three themes paralleling the decision making of this study's participants.

The first theme in Kosowski and Robert's (2003) study was *backing it up*. Essentially this meant that participants who had an intuitive thought tried to back up that feeling with additional data or cues. Similarly, during this study's interviews, the junior officers stated that they would see a situation develop and try to confirm their assessment of the situation with other team members or further examine their data from the radar.

The second theme, *knows the rules*, indicated when the participant knew the rules yet took a risk in a decision (Kosowski & Roberts, 2003). Again, during this study's interviews,



most of the deck officers were well aware of the rules, yet there were a few who did take a risk in their maneuvers or navigation. In half the cases the risk worked, but did not in the other half. One example is when Edward was the mate on a container ship inbound to Seattle. He encountered a vessel overtaking his ship at high speed. He was supposed to contact the other ship and if that failed, he was required to maneuver his ship to avoid a collision and allow for an obvious clearing distance between the two vessels for a safe passage. From my display in the control room, it looked like there was a collision; however, the system did not register as such. In the interview I asked him about the encounter, and he felt that while he could have made the gap wider between the two vessels, he made an assumption that he had enough clearance.

The third theme, *reflecting* (Kosowski & Roberts, 2003), occurred when participants were looking back and reflecting on what they did, either right or wrong, and how they could have improved. The observations in this maritime study were in real time, in what could be considered an aggressive scenario, whereas the interviews in this study had the junior officers later describe their decision making during that adverse situation. Subsequent to the observations occurring in real time, the interviews required reflection on what had already transpired. With these reflections, most of the participants realized that there were moments they could have made better decisions.

Chalko, Ebright, Patterson, and Urden (2004) conducted a study that identified the human performance factors that characterized novice registered nurses. They identified nine themes. They were: (a) clinically focused critical thinking; (b) seeking assistance from experienced nurses; (c) knowledge of unit and workflow patterns; (d) first-time experiences; (e) time constraints; (f) hand-offs; (g) influence of peer pressure and social norms; (h) losing the big picture; and (i) novice assisting novice (Chalko et al., 2004). Chalko et al.'s study focused more

on human performance than on decision making.

Two of the themes in Chalko et al.'s (2004) study, time constraints and losing the big picture, were related to this study. Like the theme workload in this study, time constraints dealt with an emerging event that caused the participant to feel overwhelmed. Additionally, a similar occurrence was noted by this study's workload and self-awareness factors when describing losing the big picture. The participants in Chalko et al. (2004) were not able to describe what they were experiencing when they lost track of the larger picture, while the participants in this study did describe their decision making when they lost the big picture. Some of the participants were able to make suggestions about what they could have done to remedy the situation. Furthermore, the participants who did succeed in their voyage plan described what they did to prevent losing the big picture. *The big picture* is also considered in the maritime industry as *situation awareness*.

### **Emotional Intelligence**

During this study, two themes became apparent that needed further explanation. Participants were expressing their inner thoughts and behaviors about why they did or did not make good decisions. Even though the studies by Kong-Hee (2012) and Lakomski and Evers (2010) pointed to the right direction, their description of what was going on emotionally with decision making did not completely analyze what the participants were describing. Goleman's (1995) Emotional Intelligence model, however, featured five distinct constructs that were helpful in further analyzing decision making: self-awareness (knowing one's emotions), managing emotions, motivating oneself, recognizing emotions in others, and handling relationships.

Two constructs helped formulate the themes and explain what the participants were describing: self-awareness and self-motivation. Self-awareness describes how much individuals

know or are aware of how they feel (Goleman, 1995). While the participants were engaging in a situation, their inner self-talk was either talking them into a solution or telling them they were in dire straits. The participants who were in control of the situation were feeling less stress and more confidence, and were able to convince themselves that they were doing the right thing. Those who were less than successful experienced conflicting thoughts and feelings, which many of the participants called being *double minded*. Even though they were aware of their state of mind, they lacked the skill to dispel their mental anxiety.

While self-awareness indicated how much participants were aware of their present emotion, self-motivation was how much individuals deal with and control their emotions. Having control over one's emotion has shown that individuals can have more control of their decision making. Motivating oneself is how individuals are able to direct their emotions in succeeding at a goal (Goleman, 1995). The interviewees described the need for preparing for the simulation or indicating that they had wished they had used either a written or a mental checklist. Those participants who were able to complete their voyages successfully discussed how they had a proper voyage plan and how they felt their education, even as far back as their first year in school, benefited their ability to make competent decisions.

### **Self-Efficacy**

Even though emotional intelligence has influence on a person's ability to make a decision, other factors were found to have influence as well. One part of this study was to investigate if self-efficacy had a role in individual ability to make a decision. According to Bandura (1997), "Perceived self-efficacy refers to belief in one's agentive capabilities that one can produce given levels of attainment. A self-efficacy belief, therefore, includes both an affirmation of a capability level and the strength of that belief" (p. 382). Bandura (2006)

described self-efficacy as people's belief in their own ability to succeed in specific situations. If a person is considered to have high self-efficacy, then that person believes the task can be achieved (Bandura, 2006; Miller, 2011; Ponton & Rhea, 2006).

It was noted in both National Transportation Safety Board reports (1990, 2008) that neither the *Exxon Valdez* nor the *Empress of the North*'s third officer notified the captain in a timely manner as required by the captain's standing orders. New deck officers, if they are following the standing orders or if they are in doubt of their situation, are required to notify the captain. However, in previous research Feltz and Hepler (2012a) suggested that if new deck officers have low self-efficacy, do not believe in their own capabilities, and do not wish to look like ineffective watchstanders, they may not make the call to the captain.

The General Self-Efficacy Questionnaire (GSE) was used in this study, not as a statistical measure, but to investigate how much self-efficacy has influence on the person's decision making. The assumption is if individuals have a high self-efficacy, then they should be able to make calls to the captain without fears of repercussions. Feltz and Hepler (2012a) concluded that self-efficacy was a significant constant predictor of decision making and that it was beyond the influence of past performance. The initial premise was to examine if someone with low self-efficacy would not make the required calls to the captain as required by the standing orders. From the observations and the questionnaire, there were some surprising results.

The GSE was administered prior to the interview (see Appendix E). The results are shown in Table 2. Schwarzer (2008) established the boundary for low self-efficacy as any number below 30 points on a scale of 40 points. The scores in Table 2 indicated that six out of 15 participants in this study scored below 30 points. The scores of both high and low self-efficacy were compared with participant actions observed during the simulations. This included

comparing the questionnaire results both with the results of completion of the required passage

Table 2

*General Self-Efficacy Questionnaire Results*

The General Self-Efficacy Scores											Totals
Question Number	1	2	3	4	5	6	7	8	9	10	
<b>Names</b>											
Alan	4	4	4	3	4	4	3	4	4	4	<b>38</b>
Ben	3	3	4	4	4	4	3	3	4	4	36
Carl	3	3	3	3	3	4	3	3	3	3	31
Diana	1	1	2	3	3	3	2	3	3	3	<b>24</b>
Edward	3	3	3	3	3	3	2	3	3	3	<b>29</b>
Frank	4	2	4	3	3	4	3	4	4	4	35
Gary	3	3	4	4	3	3	3	3	4	4	34
Henry	3	2	3	3	2	4	3	2	3	3	<b>28</b>
Ike	3	3	4	3	3	4	3	3	3	3	32
Jason	3	1	3	3	3	4	3	3	2	3	<b>28</b>
Ken	3	2	4	3	3	3	3	2	3	3	<b>29</b>
Lamont	3	2	4	3	3	4	3	3	3	3	31
Mark	3	3	3	2	3	4	3	2	4	3	30
Nat	3	3	4	3	4	4	3	2	3	3	32
Oscar	3	3	3	3	3	3	2	3	2	3	<b>28</b>
	45	<b>38</b>	52	46	47	<b>55</b>	<b>42</b>	43	48	49	
		2.53333				3.66667	2.8	2.86667		<b>Mean</b>	31
		3				4	3			<b>Mode</b>	28
		3				4	3			<b>Median</b>	31

and with the number of times the participants made appropriate calls to the captain or others.

The course syllabus in Appendix B provides different simulator exercises. Even though not all participants did the same exercise, all were exposed to a nighttime scenario with the same amount of crossing traffic and overtaking traffic. Each scenario had at least eight calls that were required by the standing orders and the scenario outline (see Appendix B). Although the simulator situations posed similar challenges, allowing effective comparison, self-efficacy levels did not prove to be constant with the participants. When counting the number of proper calls either to the captain, the chief engineer, or outside entities as required by the standing orders, those participants who scored high self-efficacy averaged a mean score of 7.78 calls. Those who scored low self-efficacy averaged a mean score of 7.0 calls (see Table 3), suggesting no notable

relationship between the participants' self-efficacy scores and number of calls to the captain.

Table 3

*Number of Appropriate Calls Made*

<b>Names</b>	<b>Self –Efficacy Score</b>	<b>Number of Required Calls</b>
<i>Alan</i>	<b>38</b>	6
<i>Ben</i>	36	5
<i>Carl</i>	31	8
<i>Diane</i>	<b>24</b>	<b>9</b>
<i>Edward</i>	<b>29</b>	<b>2</b>
<i>Frank</i>	35	3
<i>Gary</i>	34	14
<i>Henry</i>	28	<b>9</b>
<i>Ike</i>	32	13
<i>Jason</i>	<b>28</b>	<b>9</b>
<i>Ken</i>	<b>29</b>	<b>2</b>
<i>Lamont</i>	31	5
<i>Mark</i>	30	4
<i>Nat</i>	32	12
<i>Oscar</i>	<b>28</b>	<b>11</b>

<i>Average calls made by participant with high self-efficacy</i>	<b>7.8</b>
<i>Average calls made by participant with low self-efficacy</i>	<b>7.0</b>

Those who scored low on the self-efficacy scale did call the captain, and some who had high self-efficacy did not always make the required calls. Participants like Diane and Oscar made considerable calls to the captain; even though Diane had the lowest GSE score and received scorn from the captain for her mistakes, she still made several calls. The explanations provided in the interviews were that calls were required by the standing orders. Diane's actions corroborate Rasmussen (1983) and Price (2013) in their assertion that in crisis, people often depend on established rules to help guide their decisions.

