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A Study on Educations Role in Establishing Strategies for Improving Safety at Sea

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Contents

Abstract

Safety at sea is a major concern of the maritime industry and it is through education and training that continued improvement can be realized. Despite increased awareness there has often only been minimal improvement made to training programs. The steady stream of accidents and disasters at sea are testament to this situation. This paper has been written to encourage a review of present maritime education and training so as to provide a catalyst for improved safety at sea.

In order to deal with these issues, three specific areas have been selected from extant literature that clearly demonstrate the important role education plays in the improvement of safety at sea. Parallels have been made to ways in which the aviation industry also deals with safety. The opinions of cadets at one maritime university in South Korea have been surveyed which afford a very powerful insight into the viewpoints of our future seafarers. A major rationale of this study is that issues of safety at sea are kept clearly in the attention of all involved in the maritime industry. By understanding the important role that education plays in improving safety at sea it is hoped that trainers and educators will continuously take time to improve the service they provide to seafarers and to the industry as a whole. The implications of the strategies outlined in this paper will hopefully encourage those with the power to induce change to search for ways to improve and implement the education and training that seafarers urgently need in order to enjoy a safe working environment.

Key words : Safety at Sea, Education & Training, Human Factors, Strategies & Solutions

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I. Introduction

Maritime safety continues to receive increasing amounts of attention from governments, media and the general public. This paper looks at three strategies that if developed and integrated into educational training programs could make a considerable contribution to the improvement of safety at sea. First, the importance of early exposure to the various aspects of Human Factors will be emphasized. This is followed by the need for educators and trainers to assume greater responsibility in developing safety awareness in their trainee. Finally, the need for those working in training centers to be actively involved in discussions on policies that affect safety and searching for ways to develop a safety culture within their organizations. By examining various means of developing a safety culture within an educational setting it is hoped that the educators and trainers involved in ensuring safety at sea are well-informed about possible areas that could be ameliorated through better understanding of the role education plays in improving safety at sea. The strategies that are discussed have been specifically selected for their relevance to Korean maritime education and are based on recommendations by the IMO and various researchers in this field. Lessons are also drawn from the aviation industry which is a leader in safety education and training. The research data presented in section three is an excerpt from a survey that collected the opinions of over 200 cadets. These cadets were asked to express their opinions on present curriculum details and areas where they would like to see changes made. The findings proved helpful in establishing the need to review training policies at maritime educational institutes. The section on Education and Training at Maritime Institutes (4.2) addresses the specific problem faced by Korean cadets of how to improve their Maritime English skills prior to going on board.

Although training and education is generally accepted to be the best method of improving safety at sea there has been little published on the subject. This paper will expand on presently published material by showing the potential that a country such as South Korea has for developing, training and benchmarking educational policies essential for seafarers. Although this article does not go into great depth on any particular item it will serve as an

introduction to possible ways to improve safety at sea through education. Future research papers will be designed to address individual strategies in isolation and in greater detail. It will be concluded from this paper that there is a need to constantly consider and review the way training and education is viewed by those in the industry that have the responsibility to ensure that the health and safety of crew, ship and the environment are always cared for.

II. Literature Review

The International Maritime Organization (IMO) is a UN agency that promotes safety at sea through education. In the preamble to the International Safety Management (ISM) Code, the IMO states, "The cornerstone of good safety is commitment from the top. In matters of safety and pollution prevention it is the commitment, competence, attitudes and motivation of individuals at all levels that determines the end result."[1] This especially includes those who have the great responsibility to train and educate future seafarers at the various maritime institutes around the world. Even though the educational systems of Europe are generally effective, continued improvement is always sought and the European Commission aims to improve the quality of maritime education and training in order to increase the safety and working condition of the shipping environment. The research done by the European Commission has contributed greatly to improving many areas of maritime policy. One of the key domains concerns the human element in safety. They recognize a need for the "harmonised education of seafarers, the importance of common curricula and the optimum use of simulators and modern training tools." Research has also carried out on the sociological and linguistic origins of constraints on ship crew performance. The results indicated the need to consider language and cultural issues in the recruitment and training of ship crews.[2] If the European Commission acknowledges that such considerations are important even at the recruitment stage of a seafarers career then it must be during a cadets early training that attention is paid to such issues.

