



Assessment of nautical competence

A comparative study of Swedish and Philippine final year students

Diploma Thesis in the Master Mariner Programme

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CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden, 2013
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The report authors attending the graduation ceremony at the University of Cebu in the Philippines.

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ABSTRACT

The purpose of this study is to investigate if there are any differences in maritime competence between Swedish and Philippine final year students at the master mariner programmes. If there are differences occurring, the aim is to connect these to the different educational systems.

In the study an extensive questionnaire has been used to assess possible differences in theoretical knowledge. It is built on multiple-choice questions and comparable to a written test. The questionnaire has been distributed to the final year students at Chalmers University of Technology in Sweden and the University of Cebu in the Philippines. To control if there are any differences in practical skills a simulator study has been conducted at the same universities.

The study involves three classes of students, one from Sweden and two from the Philippines. Some Philippine students get sponsored, which involves extra education and integrated onboard training. The regular students do not have the same opportunities, which is the reason to why the two groups are studied separately.

Comparing the three groups, the actual meaning of competence is first clarified. Immersing in the subject reveals that the actual meaning is very complex, as a consequence the results of the thesis represent only a part of the total definition.

The study concludes that there are differences in maritime competence between the two universities. However, the results cannot be considered to represent the entire two nations, due to the varying quality of institutions within the countries. In addition, it is obvious that the educational system does have an affect on the competence level, in what extent is however difficult to conclude from the results of this thesis.

Keywords: Competence, the Philippines, education, knowledge, skills, Sweden, questionnaire, simulator, assessment, comparison.

SAMMANFATTNING

Syftet med denna studie är att undersöka om det föreligger några skillnader i nautisk kompetens mellan Svenska och Filippinska sistaårselever på sjökaptensprogrammen. Målet är att knyta eventuella skillnader till de olika utbildningssystemen.

Ett utförligt frågeformulär har genomförts för att bedöma eventuelle skillnader i teoretisk kunskap. Frågeformuläret bygger på flervälsfrågor och kan liknas vid ett skriftligt prov. Det delades ut till sistaårselever på Chalmers Tekniska Högskola och det maritima universitetet i Cebu, Filippinerna. För att kontrollera om det föreligger skillnader i färdigheter så genomfördes även en simulatorstudie på de två universiteten.

Studien involverar tre klasser, varav en är från Sverige och två från Filippinerna. Ett fåtal Filippinska studenter får sin utbildning sponsrad, vilket bland annat innebär extra undervisning och integrerad ombordförlagd fartygsutbildning. De vanliga studenterna får inte samma möjligheter, vilket är orsaken till att grupperna studerats separat.

För att kunna jämföra de tre grupperna har innebörden av kompetens först definierats. Själva definitionen av kompetens är väldigt komplex och resultatet av studien svarar bara för en del av definitionen.

Studien visar på att det föreligger skillnader i nautisk kompetens mellan de två universiteten. Emellertid kan inte resultatet anses representera de två nationerna i stort, då kvalitén på utbildningarna varierar inom respektive land. Det framgår vidare att utbildningssystemet har betydelse för kompetensnivån, men i vilken utsträckning går ej att fastställa i denna undersökning.

Nyckelord: Kompetens, Filippinerna, utbildning, kunskap, färdigheter, Sverige, enkät, simulator, bedömning, jämförelse.

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Our experience of working at sea together with different nationalities and Philippine labour in particular raised the interest for this thesis. An interest was also shown from the shipping industry since no comparative study of competence between Swedish and Philippine seafarers was previously available. This fact contributed to the choice of topic as well. With good support from Per Barkman (HR manager at Sirius Shipping Aps.), the thesis was constructed to fill a gap of information of interest to the Swedish shipping industry.