Another finding was that those who scored highly on the self-efficacy scale were more

likely to complete their voyage successfully. Although I did not specifically seek this finding, it was not unexpected. Prior to conducting the research, I was curious about the impact of self-efficacy on decision making, which in this study was based on whether or not the participant called the captain when a situation deemed it necessary. The premise of calling the captain was grounded on previous incidences that involved a third officer failing to make the required call.

The issue of self-efficacy did manifest itself when participants were describing a situation and their subsequent decision. Of particular interest was what they were feeling during the process of making a decision and whether the decision was a good one or not. Nonetheless, eight of the nine participants with high self-efficacy and only one with low self-efficacy completed their voyage. These results could be indicating that junior officers with high self-efficacy should be able to make reasonably good decisions and would more than likely have a successful watch.

Five of the six participants who had low self-efficacy scores did not complete the required passage (see Table 4). For participants to not complete a passage indicates one of the following: they had a collision or grounding, missed the turn going either in out of the harbor, or headed the wrong way. Only one of the nine who had a high self-efficacy score did not complete the required passage plan, which suggests that the participants with lower self-efficacy scores performed poorer on the simulation task than those with higher self-efficacy scores.

The GSE Questionnaire (see Appendix E) was not used as a statistical measure although seven of the participants did score high for self-efficacy. Because the sample size of participants was small, it would be difficult to draw any conclusions from the numbers that are presented in this study. However, triangulating the participants' responses to certain GSE questions and my observation notes with their comments and reflections on their decision making during the

interviews helped shed insight into their decision-making process and key influencing factors.

Table 4

*Factors in Decision-Making Themes: Self-Efficacy and Voyage Completion*

	Alan	Ben	Carl	Diana	Edward	Frank	Gary	Henry	Ike	Jason	Ken	Lamont	Mark	Nat	Oscar	
Self-Efficacy	H	H	H	L	L	H	H	L	H	L	L	H	H	H	L	H = High Self-Efficacy L = Low Self-Efficacy
Voyage Completion	S	S	U	U	U	S	S	U	S	U	S	S	S	S	U	S = Successful U = Unsuccessful

Cross referencing the information in Appendix E, showing the specific questions on the GSE, with Table 2, showing each participants' score for each question on the GSE, and with Table 4, showing both participants' individual self-efficacy levels and the status of their voyage completion provided helpful information. For example, GSE Question 6, "I can solve most problems if I invest the necessary effort," had the highest mean score 3.667 out of 4. Most participants recognized the importance of preparation; even those who were not properly prepared understood that this lack of effort could have prevented them from succeeding, as revealed in their interview reflections on preparedness.

GSE Question 7, "I can remain calm when facing difficulties because I can rely on my coping abilities," had an overall mean score 2.8 which was the second lowest score. Three of the participants who scored low for self-efficacy indicated a low score in that particular question as well. Additionally, those three participants had the greatest difficulty in the simulation. When the situation became difficult and overwhelming, it was clear from the observations that those three participants were displaying signs of frustration. Diane had problems with her navigator, who did not volunteer to participate in the interview or GSE parts of this study but who was



clearly unable to perform her job. Diane was trying desperately to recover from this negative team work situation. She was on the wrong side of the channel as a result of the lack of information coming from the navigator. Eventually with some guidance from the instructor, she was able to get back on track, but her frustration was obvious.

The lowest mean score, 2.553 out of 4, was from GSE Question 2, “If someone opposes me, I can find the means and ways to get what I want.” Alan scored the highest for self-efficacy, as well as for GSE Question 2. He was also one of the few participants who had the least difficulty in the simulation. As in Diane’s situation with her navigator, seven of the participants’ teams were not effective in assisting the participant in completing their voyage. It was also observed that none of those participants challenged their teams when faced with difficulties, reflected by the low score responses to GSE Question 2.

Feltz and Hepler (2012b) stated, “In other words, participants with low self-efficacy took longer to make their decisions than those confident in their decision-making capabilities” (p. 160). Eight participants completed their voyage and only one of those eight scored low for self-efficacy. Many of the participants expressed confidence as a factor in their decision making. However, Bandura (1997) cautioned that confidence was not to be confused with self-efficacy. Although many interchange those terms, Bandura considered confidence to be a colloquial term without strong meaning, whereas self-efficacy expressed the strength of one’s belief in the ability to achieve a goal. An interview with Diane might suggest that Bandura’s belief about confidence may be correct. She started off in the simulation with confidence, and she was knowledgeable about the captain’s standing orders, how to do navigation, and how to operate the radars. However, when the vessel was leaving the harbor, it was not up to the required speed set by the captain’s orders. This got her in trouble with both the chief engineer and the captain. As soon as

the conditions became increasingly overwhelming, her low self-efficacy prevented her from

Table 5

*Factors in Decision-Making Themes*

		Factors in Decision Making Themes																
		Alan	Ben	Carl	Diana	Edward	Frank	Gary	Henry	Ike	Jason	Ken	Lamont	Mark	Nat	Oscar		
Self-Efficacy		H	H	H	L	L	H	H	L	H	L	L	H	H	H	L	H=High Self-Efficacy L=Low Self-Efficacy	
Voyage Completion		S	S	U	U	U	S	S	U	S	U	S	S	S	S	U	S=Successful U=Unsuccessful	
Confidence		C	C	C	N	C	N	C	C	C	C	C	C	N	C	N	C=Confident N=Not Confident	
Teamwork		P	P	P	P	P	G	P	G	P	P	G	G	G	G	G	G=Good Teamwork P=Poor Teamwork	
Workload		I	I		I	I	I	I	I	I	I			I		I	I=Considered an Issue	

successfully completing the voyage, regardless of her initial feeling of confidence.

Table 5 indicates those most likely to have a successful voyage were those participants with high self-efficacy. Those who were most likely to not complete their voyage had low self-efficacy as well as workload issues as a factor in their decision making. Even though confidence was described by most of the participants as a factor in good decision making, Table 5 indicates that it did not have any effect on the completion of a voyage.

Two participants did not seem to follow the predicted pattern for success or failure. Carl, who had a high self-efficacy score and no workload issues, failed to have a successful voyage. Ken who had a low self-efficacy score and workload issues, managed to have a successful voyage. But, there was one distinguishing item that may have made the difference in their success or failure, and that was teamwork. Carl had poor team work, while Ken had good teamwork. Even though the other participants seem to follow certain identified factors for their

success or failure, Ken's success could potentially be attributed to his team providing good recommendations as well as to him being receptive to those recommendations.

**Competency.** Even though competency was not directly addressed in the study, it became apparent as a factor in good decision making. Competency is a difficult construct to define. Most general definitions suggest it measures the success of one's ability or knowledge. The STCW Code considers that the standard of competence:

...means the level of proficiency to be achieved for the proper performance of functions on board ship in accordance with the internationally agreed criteria as set forth herein and incorporating prescribed standards or levels of knowledge, understanding and demonstrated skill. (International Maritime Organization, 2011, p. 4)

For junior officers to be recognized as competent officers, they must demonstrate their knowledge of the rules of the road, the equipment on the bridge of the vessel, knowledge of navigation and proper watchstanding procedures. Therefore, the eight participants who successfully completed their voyage would be considered competent.

### **Implications**

Maritime commerce has been a global occupation since ancient times. Incidents are as old as recorded history. When an incident occurs there is usually loss of lives, damage to the cargo or passengers, or damage or destruction to the vessel. Each time these incidents occur, the cost of indemnification of the ship and crew rises, which affects all consumers up and down the economic chain (UK P&I Club, 1996). The findings in this study about novice junior maritime officers has global implications for the industry and for maritime education.

### **Maritime Educators**

Once mariners make the decision to become an officer, their training is crucial and must

benefit them when the time comes for them to stand alone on the bridge of a ship. Some of the participants like Ken were not satisfied with just attending school and getting a degree. They went to school with the sole intent of absorbing as much knowledge and experiences their education had to offer. These individuals made the most of their summer training cruises and any hands-on or simulation activities the school had available. They knew that this education was what was going to make them a successful and competent officer. Maritime universities and other institutions should help the mariners from day one of their training to understand their obligations and responsibilities to their own education. This emphasis should be ongoing throughout their training as they make their transition to becoming officers. Students with a high sense of self-motivation typically take their studies seriously.

Whether the mariner is seeking to become a junior officer through the traditional means of a four-year degree at a university or through a nontraditional license-only track, both mariners must meet the training requirements set forth in STCW Code, section and table A-II/1 for mandatory minimum requirements for certification of officers in charge of a navigational watch on ships of 500 gross tonnage or more (United States Coast Guard, 2014b). For mariners in the United States (US), these required courses are also listed in 46 CFR §11.309. Irrespective of the US legal requirements, the STCW is the international standard for a person's training to become an officer, and the course's curriculum comes from the International Maritime Organization (IMO) model course 7.03, "Officer In Charge of a Navigational Watch" (IMO, 2014b).