1) IMO (1993).
2) European Commission (2001).

Teaching standards vary in the way professional subjects are taught at maritime training centers around the world. Despite some good examples, many remain in need of improvement. General recognition of the need to raise teaching standards in maritime education and training was emphasized by Mr. H Madsen, CEO of Det Norske Veritas. When he reported on a survey conducted by DNV which found that 50% of the academies surveyed were operating in a sub-standard manner.[3] This situation was also picked up by the Director of AustralAsian Maritime Education Services, Valerie A. Short. She states that "while all seafarers can be held responsible, it is their trainers who need to upgrade their teaching skills." She goes on to explain that the usual type of maritime training in many countries is that of "large classes of trainees listening to a lecturer who may or may not welcome questions or interaction during the teaching session."[4] This method of training certainly does not promote good retention of ideas or practical application of essential maritime skills necessary for developing safety awareness.

III. Ramifications of Current Maritime Training and Education

This section details the present situation of maritime training and education by using the case study of Mokpo National Maritime University in South Korea. There is currently minimal training in Human Factors despite the obvious importance such training would have in improving safety at sea. Time and budget allocation in maritime academies is more often spent learning technical subjects or in attaining an English listening and reading test score, rather than in ways the human relates to the on board environment. This is despite common acceptance that the marine industry experiences more than 70% of its casualties directly related to human error.[5] It is not until cadets have their first on board experience that they understand directly the importance of human factors. Often with little awareness of what is happening and the reasons why, new seafarers are often incapable of handling difficult, stressful or surprising situations on board. This prompts us to question what

3) Madsen (2006).
4) Short (2006).
5) Crowch (2009).

percentage of allocated training budget at maritime training centers is directed towards non-technical skills such as Human Factors and other essential skills necessary for safety. Until now, the answer is very little and this chronic imbalance needs to be addressed.[6)]

A major concern of the IMO and other governing bodies are the communication problems that continue to threaten the safety of seafarers. This is borne out by recent research carried out on the usefulness and applicability of the Test of English for International Communication (TOEIC) for life on board.[7)] Over 200 senior cadets were survey about the training they had received. The following is relevant data that supports the need for the implementation of a more comprehensive Maritime English program and testing system. Cadets who had been at sea for six months on board merchant vessels were asked to agree or disagree with the following statement (Item 1): *the TOEIC lessons I took while at university were very helpful for my on board life*. Only 8.5% of students responded that they "agreed" or "strongly agreed" that these lessons were very helpful for on board life. However, 22% "neither agreed nor disagreed", 33% "disagreed" and 34.4% "strongly disagreed". The mean of these results can be seen in Table 1.

<Table 1> Item 1 One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Item 1	210	2.05	1.077	.074

<Table 2> One-Sample Test for Item 1

	Test Value = 4					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Item 1	-26.206	209	.000	-1.948	-2.09	-1.80

6) Crowch (2009).
7) Davy (2011).

The Null (Ho) hypothesis used for this item was that the TOEIC is useful for on board life. As can be seen in Table 2 the Test Value was set at 4. This represents the opinion that "agrees" with the statement in Item 1. Considering the amount of time that is often spent on preparation and the importance it has as a high stakes test for graduation and recruitment it would presumably be the view of the institute that the Test of English for International Communication had some intrinsic value to the training of seafarers. However, as can be seen from the p value 0.000 which is less than the Alpha 0.05, there is a statistically significant difference of opinion from the cadets themselves. This is supported by the 95% Confidence Level showing the mean to be around 2.05 which means that Ho can be rejected and it can be confidently stated that the cadets believe the TOEIC is NOT useful for on board life. To understand whether cadets felt that TOEIC tests scores were an effective way of determining a person's speaking and conversational ability, they were asked to agree or disagree with the following statement (Item 2): *The TOEIC is an effective way of determining a person's speaking and conversational skills*. Tables 3 and 4 show statistics and results after conducting a One-Samples T-Test:

<Table 3> Item 2 One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Item 2	45	2.11	1.153	.172

<Table 4> One-Sample Test for Item 2

	Test Value = 4					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Item 2	-10.994	44	.000	-1.889	-2.24	-1.54

It can be seen from these results that the majority of cadets disagreed with the statement. These data support the relevant literature that state that TOEIC

scores are not a good indication of a person's communicative competence.[8] Although the TOEIC company recommends using the test as a graduation tool, according to available literature, it was concluded by Cunningham that this test should not be used as an achievement test as it does not reflect what students are able to do with the language. If someone is being hired to go to sea, to work a dangerous job with a crew of various nationalities, yet is unable to work using a common language, then the safety of those on board will be in jeopardy. This is made clear in the SOLAS Convention Chapter 5 which specifies that a common working language is essential for safety. A language testing system therefore, needs to be developed and implemented by the industry that allows new recruits to demonstrate more clearly how they are able to use maritime English for the specific needs of their chosen career. This can be most easily accomplished by the collaboration of maritime trainers alongside the relevant shipping recruiting agencies.

The responsibility for providing a safety culture at sea is in the hands of the maritime educators and this responsibility must not be taken lightly. Holistic courses that focus on practical maritime skills and which include more than just technical knowledge need to implemented. For example, within the curriculum it is necessary to learn about different cultures, assertiveness, body language and conflict resolution. These needs are supported by the empirical results gained from cadet responses when asked to disagree or agree with the following statements about Maritime English (Item 3): *If there was more focus on practical English skills for seafarers at university it would be very useful*. 18.8% of all those that responded "strongly agreed" with this statement along with 23.7% who also "agreed". Those that "neither agreed nor disagreed" totaled 27.2% while 8.5% "disagreed" and 9.8% "strongly disagreed". Cadets were then asked to agree or disagree with the following statement (Item 4): *I wish I had more time and opportunities to improve my English maritime speaking skills*. 24.1% of respondents said that they "strongly agreed" with the above sentence and 20.5% also "agreed" but not strongly. 29.5% of the total number "neither agreed nor disagreed" while 10.7% "disagreed" and 5.8% "strongly disagreed". These two items asked closely related questions so the results have been analyzed together and are presented in Table 5 and Table 6 below.

8) Cunningham (2002).

<Table 5> One-Sample Statistics for Item 3 & 4

	N	Mean	Std. Deviation	Std. Error Mean
Item 3	224	3.03	1.530	.102
Item 4	224	3.18	1.526	.102

<Table 6> One-Sample Test for Item 3 & 4

	Test Value = 4					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Item 3	10.046	223	.000	1.027	.83	1.23
Item 4	11.601	223	.000	1.183	.98	1.38

The Null (Ho) hypothesis used for Item 3 was that if there was more focus on practical English skills for seafarers at university it would not be useful. As can be seen in Table 6 the Test Value was set at 2. This represents the opinion that “disagrees” with the statement in Item 3. As can be seen from the p value of <0.05, there is a statistically significant difference of opinion between the Null hypothesis and that of the cadets. This means that Ho can be rejected and it can be confidently stated that if there was more focus on practical English skills for seafarers at university it would be useful. The Null (Ho) hypothesis used for Item 4 was that cadets do not wish they had more time and opportunity to improve their English maritime speaking skills. As can be seen in Table 7 the Test Value was set at 2. This represents the opinion that “disagrees” with the statement in Item 4. As can be seen from the p value of <0.05, there is a statistically significant difference of opinion between the Null hypothesis and from the cadets themselves. This means that Ho can be rejected and it can be confidently stated that the majority of cadets do wish they had more time and opportunity to improve their English maritime speaking skills.