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TABLE OF CONTENTS

ABSTRACT	I
SAMMANFATTNING	II
ACKNOWLEDGMENTS	III
TABLE OF CONTENTS	V
LIST OF FIGURES	VII
LIST OF TABLES	VII
LIST OF ABBREVIATIONS	VIII
1. INTRODUCTION	1
1.1 Main question.....	2
1.2 Sub-queries.....	2
1.3 Purpose.....	2
1.4 Delimitations	2
2. BACKGROUND	3
2.1 The definition of competence	3
2.2 The STCW Convention's role in this thesis	3
2.2.1 Delimitations of the competence requirements	4
2.3 How to measure competence	4
2.3.1 The meaning of performance assessment.....	4
2.3.2 Assessment in a competency based qualification system	5
2.3.3 STCW standards of competence.....	5
2.4 The use of multiple choice questions for competence assessment	6
2.5 The use of simulator studies for competence assessment.....	7
2.6 The educational systems	7
2.6.1 In Sweden	7
2.6.2 In the Philippines	8
2.7 General data and statistics	9
2.7.1 Sweden	9
2.7.2 The Philippines	9
3. METHODOLOGY.....	10
3.1 Introduction.....	10
3.1.1 Ethics	10
3.2 The questionnaire.....	10
3.2.1 Development of the questionnaire	11
3.2.2 The pilot research	12
3.2.3 Selection	12
3.2.4 Performing the questionnaire	13
3.3 The simulator study	14
3.3.1 Preparations	14
3.3.2 The process of selection	15
3.3.3 Performing the test	15
4. DISCUSSION OF METHODOLOGY.....	17
4.1 The questionnaire.....	17
4.2 The simulator study	18

4.2.1 Choice of methodology.....	18
4.2.2 Complications in reaching validity	18
4.2.3 The simulator study as contribution to the research	20
5. RESULTS	21
5.1 The questionnaire.....	21
5.1.1 Total score	21
5.1.2 Results per area of competence	23
5.1.3 Questions of specific interest	26
5.2 The simulator study	29
6. DISCUSSION OF RESULTS	30
6.1 The knowledge level and its relation to the educational system	30
6.1.1 Questions of specific interest	33
6.2 The skill level	34
6.3 The correlation between knowledge and skills	35
6.4 Ideas for future research projects	35
7. CONCLUSIONS	36
REFERENCES	37
APPENDICES.....	39
Appendix 1 – The questionnaire.....	40
Appendix 2 – The simulator observation scheme	52

LIST OF FIGURES

Figure 1 – Introducing the questionnaire to the regular students at UCLM	13
Figure 2 – Overlooking the progress of the simulator scenario at UCLM.....	16
Figure 3 – The simulators	20
Figure 4 – Total average score.....	21
Figure 5 – Distribution of the score.....	22
Figure 6 – Results from ‘terrestrial and coastal navigation’	23
Figure 7 – Results from ‘watchkeeping’	24
Figure 8 – Results from ‘radar navigation’.....	25
Figure 9 – Question 1 from the questionnaire	26
Figure 10 – Score question 1	26
Figure 11 – Question 5b from the questionnaire	27
Figure 12 – Score question 5b	27
Figure 13 – Question 4 from the questionnaire	28
Figure 14 – Score question 4	28

LIST OF TABLES

Table 1 – General data for the total score.....	21
Table 2 – Total score difference	21
Table 3 – General statistics part one	23
Table 4 – General statistics part two.....	24
Table 5 – General statistics part three	25

LIST OF ABBREVIATIONS

- AMOSUP – The Associated Marine Officers’ and Seamen’s Union of the Philippines
- AS – Average score
- CHED – Commission on Higher Education (the Philippines)
- ECDIS – Electronic Chart Display and Information System
- COLREG – International Convention for Preventing Collisions at Sea
- EMSA – European Maritime Safety Agency
- IMO – International Maritime Organization
- Med. Score – Median score
- MOA – Maritime Officers’ Association
- MS – Maximum score
- NTC – The Norwegian Training Center (the Philippines)
- NSA – National Shipowners’ Association (Norway)
- NVQs – National Vocational Qualifications (Great Britain)
- PPT – Percentage points
- PRC – Professional Regulation Commission (the Philippines)
- SD – Standard deviation
- SEA – The Swedish Shipowner Employers’ Association
- SMOC – The Swedish Maritime Officers’ Coalition
- TSS – Traffic Separation Scheme
- UCLM – University of Cebu, Lapu-Lapu and Mindaue