Regardless of the path a mariner takes to become a junior officer, the maritime educator instructs this individual to accomplish the goal of becoming a competent and qualified officer. Most educators utilize learning objectives when conducting a course of instruction. Maritime educators who use the STCW for their instruction follow the Knowledge, Understanding and

Proficiency (KUP) of column 2 of the STCW tables to achieve the learning objectives of the class. These KUPs or learning objectives are related to Bloom's Taxonomy (Bloom, 1956). Benjamin Bloom (1956; Seaman, 2011) outlined three areas of learning domains: cognitive, affective, and psychomotor. Much of maritime education curriculum focuses on learning objectives primarily from the cognitive and psychomotor domains. Because this study suggested that emotional intelligence has a factor in decision making, educators may need to include more affective learning objectives. Emotions have the ability to impact long-term memory either by acceptance or avoidance of a belief or behavior (Buchanan, 2007).

Holden and Van Valkenburg (2004) described the benefits of addressing the affective domain in education. They noted affective education develops critical thinking and professional judgment that stimulates excellence in one's abilities. Additionally, affective education inspires officers to preserve professional standards and ethics. From the students' perspective, affective education fosters self-awareness. Self-awareness was an identified theme, which if properly cultivated, helps the students recognize when their emotions are getting in the way of their ability to reason, thus interrupting the process of emotional hijacking (Goleman, 1995).

To facilitate this affective training, many of the courses put forth by the STCW should be combined or followed in sequential order to ensure maximum effectiveness of the learning objectives. Courses like basic and advanced firefighting can stress the value of the training on the crew being their own fire department at sea, where calling 911 would not be possible. Some courses may need to be combined, because a lower level course, like first aid, is prerequisite to medical care provider. This is especially true in navigation in that terrestrial and coastal navigation is the base or prerequisite to radar, electronic navigation and electronic chart display, in information system courses. Table 6 suggests which courses could be combined, if not

arranged in sequential order.

Table 6 also suggests which affective learning objectives should be incorporated and which key words could be used in writing the course syllabus. Training needs to include as much new technology, as possible as often as possible. The participants discussed that their generation grew up around electronics and computers. Instructors need to develop into their instruction, where appropriate, online simulation for homework, the use of virtual and artificial reality training systems, and desktop and full mock-up simulators (Dunleavy, Dede, & Mitchell, 2009). Along with the technology, the instructor should take every opportunity to reconstruct scenarios from case studies and let the students determine what they would do given similar conditions. Furthermore, instructors can incorporate sites like YouTube and videos from the History Channel to dramatize actual shipboard incidents, discuss implications and what the decision makers could have done differently.

Courses like terrestrial and coastal navigation are primarily hands-on learning experiences. Just prior to the students taking their final exam, the course should include a series of practical assessments. The students should as often as possible, conduct navigation exercises in a full bridge simulator, given inbound and outbound scenarios. The team can be divided into various roles: a navigational aid bearing taker, a bearing recorder, a chart plotter, and a navigation evaluator. These roles should be rotated with each scenario. Upon completion of the exercise, both the students and the instructor should evaluate the team's performance and make recommendations for self and group improvement. This approach facilitates the incorporation of established affective education learning objectives, such as in responding, valuing, and organization, into maritime courses (Bloom, 1956; Holden & Van Valkenburg, 2004; Seaman, 2011).

During the interviews, the participants presented an interesting point about the use of electronic aids on the bridge. When asked about why they focused on one piece of gear over another, they said that it was based on how the instructor presented its importance and how to use it effectively. Instructors are a significant part of affective education. They are the role models that these new mariners will emulate. It is important that the instructors do not portray an attitude of *do as I say not as I do*. The instructors should include the following strategies in their instruction: be nonjudgmental and non-threatening; emphasize events like how upcoming difficult exams are significant to the course, not merely as a part of the grade, but how it will relate to the success of the maritime endeavors; utilize quizzes and exams as a learning experience rather than a punitive device; use cooperative rather than competitive learning environments (Holden & Van Valkenburg, 2004).

Table 6

*Suggested STCW Course and Associated Affective Learning Objectives*

<b>STCW Courses</b>	<b>Affective Learning Objectives</b>	<b>Affective Objectives Key Works</b>	<b>Affective Education Methods</b>
Personal Safety and Social Responsibility (PSSR)	Receiving, Responding, and Valuing	acknowledge, asks, attentive, listens, understands answers, assists, complies, conforms, discusses, labels, performs, presents, tells, appreciates, demonstrates, initiates, justifies, proposes	Role Play, Discussions that may include ethical dilemmas, Emphasize the significance of the class to actual shipboard experience.
Basic and Advanced Firefighting.	Receiving, Responding, Valuing, and Organization	acknowledge, asks, attentive, listens, understands answers, assists, aids, complies, conforms, discusses, labels, performs, presents, tells, appreciates, demonstrates, initiates, justifies, proposes, compares, relates, synthesizes	Role Play, Case Studies, Discussions, Emphasize the significance of the class to actual shipboard experience.
Personal Survival Techniques and Proficiency in Survival Craft.	Receiving, Responding, Valuing, and Organization	acknowledge, asks, attentive, listens, understands answers, assists, aids, conforms, discusses, labels, performs, presents, tells, appreciates, demonstrates, initiates, justifies, proposes, compares, relates, synthesizes	Role Play, Case Studies, Discussions, Emphasize the significance of the class to actual shipboard experience.
First Aid / CPR and Medical Care Provider.	Receiving, Responding, Valuing, and Organization	acknowledge, asks, attentive, listens, understands answers, assists, complies, conforms, discusses, labels, performs, presents, tells, appreciates, demonstrates, initiates, justifies, proposes, compares, relates, synthesizes	Role Play, Identify problems and discuss solutions, Emphasize the significance of the class to actual shipboard experience.
Seamanship (Able Seaman/Seafarer), Ship Construction & Basic Stability, and Cargo handling and Stowage.	Receiving, Responding, Valuing, and Organization	acknowledge, asks, attentive, listens, understands answers, assists, complies, conforms, discusses, labels, performs, presents, tells, appreciates, demonstrates, initiates, justifies, proposes, compares, relates, synthesizes	Case Studies, Identify problems and discuss solutions, Emphasize the significance of the class to actual shipboard experience.
Terrestrial & Coastal Navigation, and Magnetic & Gyro Compass	Receiving, Responding, Valuing, and Organization	acknowledge, asks, attentive, listens, understands answers, assists, aids, complies, conforms, discusses, labels, performs, presents, tells, appreciates, demonstrates, initiates, justifies, proposes, compares, relates, synthesizes	Case Studies, Discussions, Role play in a simulation activity. Emphasize the significance of the class to actual shipboard experience.
Radar, Automatic Radar Plotting Aid, Electronic Navigation, Electronic Chart	Receiving, Responding, Valuing, Organization and	acknowledge, asks, attentive, listens, understands answers, assists, complies, conforms, discusses, labels, performs, presents, tells,	Role Play, Case Studies, Create challenging situations based on case studies,



Display and Information System.	Characterization	appreciates, demonstrates, initiates, justifies, proposes, compares, relates, synthesizes acts, discriminates, displays, influences, modifies, performs, qualifies, questions, revises, serves, solves, verifies	Identify problems and discuss solutions, Emphasize the significance of the class to actual shipboard experience.
Meteorology	Receiving, Responding, Valuing, and Organization	acknowledge, asks, attentive, listens, understands answers, assists, complies, conforms, discusses, labels, performs, presents, tells, appreciates, demonstrates, initiates, justifies, proposes, compares, relates, synthesizes	Case Studies, Discussions, Emphasize the significance of the class.
Global Maritime Distress and Safety System (GMDSS) and Search and Rescue (SAR)	Receiving, Responding, Valuing, Organization and Characterization	acknowledge, asks, attentive, listens, understands answers, assists, aids, complies, conforms, discusses, labels, performs, presents, tells, appreciates, demonstrates, initiates, justifies, proposes, compares, relates, synthesizes acts, discriminates, displays, influences, modifies, performs, qualifies, questions, revises, serves, solves, verifies	Role Play, Case Studies, Create challenging situations based on case studies, Identify problems and discuss solutions, Emphasize the significance of the class.
Basic Shiphandling, Rule of the Road, Emergency Procedures, Bridge Resource Management, and Watchkeeping.	Receiving, Responding, Valuing, Organization and Characterization	acknowledge, asks, attentive, listens, understands answers, assists, complies, conforms, discusses, labels, performs, presents, tells, appreciates, demonstrates, initiates, justifies, proposes, compares, relates, synthesizes acts, discriminates, displays, influences, modifies, performs, qualifies, questions, revises, solves, verifies	Role Play, Case Studies, Create challenging situations based on case studies, Identify problems and discuss solutions, Emphasize the significance of the class as it applies to their upcoming occupation endeavors.

This study also suggested that the curriculum at the earliest level should include frequent use of case studies, role playing, and videos to dramatize shipboard incidents and possible solutions. There should be a frequent use of labs and exercises that require constant application of problem-solving skills. Like a muscle or the use of the brain, frequent exercise of problem solving that uses the affective domain increases the new officer's ability to rapidly build self-awareness and confidence in making decisions. Self-awareness is a skill of emotional intelligence that can be improved (Goleman, 1995). The course entitled NAUT 416

(watchkeeping) was a culmination of all the participants' training. Introducing application assignments earlier in their educational process prior to this culminating course may have benefitted the participants and their performance.