If the results had been different it would indicate that the current training

methods of the university were satisfactory. Unfortunately, this does not seem to be the case. The daily schedule of cadets is often very full and therefore a wise use of time is surely expedient. These data support the need for a re-evaluation on the use and appropriateness of the test for use by cadets preparing for a career at sea. A large percentage of cadets from the study claimed that they were unable to learn, practice and develop their maritime English skills at university. This is a worrying situation when so much time must be invested into the TOEIC which does not encourage speaking and contains no maritime content whatsoever. If the cadets do not have the time to use what they do learn in practical situations, then when they finally go to sea it will be too late. Cadets strongly believed that the maritime institute should be a place where they can learn about the 'real life' of being a seafarer. Focusing more on the practical application of things learnt during class time would surely be beneficial and this would be especially true with Maritime English. The benchmarking and implementation of Maritime English courses at other European maritime institutes would surely contribute to the development of the essential skills required for safety at sea.

IV. Strategies for Improving Safety at Sea

Although by no means exhaustive, the following powerful strategies are being implemented in many European maritime nations, along with support and funding from governmental agencies and private investors. They each generate a positive impact on maritime safety. The careful implementation of just one strategy would prove that further investment would not be wasted, especially when long-term benefits are procured. All safety strategies involve much change from present systems and paradigm shifts to new and innovative ways of training, working and thinking. Considerable investment is also needed to implement any strategy effectively and all require continuous support and commitment from the entire industry including maritime training centers and shipping companies.

1. Human Factors Training

A simple definition of Human Factors is the interaction between people, machines and the environment for the purpose of improving performance and reducing error.[9] Experts in the field of Human Factors list twelve items that make up the most important elements. These error-promoting conditions are often referred to as the 'dirty dozen'[10]:

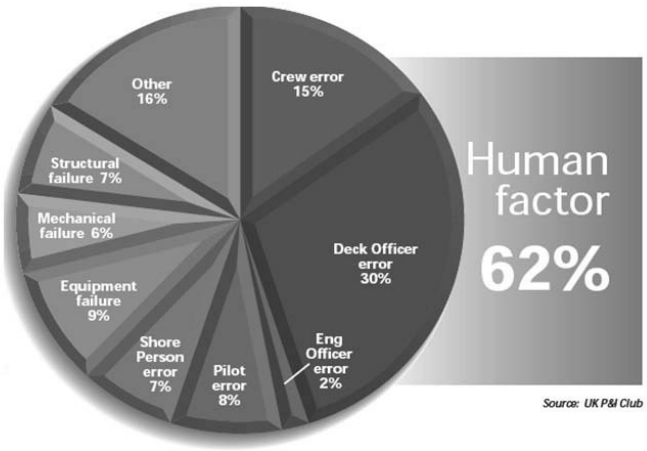
<Table 7> Human Factors or the 'Dirty Dozen'

Lack of:	Abundance of:
Communication	Pressure
Resources	Stress
Assertiveness	Norms
Awareness	Fatigue
Teamwork	Distraction
Knowledge	Complacency

Human Factors training involves a study of human behavior and performance in relation to the working environment. It is essential to understand seafarers as human beings and examine factors that affect or influence their performance. Within aviation education and training these twelve factors are explained carefully in the context in which those working in the industry would experience them along with practical application. This needs to be the focus of similar training in the maritime industry. The UK P&I Club stated in 2003 that the percentage of errors attributable to human factors was over 60% as shown below in <Figure 1>.

9) FAA (2008).
10) Franklin (2008).