1. INTRODUCTION

‘How competent are the Philippine seamen actually?’ (Sjöbefälsföreningen, 2011, p. 33, our translation). These words are the introduction to an article in the Swedish magazine ‘*Sjöbefäl*’, where the competence level of the Philippine seafarers is discussed. The question is of utmost importance since the Philippines are the world’s biggest labour exporting nation within shipping. The EU-commission is now discussing the possibilities for invalidating parts of the educational system in the Philippine’s because it does not live up to the requirements in the STCW Convention. The consequences of such a decision could be that many thousands of Philippine seafarers’ licences would become unusable. As a result the European ship owners would most likely encounter problems manning their vessels (Sjöbefälsföreningen, 2011).

The employment of non-EU/ESS members onboard Swedish ships is controlled by a general agreement between The Associated Marine Officers’ and Seamen’s Union of the Philippines (AMOSUP), the Swedish Maritime Officers’ Coalition (SMOC) and the Swedish Shipowner Employers’ Association (SEA). The agreement was first established in 1997 and controls wages and working conditions for temporarily employed personnel (MOA, 2013). The total monthly cost for a temporarily employed Philippine Chief Officer is approximately USD 3,300 (CBA for officers, 2011). It is clearly economically beneficial for shipping companies to employ labour through the temporary employment agreement. Many Swedish owned vessels are therefore manned by Philippine seamen. Today about 250 Philippine officers are working on Swedish vessels as a result from the agreement (MOA, 2013). Consequently, the question about the competence level of Philippine seafarers is of great importance for the Swedish maritime industry.

This research project has found no prior published study comparing the competence level of Swedish and Philippine seafarers. An extensive investigation of the Philippine’s export of seafarers to the EU, involving all associated authorities, is being performed by the European Maritime Safety Agency (EMSA). However, the report is not yet finished and none of the work so far is made official¹. The lack of data on the area was confirmed by representatives from Swedish ship owners who showed a great interest in a research regarding this controversial topic. The interest from the shipping industry together with onboard experiences from sailing with Philippine crew are the reasons for choosing this subject.

This thesis is primarily addressed to the Swedish shipping companies, teachers and students at the academies and all personnel who have participated or in any way contributed to the making of the research.

¹ Senior Communication Officer at EMSA

1.1 Main question

Are there any differences in nautical competence between Swedish and Philippine final year students in the master mariner programmes?

1.2 Sub-queries

- Are there differences in the level of theoretical knowledge required for navigation at an operational level?
- Are there differences in the level of the practical skills required for navigation at an operational level?
- Is there a correlation between the level of knowledge and the skills?
- Are possible differences in competence connected to differences in the educational systems?

1.3 Purpose

The purpose of the thesis is to contribute to the discussion about the manning of Swedish vessels by looking at the competence level of final year students at the master mariner programmes in Sweden and the Philippines. If there are differences, the aim is to discuss how and why they appear and establish how these may be connected to the different educational systems.

1.4 Delimitations

The thesis will be limited to certain areas of competence regarding navigation on the operational level. No consideration is taken to varying age, gender or seagoing experience between the participants.

The text sometimes refers to differences between Sweden and the Philippines, however the research is built only on the differences between two universities. It can therefore not be said to fully represent the entire countries, but rather just the specific case of the two current institutions.

2. BACKGROUND

2.1 The definition of competence

In the main question the term 'competence' is used. The definition of the expression is 'the ability to do something successfully or efficiently' (*The New Oxford Dictionary of English*, 1998). The exact meaning of the definition may be hard to grasp and is therefore further defined in compliance with the STCW Code. The Code defines the minimum requirements for certification by terms of knowledge, understanding and proficiency (IMO, 1996). The definitions of these three terms are:

- *Knowledge* – 'facts, information, and skills acquired by a person through experience or education; the theoretical or practical understanding of a subject'.
- *Understanding* – 'the ability to understand something; comprehension'.
- *Proficient* – 'competent or skilled in doing or using something'.