### **The Maritime Industry**

Unless the mariner is a career third officer, most new junior officers reporting to the vessels may come for their first sea tour. In a three-section watch rotation, many companies have the third officer stand the 8 a.m. to 12 p.m. (0800-1200) watch and again the 8 p.m. to 12 midnight (2000-2400) watch. This assignment is so the captain will be readily available for this inexperienced officer. The captain, the chief officer and the second officer should be willing to assist in training the new officer. Diane expressed the benefit of learning from other officers on the bridge. This insight stemmed from her experience working with high school students where she was a mentor to students learning about safe boating. She desired opportunities to walk around with more experienced officers to see how they conducted their watches, and wanted to be free to ask why they made one decision over another. She wanted to learn from other officers the best solutions to difficult problems encountered on a ship. Nevertheless, she expressed some apprehension that a senior officer may be unreceptive and less than cooperative due to her being new onboard the vessel.

Shipboard organization is a hierarchy arrangement with the captain at the top having absolute authority. Because of the limited size of ship crews, most ship's crews have close-knit relationships, and it is generally assumed that all crew members are knowledgeable in their duties and are expected to work together as a team. However, when new officers join the vessel, they normally do not have the experience or comprehensive knowledge that senior officers have already acquired over time. Unfortunately, the result is that the other, more experienced officers

are not always accepting of the new junior officer as part of their team. This lack of initial acceptance is because some senior officers have unrealistic expectations that juniors should be able to competently stand their watch alone, having already acquired the necessary knowledge and decision-making skills (Hetherington, Flin, & Mearns, 2006; Schröder-Hinrichs, Hollnagel, & Baldauf, 2012).

These unrealistic expectations are often based on the assumption that simply by virtue of being an officer, the new officer is fully knowledgeable and competent to stand the watch independently. The standing orders state that when the captain is not on the bridge, the third officer is to call the captain either to keep him informed or to request assistance (Schröder-Hinrichs et al., 2012). It was noted from the interviews that junior officers may decide to not call the captain, because they think they should know what to do, they do not want to look incompetent, or they are afraid of upsetting the captain by calling him. Several participants expressed this view of fear and inadequacy. They suggested an alternative solution to alleviate their apprehensions, by having someone to help them get established and comfortable with their watch at least for the first several months onboard.

The long-term solution is to educate intermediate and senior level officers about the benefits their operations gain by effectively mentoring new officers. This would include teaching them how to mentor and educate the new junior officer. Goldberg (2013) stated that 70% of professional knowledge comes from informal training. He suggested even though mentoring is an under-utilized practice in the maritime industry, the industry would benefit greatly from the practice of transferring knowledge from one generation of mariners to another. The IMO requires that captains and chief officers attend the leadership and managerial skills course that includes shipboard management and training. Nevertheless, the curriculum for that

course does not specifically address how to help a new officer through the transition of becoming a functional independent watchstander, nor does it teach senior officers how to be a mentor for these new officers. The curriculum addresses decision making, but has nothing to explain the degree of experience a person needs to make competent decisions (IMO, 2011).

The curriculum for mentoring should first emphasize the importance of mentoring, which included its benefits to both the captain and the company by developing and retaining talent for the organization. It is personally beneficial to the mentors by enhancing their skills from sharing their knowledge and experiences. The relationship is not without conflicts. For the protégés to reach their full potential, they will at times require some firmer guidance, which should include some constructive feedback as well. By investing in the protégés, the mentors can develop long-lasting relationships (Goldberg, 2013).

Next the curriculum needs to emphasize to the mentor understands this relationship for developing new members may take several years, due to the complexity of watchstanding. Knowledge is not enough. Experience is what helps the new officer to form competent decisions, which can be expedited by having the mentors find ways to challenge and coach their new officers through new experiences.

An example of how this would be accomplished is in radio communication. Most of the participants expressed their limited skills of talking on the radio. The captain can take this opportunity to teach radio communication by giving the new officer a scenario such as a vessel off the port bow crossing to starboard and coming to a collision course. The captain would instruct the officers to write down what they would say. Then the captain would simulate the opposing vessel and have the new officer simulate calling the ship. The captain would then evaluate whether proper or improper communication occurred. This could be done several times

until a level of confidence develops within the junior officer.

Next in the curriculum, the captain should let the new officers, under actual conditions, use the radio with the captain's supervision. Again the new officers should write down what they are going to say, review with the captain and then execute the actual call. The captain should follow up with a discussion of the performance. The following is a proposed addition to IMO model course 7.01 Master and Chief Mate, in Part C syllabus of the Leadership and Managerial Skills course (IMO, 2014a):

## 1.0 Shipboard Personnel Management and Training

### Shipboard personnel management

#### 1.1 Principles of controlling subordinates and maintaining good relationships ...

##### 1.1.12 Discusses theories on coaching individuals and teams to improve performance

- Explain the benefits of mentoring junior officers:
  - o Retention of highly qualified officers to the vessel and the company;
  - o Mutually beneficial to both the protégé and the mentor by increasing their knowledge and abilities;
  - o Long term relationship.
- Discuss the relationship will encounter conflict and how to resolve it.
- Demonstrate an example of instruction using radio communications:
  - o Practice a scenario with the junior officers writing down what they are going to say and the captain critiquing the effectiveness of the proposed communication.
  - o Coach an actual radio communication.

- Explain this is a long term process with a great return in investment.

The temptation for most captains is to do things themselves due to time and experience. It takes discipline and patience for the captain to stop and teach someone less experienced to do the same job. However, the rewards are not just for the individual, but also for the captain. Training someone new to do what the captain does strengthens the team by having one more experienced officer on the bridge. It should be the practice of the shipping company and the other officers on the vessel to know that this person does not have the years of experience to draw from for reliable decision making. These new officers require additional support both intellectually and emotionally rather than chastising for what they do not know or fail to do (Iordanoaia, 2010; Wang & Zhang, 2000).

### **Limitations**

The study has addressed the details of the findings and their implications to the maritime world. Yet, no study can be all-inclusive of the data, nor can it include the entire population that is being studied. To ensure credibility of research, it is necessary for a researcher to address those limitations. According to Galić, Lušić, and Pušić (2012), US maritime officers make up 5% of the world's maritime commercial trade. With the exception of two, all the participants of this study were from the US. Maximum variation sampling method was utilized when selecting participants. Nevertheless, those from the Hispanic ethnic group made up 9.4% of the school's population and none of the school's Hispanic population volunteered for the study. Additionally, only one female volunteered to participate. Of the American population, all of the participants were from the east coast; there was no representation from the Gulf region, the Great Lakes, or the west coast. Because of the small number of participants and the lack of diversity, the results of this study may not be generalizable to the entire population of the maritime community.

The study's population utilized the traditional education path for becoming an officer from a four-university degree program. Mariners can follow a non-traditional education path where they must complete three years of sea service, over 100 hands-on assessments, and five to six months of intense classroom training. Mariners who follow this non-traditional path are known as *Hawsepipers* for those mariners working their way off the deck plates to the bridge. The *hawsepipe* is primarily known as a tube for which the anchor chain passes through the ship's hull going out to the ship's anchor. None of these mariners were included in the study because of the convenience of the maritime university having a larger and more diverse population. A class for watchkeeping may have 200 students attend in a year. The hawsepiper usually attends one of the 250 Coast Guard approved training facilities, which typically have smaller class sizes of six students in a two-to-three week class, totaling about 60 students a year. This gave the researcher less opportunity to study a diverse population, but is still an important part of the industry that should be studied.

Another limitation within this study is the nature of the survey used. The GSE is a self-reporting instrument and has the potential for the participants to report false positives about themselves. Even though a questionnaire for self-efficacy was included in the study, the results from the observation and the interviews suggest emotional intelligence and working memory were additional factors in decision making. No instrument or measure for either emotional intelligence or working memory was adapted for comparison between the observation or the interviews.

### **Recommendations for Future Research**

Even though this phenomenological study investigated the decision making of novice decision makers in the maritime domain, future research should include other levels of

experience. It has been suggested that a person is considered an expert in a field after 10,000 hours or 10 years of engaged experience. UK P&I Club (1990) suggested that second officers were twice as likely to be involved in a collision; therefore, additional studies should investigate decision makers at the intermediate level between three and 10 years of experience, and experts with 10 or more years, because the UK P&I Club report suggested that captains are involved in 33% of the incidents.

Furthermore, self-efficacy was used for descriptive purposes of the participants' reaction to a situation. Because the study was qualitative research, the sample size used was too small to determine any statistically significant findings. To determine significance, a quantitative study should be used with a large sample size to determine if there is a correlation between completion of a voyage and self-efficacy scores. Additionally, other factors should be included in the study, such as teamwork, communications, and level of workload.

Because the results suggested that emotional intelligence was important to a person's decision making and confidence, studies measuring this component would be recommended. Because this research was a qualitative study, a quantitative study in a similar population would be recommended that compares the GSE and either the Emotional Competency Inventory (ECI), or the Emotional and Social Competency Inventory (ESCI), Emotional and Social Competency - University Edition (ESCI-U), or an instrument to measure confidence. By using three different measures, a researcher might determine if there is a correlation between self-efficacy, confidence, and emotional intelligence when it comes to determining success of an officer's decision making in an adverse situation.

The study's participants were from a traditional education pathway to becoming junior officers. Future studies should conduct similar research of mariners who follow a non-traditional



path; i.e., Hawsepipers. The research should consider a facility that has a high-resolution full bridge simulator. The training equivalent for NAUT 416 would utilize the United States Coast Guard (USCG) required watchkeeping course and the associated assessments. Additionally, similar research should focus on other regions of the US and countries other than the US where the majority of the world shipping manpower comes from.