<Fig. 1> Percentage of human errors



The union for professional seafarers, Nautilus, reports an even higher figure of around 80% of accidents at sea being attributable to human error.[11] Human Factors training in the aviation industry is an integral part of the Crew Resource Management (CRM) courses that are mandatory for all in the industry. The shipping industry has in some way tried to implement a similar concept called Bridge Resource Management but the success and usefulness of this has not been proven. It has often been poorly implemented at best and not utilized effectively.[12] Further review, support and investment needs to be given to create effective CRM courses that yield tangible improvements for the safety of seafarers and the environment they must work in.

Naturally, the place to start implementing training in human factors is at the educational level of the industry before cadets even have the chance to board vessels. By training cadets early on in the understanding and practical application of human factors a reduction in incidents and accidents is possible. With improved simulation facilities and courses in environmental and stress training, maritime institutes could prepare cadets for the real-life situations they find themselves in at sea. By providing continued compulsory refresher training courses for all in the industry, including the coastal sector, heightened safety awareness and improved competence would result. Human Factors training provides the holistic approach to training. Supported by IMO legislation, understanding human factors is essential for improving long-term

11) Nautilus (2006).
12) Crowch (2009).

safety conditions at sea. Not only this, but by reducing incidents and accidents a cost-effective, sustainable future can be ensured for international and coastal shipping companies. Education and training in Human Factors and the role they play in the daily lives of those on board will promote good relations between crew members and a community of trust that is essential to the safety of those in front line operations.

2. Education and Training at Maritime Institutes

Sound and effective training in safety issues needs to be addressed at the earliest possible stage in a seafarer's life. Environmental training must be an essential part of any curriculum and should be as real-to-life as possible. It must impart essential knowledge such as self-awareness and interdependency so that leaders can ascertain where there are weaknesses. By way of example, life on board is often characterized by long periods of isolation away from friends and family. The Philippine Merchant Marine Academy, in order to help new cadets quickly adjust, provide a one-month orientation training period where they are isolated from family and friends and prohibited from entertaining visitors.[13] This is a simple yet effective training strategy. Instead of just using maritime institute training ships as 'floating classrooms', cadets need to experience the real world of shipping in all its forms. For example, the habit of error reporting needs to start at the institute level where there is the promotion of a safety culture that will not just hand out punitive judgments. Rather it will help the group and individual see the benefits of reporting by objectively analyzing what led up to the error and the lessons that can be learnt from such experiences.

Environmental training and stress training are systems that are effectively used by the aviation industry in developing personnel that are competent in operating and performing their tasks in all possible situations. Similar systems need to be adopted in maritime training centers if cadets are to survive and operate effectively and safely in their chosen careers. The implementation of a 'back to basics' training scheme is highly recommended once goals and expected outcomes are clearly defined. Education in human error must be an essential element of a maritime curriculum.

13) PMMA Admissions (2010).

3. Safety Culture & Shipping Policy

According to Cox & Cox., "Safety culture reflects the attitudes, beliefs, perceptions and values that employees share in relation to safety".[14] These attitudes initally developed during the training period at maritime institutes and form the foundation of a persons safety awareness or lack thereof. In order to measure the safety culture of an organization, commitment from management, employee empowerment and an effective reporting and rewarding system are used as indicators. At a maritime institute also, commitment from faculty to the reinforcement of safety awareness is essential for forming the foundation of a safety culture. For a successful safety culture three requirements are necessary: a reporting culture, a just culture, and a learning culture. These are all important elements that should and can easily be developed during training at maritime centers. Attitudes and opinions about safety need to be shared at both individual and organizational levels. An important prerequisite is the establishment of trust. Without trust the three requirements are unattainable. A just culture is by no means a no-blame culture. While groups and individuals must take responsibility for their actions a just culture protects against using the individual as a scapegoat for the organization. An effective safety culture must also be flexible and willing to implement reform when required. A process of feedback, learning and adaption should go on continuously across all levels of an organization.[15] These concepts need to be central to training and educational philosophy and integrated into the curriculum of maritime courses so that new seafarers are well-equipped for life at sea.