(*The New Oxford Dictionary of English*, 1998)

Traditionally the view of competence has been related to the level of knowledge and skills. Performance is in this case taken to mean performance in written examinations or performance in stated skills. Occupational performance today refers to the term 'occupational competence'. This includes skills, knowledge and understanding that are specific to an occupation, but also more general skills and knowledge as well as personal effectiveness. A definition of occupational competence by Mr R.C. Matthew is 'the bringing together of all the diverse skills, knowledge and abilities needed to ensure that individuals are capable of fulfilling the roles expected of them in the way and to the standards expected in employment' (1997, p. 189). The precise definition is however not considered to be of most importance, but rather the fostering of a broad and holistic view of the term (Matthew, 1997). Assessment of occupational competence is, according to Matthew (1997), the heart of vocational qualifications described later in this text.

2.2 The STCW Convention's role in this thesis

The STCW Convention was established by IMO in 1978. It prescribes minimum standards for seafarers, which countries are obliged to meet or exceed. The establishment of the Convention was a first step to set the minimum requirements of training, certification and watchkeeping on an international level. Previously the standards were set by individual governments without reference to practices in other countries. This led to great varieties of standards and procedures the shipping nations between (IMO, 2013).

After 1978 the Convention has been revised and improved several times. Major changes were made in 1995 as a response to a recognized need for bringing the Convention up to date and clarify ambiguities. The Code is since then referred to as STCW-95 and includes all previous amendments. Less extensive changes were made in 1997, 1998 and 2006. They do however not affect the area of interest for this research. In 2010 the Manila amendments were adopted. The purpose of the implementation was to bring the Convention and Code up to date once again, since the initial adoption in 1978. This was another extensive revision, including several new amendments also affecting the area of interest for this research. Among other thing it includes requirements relating to modern technology and guidelines for training in leadership and teamwork. The amendments entered into force on 1 January in 2012 (IMO,

2013).

The source of information used to assess competence in this thesis is based on the STCW-95, as amended in 1997. The Manila amendments are not taken into account. However it is of less importance since the amendments have not changed the original requirements, but only added further instructions on the provisions. In addition the participants of the research have gone through the education mainly before the implementation of the Manila amendments, meaning that the STCW-95 has been used as a legal framework in the major part of their education (IMO, 2013).

2.2.1 Delimitations of the competence requirements

The STCW Code serves to support and further enhance the STCW Convention, where the training requirements of seafarers are defined. Part A of the Code contains the mandatory provisions, which in detail give the minimum standard requirements requested to fully comply with the STCW Convention. The provisions are specifically referenced to the articles and regulations of the Convention. Chapter 2 of part A in the code, section A-II/1, shows the mandatory minimum requirements for certification of officers in charge of a navigational watch on ships of 500 gross tonnage or more. These requirements relate to navigation at the operational level (IMO, 1996). This research will use section A-II/1 of the Code as a primary reference to competence requirements and evaluation. Focus will be put on the following three areas of competence:

1. 'Plan and conduct a passage and determine position'
Terrestrial and coastal navigation
Electronic systems of position fixing and navigation
2. 'Maintaining a safe navigational watch'
Watchkeeping
3. 'Use of radar and ARPA to maintain safety of navigation'
Radar navigation

(IMO, 1996)

2.3 How to measure competence

2.3.1 The meaning of performance assessment

To enable comparison of performance there must be some kind of reliable method for gathering data. The recording of performance data can be called measurement. It is a way to get a statement of performance against some established scale or rule, usually expressed in a quantitative form. Measurement can be made through several different techniques, for example through written exams or practical testing. Regardless of which technique that is used it is most important that it is systematic, reliable and valid. Assessment can be considered as placing an interpretation on measurement. It is useful for finding out the extent of knowledge, understanding and skills of a student (Muirhead, 1997).