This study focused on junior deck officers. Additional studies should include junior engineering officers who stand as officer in charge of an engineering watch (OICEW). Even though Giziakis, Goulielmos, and Lathouraki (2012) reported that engineering officers were involved in less than 5% of shipboard incidents, recent news events with Carnival cruise ships such as the *Carnival Dream*, *Carnival Triumph*, *Carnival Elation*, *Carnival Legend* and *Carnival Ecstasy* were a result of engineering failures and suggest additional studies in the engineering department may be required.

### **Summary**

This research study described the maritime junior officer's decision making. In answering the three main questions, the study suggested three themes: the Decision-Making Process, Factors in Decision Making, and Motivations and Solutions to Decision Making. Each theme had three key points or subthemes. The Decision-Making Process was based on how well participants were prepared for the exercise, how well they knew themselves and their abilities, and whether or not they took the simulation seriously. Factors in Decision Making included three subthemes: confidence, workload, and team cooperation. Finally, Motivations and Solutions to Decision Making depended on rules, knowledge, and self-motivation. Specifically, lacking in any of these key points posed barriers for junior officers taking advantage of techniques described in the literature as naturalistic decision making, specifically the

Recognition Primed Decision model (RPD) when encountering a complex and unfamiliar situation.

Interestingly, many of the key points identified under the three main themes were related to the affective domain, an area often neglected in maritime education. Maritime educators should begin all courses emphasizing the need for the students to be committed to their studies and to take advantage of those teaching aids that stimulate the affective domain. By using the affective domain, the educator makes an appeal to the students' emotions. It is not enough to know intellectually how to make a decision. Emotion has the ability to influence long-term retention of information.

The maritime industry has realized that the traditional hierarchy with the captain as absolute authority may need to be updated. The methods of Captain Bligh have proven to be ineffective; likewise, abusing and berating junior officers today is just as ineffective if not unethical. For new junior officers to make better decisions, the industry should implement a mentoring program and make it policy or normal practice of shipping companies. The curriculum for the leadership and managerial skills course should include the benefits of a mentoring program and how such a program could be implemented. By taking the time to consider the proposed methods the maritime industry may help ensure a future of better prepared leaders and decision makers.

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**APPENDIX A**

## IRB Approval Letter

**LIBERTY UNIVERSITY.**  
INSTITUTIONAL REVIEW BOARD

February 4, 2015

John Sitka III  
IRB Approval 2081.020415: Decision Making of Maritime Junior Watch Officers: A  
Phenomenological Study

Dear John,

We are pleased to inform you that your above study has been approved by the Liberty IRB. This approval is extended to you for one year from the date provided above with your protocol number. If data collection proceeds past one year, or if you make changes in the methodology as it pertains to human subjects, you must submit an appropriate update form to the IRB. The forms for these cases were attached to your approval email.

Thank you for your cooperation with the IRB, and we wish you well with your research project.

Sincerely,

**LIBERTY**  
UNIVERSITY.

*Liberty University | Training Champions for Christ since 1971*

## APPENDIX B

### Course Syllabus for Bridge Watchstanding NAUT 416

(For the propose of this study, permission was by Captain Walter Nadolny, Department Chair of the Marine Transportation Department for the publishing and redistribute the syllabus)

Course Objective: To prepare the Cadet as a Watch Officer on a Merchant Vessel. To qualify the Cadet as per required SCTW assessments (attached). To expose the Cadet to various Simulator experiences in order to develop decision making skills as it applies to traffic and voyage planning situations, and to develop proper situational awareness. Practical application of Rules of the Road and development of correct bridge procedures will be emphasized.

Course Policy: Nav. 416 participants must pass **both** the lecture and the simulator portions of this course. Failure of either will result in a failure for both Lecture and Practicum. In accordance with STCW guidelines, a participant must achieve a minimum grade of 70% or better in **each** of these sections in order to pass the course.

Attendance Policy: Class attendance is **mandatory**. Failure of the course will result from even one unauthorized absence. The Instructor must approve all Authorized Absences *in advance*. If you are going to be absent, you must call or e-mail *prior* to the class being missed and bring a photocopy of your authorized absence chit to your next class. Cadets will be allowed **ONE** Authorized Absence during the Semester, which will *have to be made up*. Vacations, job interviews, and airline reservations do not count as an authorized absence. If you miss one or more classes because of an unauthorized absence, you will earn an F. One absence of any kind will result in an F for the course. Cadets are expected to be on time and in uniform for all

lectures and simulations. Being late will result in loss of one letter grade, each time you are late. Repeated tardiness will result in an F for the course. No cell phones, food or drink allowed in class or the simulator.

Contact: If you are unable to attend simulation e-mail me in advance @ [wnadolny@sunymaritime.edu](mailto:wnadolny@sunymaritime.edu) and call me at 718-409-7291

Text: Watch Standing Guide for the Merchant Officer, CMP, by Robert Meurn

Recommended Reading:

Farwell's Rules of the Nautical Road, 8<sup>th</sup> Edition, U.S. Naval Institute Press

Shiphandling for the Mariner, CMP, MacElrevey, 4<sup>th</sup> Edition

Prerequisites: Naut 304 & 305      Practicum: As scheduled in the Simulator

Project: Comprehensive Term Paper review of a recent major Maritime disaster

Lecture Grade: 20% - Quizzes      30% - Project: due on or before **9 April**

50% - Final Exam

Final Lecture Grade: 50% Lecture Grade      50% Practicum Grade

Note: There will be **no** make up or rewrites for quizzes, exams, or project

Bridge Watchstanding NAUT 416(P)

Course Objective: To prepare the participant as a Watch Officer on a Merchant Vessel and satisfy the attached STCW assessments by exposing the participant to various Simulator experiences. To develop ship handling and decision making skills as they apply to traffic and voyage planning situations and to develop proper situational awareness. Practical application of

the Rules of the Road, navigational procedures and correct bridge procedures will be emphasized.

Course Policy: Nav. 416P participants must pass **both** the lecture and the simulator portions of this course. In accordance with STCW guidelines, a participant must achieve a minimum grade of 70% or better in **each** of these sections in order to pass the course

#### Class Etiquette

The class will be run as a professional bridge operation therefore the following rules apply:

1. 90% of the class time will be spent in the simulator room
2. Food and beverages are not allowed in the simulator room –EVER
3. There will be no food, drink, or cell phones in class
4. Fooling around or horseplay are not allowed
5. As in real life you never miss a watch or show up late
6. You will be treated like a professional therefore act like one. You are not a Cadet in this class.
7. **Observed Cell phone usage during an exercise will result in a failure of that exercise.**

Attendance Policy: Class attendance is **mandatory**. Failure of the course will result from even one unauthorized absence. The Instructor must approve all Authorized Absences *in advance*. If you are going to be absent, you must call or e-mail *prior* to the class being missed and bring a photocopy of your authorized absence chit to your next class. Cadets will be allowed **ONE** Authorized Absence during the Semester, which will *have to be made up*. Vacations, job interviews, and airline reservations do not count as an authorized absence. If you miss one or

more classes because of an unauthorized absence, you will earn an F. One absence of any kind will result in an F for the course. Cadets are expected to be on time and in uniform for all lectures and simulations. Being late will result in loss of one letter grade, each time you are late. Repeated tardiness will result in an F for the course. No cell phones, food or drink allowed in class or the simulator.

Contact: If you are unable to attend class e-mail me at [wnadolny@sunymaritime.edu](mailto:wnadolny@sunymaritime.edu) and call me at 718-409-7291.

Equipment: Navigation Plotting Instruments

Recommended Reading: Farwell's Rules of the Nautical Road, 8<sup>th</sup> Edition, U.S. Naval Institute Press

Shiphandling for the Master, CMP, MacElrevey, 4<sup>th</sup> Edition

<b>Naut 416 – Bridge Watchstanding</b>	
<b>DESCRIPTION</b>	<p>This simulator-based course is designed to enhance the potential Third Mate's decision-making skills as it applies to traffic and voyage planning situations and prepare the participant to take better advantage of the practical experience that will be afforded during SST III. Practical application of Rules of the Road and development of correct bridge procedures will be emphasized. Open sea and harbor conditions will be simulated for day as well as night using the simulator. Each watch team has 2 simulator hours and 1 class hour per week. A number of STCW required assessments relating to watch standing will be effected during this course.</p> <p style="text-align: center;">Ship Maneuvering and Handling, Knowledge of:</p> <p style="text-align: center;">.1 the effects of deadweight, draft, trim, speed and under-keel</p>

	<p>clearance on turning circles and stopping distances</p> <p>2 the effects of wind and current on ship handling</p> <p>.3 maneuvers and procedures for the rescue of person overboard</p> <p>.4 squat, shallow water and similar effects</p> <p>.5 proper procedures for anchoring and mooring</p> <p>Thorough knowledge of the basic principles to be observed in keeping a navigational watch; Thorough knowledge of effective bridge team work procedures; The use of routing in accordance with the General Provisions on Ships' Routing</p>	
<b>Credits = 4</b>	Schedule: <b>1 lecture hour and 2 simulator hours per week for 14 weeks</b>	
<b>Co/Prerequisites:</b>	<b>NAUT 315, NAV 312</b>	
<b>Course Materials:</b>	Text(s):	Watch Standing Guide for the Merchant Marine Officer; Meurn, R.
	Equipment:	Navigation plotting instruments
	References:	
	Other:	
<b>Special Training Aids:</b>	Full Mission Bridge Simulator	
<b>Grading Policy:</b>	Minimum passing grade of 70% (letter grade of C-), participants must complete all assessments	
<b>Attendance Policy:</b>	Participants cannot miss more than 10% of lectures, activities performed during simulator sessions <b>MUST</b> be made up	
<b>KUP's in TRB</b>	10.1.2.2, 10.1.2.3, 10.1.2.4	
<b>STCW Assessments Performed In Course</b>		
OICNW-1-3B	Chart selection	