To improve the safety culture of the maritime industry, employers, health and safety organizations and especially trainers and educators, must first work together to develop a safety climate that focuses on designing safe systems that make poor safety behavior difficult or impossible.[16] The safety culture of an organization will determine the success of achieving safety at sea. Therefore, organizations that have difficulty implementing effective safety management systems as required under the ISM Code, such as the coastal maritime sector, often neglect the safety culture of their organization.[17] The

14) Cox & Cox (1991).
15) Taylor (2008).
16) WHSQ (2009).
17) Lappalainen (2008).

safety culture in turn affects the operations of the organization. The IMO provides the way in which a safety culture can be achieved and these ideals must be instilled into the minds of young cadets prior to entering a career at sea. These include (1) recognizing that accidents are preventable through following correct procedures and established best practices; (2) constantly thinking about safety; and (3) seeking continuous improvement. The IMO believes that through application of the ISM Code a successful safety culture can be attained. The ISM Code, largely based on the philosophy of Total Quality Management, adopts the following three fundamentals: management commitment; personnel empowerment; and continuous improvement.[18] By constantly focusing on safety during the training period maritime educators can play a very important role in helping the industry achieve its main goal of safety at sea. By developing the safety culture of shipping companies and by introducing safety culture concepts early on at the educational level, trust and openness will result. Continuous improvement will enable the maritime educators and trainers to keep up to date with safety issues and implement best practices available for dealing with incidents and accidents. This will significantly enhance the image of shipping in the Republic of Korea and allow for the safe operation of vessels at sea.

V. Conclusion

This paper has looked at the role education plays in improving safety at sea. The training and education of cadets, the role of Human Factors and the continual improvement of policies are all relevant to maritime training centers and shipping companies. Furthermore, these issues especially address the needs of one maritime university in South Korea which faces some unique challenges in providing the best possible training for its cadets. The careful consideration and implementation of these strategies would significantly improve the effectiveness of training programs presently in place and in turn would have a positive effect on long-term safety.

As was mentioned in the introduction to this article the depth of investigation

18) Lappalainen (2008).

into implemetation of the strategies within a maritime curriculum has been limited. Rather, this paper calls the attention of the maritime industry to the need to re-evaluate current training methods and focus on educations role in improving safety at sea. Further articles will suggest suitable ways to implement such strategies into comprehensive training curricula. Further limitations of this paper are that only one maritime training center has been used as a case study and only one group of cadets surveyed. Future research into the opinions of a wider population and the benchmarking of other training facilities will further support the assumption of the need to heighten educations role in enhancing safety at sea.

This paper has contributed to the very limited amount of research and data that has been published into the role that education plays in improving safety at sea. Instead of expecting shipping companies to adequately train their officers, it shifts the responsibility more towards the educators from whom these new officers have had their first contact with maritime issues. Initially, it was shown that the essential knowledge of Human Factors needs to be thoroughly integrated into the maritime curriculum so that cadets are fully aware of the impact these have on the day to day operations of life at sea. It was next shown that educators and trainers need to be more aware of the great responsibility they have in providing the foundation of knowledge and experience that young seafarers will take with them into the future. Emphasis must be on practical skills rather than on test preparation. Finally, it was emphasized that all parties in the maritime industry need to take an active role in discussions and research to make continual improvements in the relevant shipping policies that will encourage the continual improvement of safety at sea.

It is through education that the potential of Korean seafarers will be fully recognized. By reviewing the details of each strategy it is possible for any maritime institute or trainer to re-examine their present educational system and find ways of implementing more holistic, practical and industry specific training methods that will fulfill the needs of the industry and be in line with IMO standards. This paper has highlighted to shipping companies and other interested parties the importance of being involved in and supporting the role that education facilities provide. By reviewing the strategies mentioned it

is possible for all within the maritime industry to realize the importance of education in providing the best possible training in order that all seafarers can benefit from improved safety at sea.*

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