Two common ways of assessment are called 'norm-referenced assessment' and 'criterion-referenced assessment'. Norm-referenced assessment compares the competence of one

individual with others, using the same measuring device. It can be expressed in many ways, for example by putting grades for performance, where each grade includes a percentage of the total number of students. Written tests are commonly norm-referenced. Criterion-referenced assessment relates to objectives. It compares a student's performance with a pre-determined criterion or standard of performance (Muirhead, 1997). The STCW standards represent good example of criterion-referenced assessment for competence (IMO, 1996).

In assessment, there are several factors that can affect the student's result. Obviously the level of knowledge, skills and ability as well as the general level of intelligence will have a major influence. Though, other aspects, for example the interpretation of issues or the student's health, fatigue, motivation and stress levels, may also have an affect on the performance. Another factor that may contribute to the student's score is the subjective judgement of the answers by the examiner. A good way to prevent this is to make an objective and unbiased test by using multiple-choice questions, also called closed questions. This means that the answers are pre-determined, which generates a fixed response. The examiner is, in this way, put in a position to have no influence on the outcome (Muirhead, 1997).

2.3.2 Assessment in a competency based qualification system

The STCW standards of competence can be likened to a competency based qualification system. The foundation for such system is built on the same principals as the British National Vocational Qualifications (NVQs), which was introduced in Great Britain in 1987. The reason for the implementation of the system was the re-evaluation of the definition of occupational competence, mentioned in section 2.1. The objective was to establish a clearly defined single set of standards of competence recognized by all concerned. Achievement of the standards would signal a successful outcome of training. The requirements for competence did not in themselves change due to the implementation, but rather the way the requirements were defined. Instead of focusing on examination syllabuses the attention was directed to the outcome to be achieved and how achievement of the specified outcome was to be measured or assessed (Matthew, 1997).

The NVQs incorporates three key components for competence assessment. These are:

- Skills to defined standards.
- Relevant knowledge and understanding.
- The ability to use skills and to apply knowledge and understanding to the performance of relevant tasks.

(Matthew, 1997).

The ultimate focus for competence evaluation is performance effectiveness. The assessment should be about what people can do. This means it must go beyond just technical skills and knowledge to include planning, problem solving, dealing with unexpected occurrences, teamwork ability and much more. It includes the ability to cope with emergencies and allow for all contingencies that might arise. However, basic knowledge and skills are still very important as providing an underlying foundation for the overall competence (Matthew, 1997).

2.3.3 STCW standards of competence

Maritime qualification and training arrangements have traditionally been based on two

assumptions. Firstly, that adequate experience could be gained simply by requiring candidates for certificates of competency to serve specified periods of time at sea. Secondly, that knowledge and understanding relevant for the tasks could be tested adequately through written exams. Many standards for seafarers are already established in the requirements for the statutory certificates of competency. However, those standards are set by the examination system rather than by reference to the desired outcome of the education and training process. Moreover, the passage of time, in the form of mandatory sea service, is not in itself a valid indicator of competence (Matthew, 1997).

With the traditional way of assessment in mind the STCW-95 was revised to measure the level of competence in a broader perspective. Much in accordance with the NVQs, it states the desired outcome of training explicitly in terms of standards of competence. It is developed to ensure that assessment incorporates the ability to perform to the defined standards and to apply relevant skills and knowledge in practice. The standards are grouped within a framework of seven functions at three levels of responsibility. One of the functions is navigation and the three levels are defined as support, operational and management. As already mentioned, the operational level is used in this thesis (Matthew, 1997).

Competence based standards represent a major change in the approach to evaluating qualifications. One of the key principles behind the 1995 review of the STCW Convention was the clarification of the standards of competence to be achieved. The intention was to ensure that certificates are awarded only to those who have demonstrated competence in accordance with internationally agreed standards (Matthew, 1997).

2.4 The use of multiple choice questions for competence assessment

Typically there are two types of formats used in written examinations, either essay type questions or multiple-choice questions. Essay type questions are often used when an action or series of actions need to be described. This type of question is generally less precise and to a greater extent subject to the subjective judgement by the examiner. The multiple choice questions are limited to pre-determined answers, but can be more precise and are, as mentioned earlier, not affected by subjective judgement in the same extent (Stutman, 1997).