OICNW-1-3C	Route planning
OICNW-1-6A	Steering gear test
OICNW-1-6B	Set weather controls
OICNW-2-1D	Determine risk of collision
OICNW-2-1E	Maneuver to avoid risk of collision – meeting
OICNW-2-1F	Maneuver to avoid risk of collision – overtaking
OICNW-2-2A	Watch relief
OICNW-2-2B	Keep a safe navigation watch
OICNW-2-2C	Notify Captain when appropriate
OICNW-2-2D	Keep a safe anchor watch
OICNW-2-2E	Navigate in restricted visibility
OICNW-2-2F	Turn over a watch
OICNW-2-3A	Voyage planning
OICNW-2-3B	Execute a voyage plan
OICNW-2-3C	Watch augmentation
OICNW-2-3D	BRM Condition III – collision avoidance
OICNW-2-3E	BRM Condition III – navigation
OICNW-2-3F	BRM Condition II or III – error trapping
OICNW-2-3G	BRM Condition II or III – navigation & collision avoidance
OICNW-2-3H	BRM Condition III – establish a bridge team
OICNW-5-1A	Maneuver for man overboard
OICNW-5-1B	Course change of more than 45°
OICNW-5-1C	Emergency stop



## STANDING ORDERS

The Watch Officer's primary duties when underway are the safe navigation of the vessel, collision avoidance, and maintenance of a good lookout.

Nothing shall supersede, contradict, or violate the Rules of the Road.

A proper lookout includes by sight and bearing as well as by all available means, including, but not limited to, the use of radar, binoculars, and information received by VHF radio either from shore or from another vessel.

Ship's position fixes shall be taken as often as necessary to insure the safe navigation of the vessel but, where possible, not less than once every hour.

Danger bearings must be taken to ascertain the safe maneuvering limits of the course of the vessel.

Positions should not be taken using floating objects such as buoys, lightships, etc. when fixed objects are available.

Where general prudence, good seamanship, and rules and regulations require, the vessel shall use established sea lanes and traffic separation tracks.

When the Watch Office turns Over the Conn or the watch to the Captain or another Watch

Officer, the action must be clearly stated and acknowledged.

When the Captain relieves the Watch Officer of the Conn this action must be clearly stated.

The Watch Officer shall make full use of all navigational equipment to determine the vessel's position. This equipment shall be used in conjunction with, but not in lieu of, celestial navigation and piloting procedures.

The Captain will keep the Watch Officer informed as to where he can be contacted at any time. In an emergency, the Watch Officer may use a short ring on the General Alarm to notify the Captain.

Even though the Captain is on the Bridge, the Watch Officer has the Conn and perform his normal watch duties and responsibilities unless the Captain formally relieves him.

Coordinate bridge-to-bridge ship to shore and station-to-station communications.

Ensure proper execution of steering and engine orders.

Record all required entries in the bell book, course recorder chart, deck logbook and any other logs or report forms.

Compare the standard compass to the gyrocompass each hour. Keep informed of the error of the compasses.

Take an azimuth once every watch if the weather permits.

Each half hour check that the vessel is being steered on the required course.

After each course change-, check that the vessel is steering the required course and check the compasses,

All orders to the helmsman shall indicate direction and amount of rudder to be used  
Courses shall be stated in three numerals.

Running Lights are to be on continually while the vessel is at sea and checked at least once a watch.

The Officer on Watch shall never leave the Bridge at any time unless properly relieved.

**MATE**

NAME: \_\_\_\_\_ DATE: \_\_\_\_\_ EXERCISE: \_\_\_\_\_

1. Prepared \_\_\_\_\_
2. Equipment setup \_\_\_\_\_
3. Awareness \_\_\_\_\_
4. Maneuvering \_\_\_\_\_
5. Communications \_\_\_\_\_

**NAVIGATOR**

NAME: \_\_\_\_\_

1. Prepared \_\_\_\_\_
2. Chart Setup \_\_\_\_\_
3. DR's \_\_\_\_\_
4. Positions \_\_\_\_\_
5. Awareness \_\_\_\_\_

**COLLISION AVOIDANCE**

NAME: \_\_\_\_\_

1. Prepared \_\_\_\_\_
2. Equipment setup \_\_\_\_\_
3. Awareness \_\_\_\_\_
4. Communications \_\_\_\_\_

### **ADMINISTRATION**

NAME: \_\_\_\_\_

1. Prepared \_\_\_\_\_
2. Awareness \_\_\_\_\_
3. Communications \_\_\_\_\_
4. Logbook/Bellbook \_\_\_\_\_

### **HELM**

NAME: \_\_\_\_\_

1. Prepared \_\_\_\_\_
2. Awareness \_\_\_\_\_
3. Communications \_\_\_\_\_

NAVIGATOR:	Range and bearing of anchor position arrived at		
RADAR OBS:	from the planned anchor position		
HELM:	TIME LET GO ↓		
<b>EXECUTION</b>			
Total 40 Points – 2 Points Per Item		<b>APPRAISAL AND PLANNING</b>	
Total 30 Points – 2 Points Per Item			
01. Compliance of Captain / Standing Order		01. All relevant pubs studied	
02. Proper preparation for ARRIVAL		02. Satisfactory plan form	
03. Proper internal communications		03. Track & courses on chart	
04. proper VHF procedures		04. Danger and safety margins marked	
05. Captain / Engineroom kept informed		05. Tidal times and heights calculated	
06. ETA's maintained		06. sufficient under keel clearance / squat ascertained	
07. Proper orders given		07. Critical W/O marked correctly	
08. Frequency and method of position fixing		08. ETA's and distance planned	
09. Margins of Safety maintained		09. VHF ch. Note and RP's marked	
10. Optimum use of all navigational aids		10. Frequency & method of fixing planned	
11. Compliance with Port Regulation		11. Relevant Port Regulation considered	
12. Safe speed maintained at all times		12. Weather expectations and forecast	
13. Efficient visual lookout maintained		13. Ship's maneuvering considered	
14. Anchoring properly prepared and executed		14. Contingency plans made	
15. Optimum use of bridge personnel		15. Effective anchoring plan made	
16. Bell Book properly maintained		<b><u>APPRAISAL &amp; PLANNING SCORE</u></b>	
17. Log Book properly maintained			
18. VHF log properly maintained		<b>ORGANIZATION &amp; TEAMWORK</b>	
19. Anchor in correct anchorage			
20. Ship satisfactorily maneuvered			Total 10 Points – 5 Points Per Item

<b><u>EXECUTION SCORE</u></b>		01. Watch Officer composure	
		02. Teamwork	
<b>MONITORING</b> Total 20 Points – 2 Points Per Item	<b><u>ORGANIZATION &amp; TEAMWORK SCORE</u></b>		
	<b><u>SUMMARY</u></b>		
01. Track (Charted fixed and PI)			
02. Depths		APPRAISAL AND PLANNING (30)	
03. Traffic		EXECUTION (40)	
04. VHF		MONITORING (20)	
05. Helm		ORGANIZATION & TEAMWORK (10)	
06. Instruments		TOTAL POINTS ( out of 100)	
07. Visibility / Weather		<b><u>AUTOMATIC DEDUCTIONS</u></b>	
08. ETA's			
09. Passing of information		1 Point for each minute late	
10. Watch Officer		15 Point for extremely poor navigation / grounding	
<b><u>MONITORING SCORE</u></b>		<b><u>ADJUSTED (FINAL) SCORE</u></b>	
<b>COMMENTS:</b>			
<b>INSTRUCTOR:</b>			

**EXERCISE 2 PUGET SOUND*****M/V VOYAGER******Call Sign: WEBE***

Date: 04 February, 2014

Time: 1900

D.R. Position:

Lat 47-56N, Long 122-31W

Course: 121 deg T    Speed: 17.0 kts    Charts: 18440

Scenario:

You are the Third Mate Inbound in Puget Sound approaching Point No Point bound for Seattle.

Follow the Traffic Lanes and, when contacted by VTS, Tugs, or Agent, respond with the proper ETA to the "SG" buoy off of West Point Light.

When abeam of the "SG" buoy, slow to half-ahead.

At West Point Lighted buoy Number "3", reduce to dead-slow ahead.

***M/VENTERPRISE******Call Sign: KFOG***

Lat 47-37N, Long 122-25W

Course: 324 deg T    Speed: 12.0 kts    Scenario:

You are the Third Mate Outbound in Puget Sound departing Seattle.

At West Point Lighted buoy Number "3", increase to Full Ahead Maneuvering Speed  
Prior to the "SG" buoy, a/c to enter the Northbound Traffic Lanes.

Follow the Traffic Lanes and, when contacted by VTS, Tugs, Pilot, or Agent, respond with the proper ETA to the Pilot Station at Port Angeles.

Notes:

An additional Mate will be on the radar to help with Collision Avoidance. The Captain will be in his cabin.

Notify Captain & E/R 15 minutes prior to "SG" buoy and Port Angeles Pilot Station. The Helm will be relieved every 30 minutes

Call the Captain any time if in doubt, particularly if an emergency arises

**EXERCISE 3 PUGET SOUND*****M/VENTERPRISE******Call Sign: KFOG***

Date: 11 February, 2014

Time: 0600

D.R. Position:

Lat 47-56N, Long 122-31W

Course: 121 deg T    Speed: 17.0 kts    Charts: 18440s

Scenario:

You are the Third Mate Inbound in Puget Sound approaching Point No Point bound for Seattle.

Follow the Traffic Lanes and, when contacted by VTS, Tugs, or Agent, respond with the proper ETA to the "SG" buoy off of West Point Light.

When abeam of the "SG" buoy, slow to half-ahead.

At West Point Lighted buoy Number "3", reduce to dead-slow ahead.

***M/V VOYAGER******Call Sign: WEBE***

Course: 324 deg T    Speed: 12 kts

Lat 47-37N Long 122-25W

Scenario:

You are the Third Mate Outbound in Puget Sound departing Seattle.

At West Point Lighted buoy Number "3", increase to Full Ahead Maneuvering Speed Prior to the "SG" buoy, a/c to enter the Northbound Traffic Lanes.

Follow the Traffic Lanes and, when contacted by VTS, Tugs, Pilot, or Agent, respond with the proper ETA to the Pilot Station at Port Angeles.

Notes:

An additional Mate will be on the radar to help with Collision Avoidance. The Captain will be in his cabin.

Notify Captain & E/R 15 minutes prior to "SG" buoy and Port Angeles Pilot Station The Helm will be relieved every 30 minutes

Call the Captain any time if in doubt, particularly if an emergency arises



## APPENDIX C

### Observational Protocol Form

<b>Observational Protocol</b>	
<i>Length of each exercise: 45 minutes</i>	
<i>Descriptive Notes</i>	<i>Reflective Notes</i>
<p>What are the initial behaviors of the participant(s) when being briefed on the assessment?</p>	
<p>What were the actions, discussions, and behaviors of the participant(s) leading up to the critical moment?</p>	
<p>What actions or inactions took place on missing the critical moment?</p>	
<p>What were the actions, discussions, and behaviors of the participant(s) after the critical moment?</p>	

## APPENDIX D

### Consent Form

The Liberty University Institutional  
Review Board has approved  
this document for use from  
2/4/15 to 2/3/16  
Protocol # 2081.020415

#### Consent Form

Decision-Making of Maritime Junior Watch Officers

John Sitka

Liberty University  
School of Education

You are invited to participate in a research study of Decision-Making of Maritime Junior Watch Officers. You were selected as a participant because of your participation in NAUT 416 and your time and experience as a deck officer. Please read through this form and ask any questions you may have before agreeing to participate in this study.

This study is being conducted by John Sitka, an Ed.D. candidate in the School of Education at Liberty University.

#### **Background Information:**

The purpose of this study is to describe or identify those factors for critical decision-making in maritime junior watch officers.

#### **Procedures:**

If you agree to be in this study, I would ask you to do the following things:  
You will be asked if you would like to participate in an in-depth interview that will be tape-recorded and to reply to 10 questions. The interview and questionnaire should not take longer than 60 to 120 minutes. I will ask for your contact information so that I may forward to you the interview and your statements for your review of accuracy.

#### **Risks and Benefits of being in the Study:**

*The study has risks:* The risks involved in this study, however, are no more than you would encounter in everyday life.

As a participant, there is no direct benefit for participation in this study. However, your participation in this study may lead to a reduction in overall accidents that are attributed to junior watch officers. In addition, educational curriculum may be improved and techniques developed to help junior watch officers forgo any future situations that may result in a catastrophic maritime incident.

#### **Compensation:**

You will receive payment of a \$20.00 Visa Gift Card. This will be provided upon completion of the in-depth interview. However, compensation will not be distributed in the event of early withdrawal. Both the participant and researcher will fill out and sign the Participant Payment Disclosure Form.

#### **Confidentiality:**

The records of this study will be kept private. In any sort of report I might publish, I will not include any information that will make it possible to identify a research participant. Research records will be stored securely and only the researcher will have access to the records.

The Liberty University Institutional  
Review Board has approved  
this document for use from  
2/4/15 to 2/3/16  
Protocol # 2081.020415

Your personal identification will be kept confidential; the data will be stored on a computer with encryption and password protected. All audio media will be transcribed and the audio recordings will be destroyed immediately by erasing the recording.

The information that is collected will be coded and classified for key phrases or significant statements. This data collected will be used to determine a theme and a meaning to critical decision-making of junior officers.

**Voluntary Nature of the Study:**

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with Liberty University and State University of New York Maritime College. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

**How to Withdraw from the Study:**

You are free to withdraw from this study at any time. **If you decide to withdraw from this study, you should notify the researcher immediately.** The researcher may also end your participation in this study if you do not follow instructions, miss scheduled visits, or if your safety or welfare are at risk.

If you elect to withdraw or are withdrawn from this research study, the researcher will immediately delete collected recordings of participants who withdraw and shred (or otherwise destroy) any hardcopy data and will not include this data in my analysis.

**Contacts and Questions:**

The researcher conducting this study is John Sitka. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact him at email: [jsitka@liberty.edu](mailto:jsitka@liberty.edu) or (cell) 757-692-2976. The student advisor for this study is Dr. John R. Duryea, Ed.D. Assistant Professor with the School of Education at (434) 592-6297.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd, Suite 1837, Lynchburg, VA 24515 at 434-592-5530 or email at [irb@liberty.edu](mailto:irb@liberty.edu).

The Liberty University Institutional  
Review Board has approved  
this document for use from  
2/4/15 to 2/3/16  
Protocol # 2081.020415

*You will be given a copy of this information to keep for your records.*

**Statement of Consent:**

I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.

I giving consent to being audio-recorded  agrees or  disagrees,

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Signature of Investigator: \_\_\_\_\_ Date: \_\_\_\_\_

## APPENDIX E

### The General Self-Efficacy Questionnaire

The General Self-Efficacy Questionnaire English version by Ralf Schwarzer & Matthias Jerusalem, 1995		Response 1-4
1.	I can always manage to solve difficult problems if I try hard enough.	
2.	If someone opposes me, I can find the means and ways to get what I want.	
3.	It is easy for me to stick to my aims and accomplish my goals.	
4.	I am confident that I could deal efficiently with unexpected events.	
5.	Thanks to my resourcefulness, I know how to handle unforeseen situations.	
6.	I can solve most problems if I invest the necessary effort.	
7.	I can remain calm when facing difficulties because I can rely on my coping abilities.	
8.	When I am confronted with a problem, I can usually find several solutions.	
9.	If I am in trouble, I can usually think of a solution.	
10.	I can usually handle whatever comes my way	
Response Format		
1 = Not at all true   2 = Hardly true   3 = Moderately true   4 = Exactly true		
(Schwarzer, 2008)		

**From:** [Schwarzer, Ralf](#)  
**To:** [Sitka, John](#)  
**Cc:** [health@zedat.fu-berlin.de](mailto:health@zedat.fu-berlin.de)  
**Subject:** RE: Request for minor changes to your submission  
**Date:** Thursday, March 17, 2016 3:33:34 PM

---

Dear Mr. Sitka,

herewith I grant you permission to publish and distribute the General Self-Efficacy Scale.

Regards

Prof. Dr. Ralf Schwarzer  
Freie Universität Berlin, Psychology  
Habelschwerdter Allee 45  
14195 Berlin, Germany  
Email | [ralf.schwarzer@fu-berlin.de](mailto:ralf.schwarzer@fu-berlin.de)  
WEB | <http://my.psyc.de>  
ORCID | <http://orcid.org/0000-0002-0069-3826>  
Twitter | <https://twitter.com/schwarzer1>  
BLOG | <http://theemeritus.wordpress.com/>

## APPENDIX F

### Interview Questions

1. Describe your experience in the simulator scenarios?
2. Describe how you felt about the decision(s) you made in the simulator.
3. What rule or procedure was in your thought process that led you to a particular decision?
4. How confident were you in your decision making and why?
5. Referring to other traffic that they made a maneuver for: Was the other ship's action correct under the International Regulations for Preventing Collisions at Sea (COLREGS)? If you disagree with what the other ship did, why do you think they did it?
6. What alternatives did you have?
7. If you missed a piece of useful information, why?
8. Would you do it differently if faced with the same situation again? If so, what would you do and why?
9. What do you think it means to miss a critical decision?
10. What factors do you think contribute to a good or bad decision?
11. Why do you think officers on the bridge make good or bad decisions?
12. What do you think would help you make better decisions?