A typical method of competence assessment has for long been the written test or examination. Colleges and examination authorities often use written tests for a wide variety of qualifications (Smith, 1997). As an example the Swedish National Agency for Higher Education offers a national written test to be used as a sorting tool for granting access to university educations (SFS 1993:100, 7 ch, 12, 20 §§). Concerning vocational qualifications it may be appropriate. It is very important though, to realize that competence in itself is not in this way being measured, but rather the knowledge and sometimes techniques that support it. To rely on the result of a written test it is also very important that it is accurately written to reflect the task required (Smith, 1997).

Multiple-choice questions take a lot of effort to create. It is essential that the questions and answering alternatives are accurate and well considered since no excessive interpretation is allowed to be made by the examinee. When developing a multiple choice questionnaire three essential aspects need to be kept in mind to make the questions valid and reliable (Stutman, 1997). These aspects are:

- Consider the level of the examinee and the learning objectives of the examination.
- Keep the questions within the appropriate subject and topic.
- Write the questions in a clear, yet challenging presentation, to avoid revealing the correct answer. At the same time, prevent the examinee from being able to select a response without having to use acquired knowledge.

(Stutman, 1997).

There are two main methods for assembling the questions. Entirely new questions can be created for the specific subject. To compose the questions in accordance with the three aspects mentioned above is challenging. The alternative is to use already developed questions. In this case a bank of questions is required to choose from, so that there can be a variation from prior exams. However, if possible, this method enables the use of already tested questions that may have established validity and reliability (Stutman, 1997).

2.5 The use of simulator studies for competence assessment

If a simulator is used as an examination tool, standardized scenarios are required to enable to put the performance in relation to predetermined criteria and the performance of others (Barnett, 1997). In a simulator based environment the assessment becomes more complex. Compared to a written test or interview, the simulator test includes judgement of initiative, decision-making and teamwork. Here the subjectivity of the examiner may, once again, have a considerable affect on assessment (Singh, 1997). There are several additional issues to consider when committing a simulator-based study, for example the level of fidelity of the simulator. To provide a valid and reliable method of assessment, the simulator must allow a behaviour that would indicate competence on a real ship's bridge. As well the time for familiarization of the simulator bridge equipment may have an influence on the performance of the crew (Barnett, 1997).

2.6 The educational systems

The master mariner programmes in both in the Philippines and in Sweden are based on the STCW Convention (IMO, 2013). The conditions and descriptions below are mainly based on the two universities where the studies took place. Since the convention sets the standards there are many similarities between the curricula at the universities, but as shown in this section there are also differences.

2.6.1 In Sweden

Swedish university educations are state funded for all European citizens, which means that the education itself is free of charge for the students (SFS 1992:1434, 4 ch 4 §). In Sweden there are two universities running the master mariner programme, these are Linnaeus University and Chalmers University of Technology. The education extends over four years, including 12 months of sea service as cadet onboard vessels approved by the authority. The sea service is evenly spread over the four years of education in three to five different periods. There is a requirement that the sea service should be on various types of vessels.

The curriculum consists of about 40 courses. Each course ends with an exam, which commonly consists of a written test, though there are also exams that are oral or simulator based (Chalmers University of Technology, 2008). The programme extends to the management level, which is the STCW's highest level of responsibility. This means the level of responsibility associated with serving as a master or chief mate. It is designed to ensure that all functions within the designated area of responsibility are properly performed (IMO, 1996).

2.6.2 In the Philippines

In the Philippines there are approximately 100 maritime academies of varying quality. The majority of them are privately owned, meaning that the students have to pay for their own education, though there are some exceptions. Successful and promising students have the chance to be sponsored by foreign shipping companies, for example the Norwegian ship owners association (NSA). In 1993 NSA founded The Norwegian training centre (NTC) in Manila. The purpose was to raise the standards of competence among the Philippine seafarers about to serve onboard Norwegian vessels. This was due to Norwegian ship owners complaining on the lack of quality of their Philippine employees. NTC works as a link between the academies and NSA. At present NTC is working with six different academies, which are all considered to be of high quality. One of the academies is the UCLM, where this research took place. The NSA sponsored students do not have to pay for their education. They also get extra education provided by NTC during semester breaks. In return the students sign a contract for future employment onboard NSA vessels ².