APPENDIX G

Sample of Field Notes

~~FA2 B1~~ ~~BYD B1~~ ~~HEM: VOYAGJA~~

CARL

Observational Protocol	
Student ID: (Personal information removed for security purposes) NAME: NAME	
Length of each exercise: 30 minutes Total time of both: 1 hour CA-BEUSTO	
Descriptive Notes	Reflective Notes
<p>In the first exercise: What decisions were correct and which one were not correct</p> <p>Slow to contact MASTER <sup>3:00</sup> NOT TARGET</p>	<p>FAIL TO MAKE APPROPRIATE SPEED CHANGE (STATED IT WAS LEFT IN WRONG POSITION)</p> <p>- NOTIFIED MASTER OF VSL TIME: 3:08</p> <p>MULTIPLE CONTACTS.</p> <p>NOTIFY MASTER OF TARGETS :52</p> <p>- TROUBLE IN STAYING IN TRAFFIC LANE :58</p> <p>- (good) NOTIFIED COMMANDER OF CHANGE OF SPEED) 2:00</p>
<p>In the first exercise: What were the actions, discussions, and behaviors of the student(s) leading up to the critical moment?</p> <p>TUNNEL VISION on a TARGET FAILED TO MANUEVER INTO CHANNEL.</p>	<p>Initial comm between THE TEAM.</p> <p>- NO HELP FROM NAVIGATION wrong direction OF TRAFFIC scheme</p> <p>DISCUSSING THE MAP TRAFFIC WITH YOUR TIME</p>
<p>In the first exercise: What actions or inactions took place on missing or catching the critical moment?</p> <p>COMMUNICATION IMPROVED WITH FERRY SKEY TBEG.</p>	<p>TROUBLE EFFECTIVE COMMUNICATE WITH MASTER ABOUT TARGET.</p> <p>- COMMUNICATION TO SKEY WITH KOBISH MANUI.</p> <p>KISTAL FERRY CALLED. POOR COMM RESPONSE</p> <p>RADIATOR OPERATION NO HELP</p> <p>→ CLOSE CALL WITH BALTIC (LUGSHP)</p>
<p>In the first exercise: What were the actions, discussions, and behaviors of the student(s) after the critical moment?</p> <p>ASK MASTER ABOUT TUG + DOCKING (W/ CONFIDENCE)</p> <p>Did you GET ANY HELP or did you make all the decisions without the information?</p>	<p>- SECURITY CALL NOT CROSSING THE LANE! (Good)</p> <p>- ASK IF HE WAS COMING TO THE BRIDGE</p> <p>you make all the decisions without the information?</p>

- Didnt know ship agents name = TRACKED!

SEEMED TO BE ARMY - ALLOT OF DIFFICULTY ESC WITH COMMS

WO RELAYED

(B1) THE IN POOR AT 30% PLV



19 FEB 2015 Carl

CARL

HE SAID A FEW THE SIMULATION WAS REAL BUT I DIDN'T FEEL LIKE HE WAS TOTAL COMMITTED

- OOD HIGH SE BUT NOT CONFIDENT
- IN AN INCIDENT WITH OTHER VESSEL HE WASN'T CLEAR ON THE RULES
- BACK TO BEING LOW CONFIDENT BUT DIDN'T WANT TO SLOW THE SHIP DOWN
- BELIEVED CALLING THE CAPTAIN WOULD HELP CONFIRM HIS DECISION
- WASN'T COMPLETELY SURE OF THE RULES OF THE ROAD (WHY?)
- WITHOUT FULL KNOWLEDGE OF THE AUTO PLS SYSTEM HE WAS UNABLE TO ID SHIPS ALTHOUGH IT WAS QUOTE HE KNOWN OF SUCH GEAR.
- KNOWS THE ECDIS AND RAOON BUT ABOUT HIS?

→ IF HE COULD HAVE DO OVER HE WOULD SLOW DOWN - WAS HE FOLLOWING THE RULES TO CLOSELY OR AFRAID OF THE CAPTAIN.

- ONE OCCASION HE CALLED A VESSEL TO MAKE A PASSAGE, BUT THE OTHER VESSEL NOR THE VSL TRACKER RECORDED.
- HE RECOGNIZE THE LACK OF EXPERIENCE WAS A HINDERANCE IN HIS DMN
- SLOW TO CONTACT MISTRON; NO GOOD REASON GIVEN

During HIS Interview HE SEEM TO HESITATE ALOT. EVEN IF I HAD HIM ON MY SHIP I WOULD NEED TO WORK WITH TO ATTITUDE ABOUT THE WATCH. HE IS A CONTRADICTION HE <sup>DOES NOT</sup> COMPLETE THE EXERCISE; HIS SELF EFFICACY IS HIGH; HIS TEAM WORK WAS POOR. HE WAS TOO RELATED IN SIMULATION, THAT WHY I THINK HE DOESN'T TAKE THE SIMULATION SERIOUSLY, OOD HE DID CALL THE CAPTAIN 8 TIMES, HE HAD SEVERAL NEAR MISSES. HIS PERFORMANCE DID IMPROVE DURING THE SIM. EVEN THOUGH HIS SE WAS HIGH SELF CONFIDENCE WAS LOW

17 FEB ET 3

YOUNGER

MATE Diane

Observational Protocol	
Student Id: Diane	
Length of each exercise: 30 minutes Total time of both: 1 hour	
Descriptive Notes	Reflective Notes
<p>good efficiency - call master despite being busy</p> <p>In the second exercise: What decisions were correct and which one were not correct</p> <p>(Very Good) why??</p> <p>1:09: NOTIFIED MASTER ABOUT AGENT PROBLEM</p>	<p>01: NOTIFIED ENGINEER - (BUT AT WRONG SPD)</p> <p>08 NOTIFIED MASTER AFTER CLEARING VSL</p> <p>15. REPORT VSL CPA TO MASTER</p> <p>31 REPORTED TO MASTER BARREL IN LANE</p> <p>44 CALL MASTER ABT VSL CPA</p> <p>52: MADE APPROP TUN. IN SCHEME</p> <p>57: CALL MSTR ABT VSL AHEAD OF TAKING -</p> <p>1:01 NOTIFIED MASTER CALL FROM AGENT</p>
<p>In the second exercise: What were the actions, discussions, and behaviors of the student(s) leading up to the critical moment?</p>	<p>DID NOT NOTIFY MASTER WHEN <u>OUT OF LANE</u></p>
<p><u>NEVER USED RADIO TO CALL VSL</u></p> <p>In the second exercise: What actions or inactions took place on missing or catching the critical moment?</p> <p>23 min &lt;</p>	<p>07: NO RADIO CALL TO VSL MTR STOP/STOP</p> <p>09 ENTERED SEPARATION SCHEME</p> <p>11 WINDY SIDE SCHEME</p> <p>17. DID NOT INCREASE SPD AS RECOMMENDED</p> <p>24 NOTIFIED BY VTS TO DO RIGHT ANGLE TO GET BACK INTO LANE</p> <p>36 AGENT CALLED ON 13 BUT RADIO'S NOT 13</p> <p>59 CALL AGENT BARREL IN ETA</p>
<p>In the second exercise: What were the actions, discussions, and behaviors of the student(s) after the critical moment?</p>	

UNFAMILIAR WITH PLAN + LOCATION. WAS ECDIS OPERATING?

Instruction - ALLEGEDLY NOT ASK WITH THIS STUDENT.

SA ALSO MEAN LISTEN ON WHO CALLED YOU ON THE RADIO

24

1777 1111

FORM 11

POOR VIEW

19 FEB 2015 Diane

Diane

Jin looking forward to meeting with Diane since she is the Contradiction. Her SE sense is the lowest but she constantly called the Captain. It's a shame she is the only female.

- Why are you nervous and doubting yourself? You have had experience on the summer cruise and you know the knowledge.
  - Disappointing that the cadet aren't given more decision making capabilities
  - !! - Her concern was correct. About Andy the Captain. He was especially offended especially by her.
    - o (Carnius?) Why is she not named in proper reporting to Captain.
    - o - The navigation is the problem. She doesn't know what she is doing and causing the team to lose 2nd. Multiply her problem is the Captain's yelling.
    - o she was familiar with the Rules but the C/A person could have been more helpful
    - she knows the Rules of the Road o It was good to see she took the sign seriously
    - started a computer that <sup>FELL</sup> ~~fell~~ apart during the exercise
  - (OK) NO PERS ON THE NAV OR THE REST OF THE TEAM.
  - She had the knowledge of PI Lines; but never used them due to lack of confidence and belief in her self
  - o Big point she was already frustrated with slowed down or ruined the decision making process
    - o she doesn't recognize the need for a list and preparation, is that because of her failure in the sim?
    - AHA! She recognizes that even though your nervous you still have control over the situation
    - o Recognizes her lack of experience is a liability in her ability to make effective decisions
  - !! one thing that she suggests that a big part is how a member said but a good point when you get to a ship the people treat you like you have the experience and knowledge
- (over)

Diane

242

Diane

WAS THE BEST SO FAR WITH INFORMATION

I WAS LOOKING FORWARD TO HEARING FROM HER. I WAS DISAPPOINTED THAT SHE WAS THE ONLY FEMALE. FROM MY EXPERIENCE I WOULD HAVE WELCOMED HER ON MY SHIP. SHE HAS SPIRIT AND COMMITMENT TO EXCELLENCE. SHE RAJDA, VERY FEW COMMANDERS AND CAPTAINS WILL MENTION THE JUNIOR OFFICER MAY SENIOR OFFICER CAN BE DOWN RIGHT CRUDE IN THEIR TREATMENT OF JUNIOR OFFICERS. WHOSE YET, WHEN THESE JR OFFICERS BECOME SENIOR OFFICERS AND BECOME THE JEKKS THAT THEY WORKED UNDER. FROM MY COUNSELLING EXPERIENCE I WONDER IF THE LACK OF CONFIDENCE OR SELF EFFICACY PREPENTATES THE BACK BEHAVIOR IN SENIOR OFFICERS BECAUSE THEY ARE NOT ST IN SENSE.

- HER FAILURE IN THE SIM WAS A CUMULATION OF SEVERAL THINGS HER NAVIGATION IS WORTHLESS - THE RADAR DEPENDENT WAS ALSO WORTHLESS SHE WAS DEPENDING ON HER OWN. WHOSE YET ANY TIME SHE ASKED FOR HELP FROM THE CAPTAIN, HE YELLED AT HER. I WAS IMPRESSED WITH HER THAT INSPITE OF THE YELLING FROM THE CAPTAIN SHE STILL CALLED HIM IN W/ STANDARD ORDERS. Diane IS THE CONTRADICTION TO MY ASSUMPTION OF SE AND CALLY THE CAPTAIN.