At UCLM there are two different ways to reach graduation. The non-sponsored students, referred to as regular students, study three years in school and after that they need 12 months of sea service as cadets. It is usually a big challenge for them to find a vessel where they can complete the cadet time. Unfortunately, many students fail here. Due to this fact, a large number of graduates never get certified. The sponsored students study two years in school, and then they do 12 months of sea service onboard NSA vessels. Usually they stay on the same vessel for the entire time. When the sponsored students finish their sea service they go back to school to complete their last year of theoretical studies ².

All students in the Philippines, whether sponsored or regular, have to pass a compulsory board exam to get their license. The Commission on Higher Education (CHED) administers the board exam, the organisation also approves the curriculums at the academies. The Professional Regulation Commission (PRC), in its turn, supervises CHED and the board exam ³.

A big difference between the Swedish and Philippine educational systems is that in the Philippines the education only extends to STCW's definition of operational level ⁴. This level refers the responsibility associated with serving as officer in charge of a navigational watch. It includes maintaining direct control over the performance of all functions within the designated area of responsibility in accordance with proper procedures under the direction of an individual serving in the management level for that area of responsibility (IMO, 1996).

² Representative from the NTC

³ Representative from Thome Ship Management (TSM)

⁴ Former representative of EMSA at the Swedish Transport agency

2.7 General data and statistics

There is some uncertainty regarding the statistics since conflicting data exists. The information aims to give an approximation about the maritime industry in the two countries.

2.7.1 Sweden

- The country's population is 9,453,000 (Utrikespolitiska institutet, 2011).
- About 12,900 inhabitants are seafarers, constituting 0.1% of the population.
- About 550 seafarers are recruited every year, of these 20-30% become officers.
- There are about 10 maritime schools in the country, of which two educate maritime officers.
- There are approximately 60 students in each class at Chalmers University and 245 registered on the master mariner programme.

(Arbetsförmedlingen, 2012)

2.7.2 The Philippines⁵

- The country's population is 94,852,030 (Utrikespolitiska institutet, 2011).
- About 700,000 inhabitants are seafarers, constituting 0.7% of the population
- About 330,000 seafarers are deployed on foreign flagged ships, contributing with USD 4 billion to the country's total BNP.
- About 40,000 seafarers graduate every year, of these 10-15% become officers.
- There are about 100 maritime schools in the country.
- There are approximately 40 students in each of the regular classes at UCLM and 1,667 students participating in the regular students program.
- There are approximately 25 students in each of the NSA sponsored classes at UCLM and 446 students participating in the sponsored program.

⁵ Representative from the NTC

3. METHODOLOGY

3.1 Introduction

In order to answer the main question both a questionnaire survey and a simulator study were carried out to collect desired data. The questionnaire is in this case equal to a written test and will constitute the main part of this study. In both parts of the study final year students were used. The participants came from the master mariner programme at Chalmers University of Technology in Gothenburg, Sweden and the University of Cebu, Lapu-Lapu and Mindaue (UCLM) in Cebu, the Philippines. In the simulator study there were 14 students participating from Gothenburg and six from Cebu. Before handing out the questionnaire, a pilot research was committed in Sweden to get feedback on the questions, thus enabling evaluation and editing. The questionnaire was handed out to 31 students in Sweden and 61 students in the Philippines.

The background section mentions three terms associated with competence, these are knowledge, understanding and proficiency. They are all connected to the choice of method. In the questionnaire focus is put on knowledge, while understanding and proficiency are demonstrated in the simulator case. Due to practical circumstances the simulator study turned out to be very limited in its validity, more about this is discussed in section 4.2.2.

3.1.1 Ethics

Prior to handing out the questionnaire the respondents were orally informed about the purpose and conditions for the test. In addition to the written instructions on the front page (Appendix 1), further background information was provided, confidentiality assured and the possibility to ask questions offered. Before commencing the simulator study each participant was informed orally about the conditions and asked to sign an approval form for participation. The form clearly stated that confidential handling of the documentation was guaranteed.

3.2 The questionnaire

As already mentioned, the questionnaire constitutes the foundation in this thesis. Its purpose is to measure the possible differences in theoretical knowledge between the students. In order to do this a questionnaire survey is used to provide quantitative data for the research. Numeric data is crucial for a quantitative study (Bryman, 2011). Therefore much effort has been put to formulate questions that give answers that are easy to measure, compile and compare. A big advantage with this choice of method is that it gives possibilities to deal with large number of participants (Robson, 2008).

The results from the survey are presented statistically in the form of diagrams and tables. To measure the significance of the results, a T-test has been performed on the response data. The test is based on two sets of data and their standard deviation. It results in a number expressing the probability that the results depend on coincidence. If the probability is less than 5%, the difference is considered 'real'. The T-test works well for small selections and the groups do not have to be of equal size, which makes it well suited for this survey (Denscombe, 2000). The T-test was performed in Excel, with two-tailed distribution and the two-sample unequal variance.

3.2.1 Development of the questionnaire

The work to put the questionnaire together started in early September, 2012. As mentioned in the background, the following three areas of competence were selected from the STCW Code.

1. 'Plan and conduct a passage and determine position'
Terrestrial and coastal navigation
Electronic systems of position fixing and navigation
2. 'Maintain a safe navigational watch'
Watchkeeping
3. 'Use of radar and ARPA to maintain safety of navigation'
Radar navigation

(IMO, 1996)

Chapter 2 in the STCW Code defines the minimum requirements for an officer keeping a navigational watch. From the three competence areas limitations were made to the following points:

- Terrestrial navigation ¹
- Technical positioning systems ¹
- COLREG – anti collision ²
- COLREG – sound and lights ²
- Safe watchkeeping ²
- Radar limitations ³
- Theory radar ³
- Theory ARPA ³

The superscript figures indicate which of the three competence areas the point corresponds to.

After the selection of subjects, the degree of difficulty was set in accordance with the three aspects, listed in section 2.4. The objective was to formulate the questionnaire at an appropriate level of difficulty, where a potential variable in correct answers could occur. A variable is something that varies; its opposite is a constant (Bryman, 2011). Since the goal was to measure differences, it was very crucial to find a level where possible differences in knowledge were measureable. Making the questions too easy or too hard would not generate a substantial variable. Taking the pilot research into account, the level was established with assistance from teachers at Chalmers University.

To ease the processing of answers and to eliminate the risk of subjective judgement, discussed in the background (section 2.4), closed questions were used. By using closed questions the comparability was also further increased. To help retain the appropriate level of difficulty earlier tests concerning the subject were viewed. Some of the questions used in the questionnaire were derived directly from these tests. The questionnaire consists of 18 questions. In addition an introduction page consisting of general instructions, the purpose of the questionnaire and some initial questions about age, nationality and so forth was added. The complete questionnaire together with the introduction page is provided in Appendix 1.

3.2.2 The pilot research

To perform a pilot research is particularly important when conducting a questionnaire because there is no interviewer present that can deal with ambiguity. At an interview survey the interviewer will early detect problems with the questions and will then have the chance to correct them (Bryman, 2011). To interview every single participating student was not possible for us, therefore a thorough pilot research was conducted. There are some disadvantages with the closed questions used in the questionnaire. For instance the respondents may get frustrated if they do not find an answer that suits them. One way to avoid this problem is to have open questions during the pilot research (Bryman, 2011). Considering this fact open questions were used. The aim was to control the following areas:

- To certify there being a variable in the answers received.
- That questions were clear and could not be misunderstood.
- That accurate instructions for the questionnaire were given.
- That no factual errors in the questions occurred.
- That the time given was enough but not too long.
- If there were other suitable answers than those already stated as alternatives.

To control the areas above the questionnaire was handed to one group of lecturers and one group of newly graduated students. The students who took the pilot test had just graduated, why there was no chance that they could interfere with the selection of students for the upcoming main research. The knowledge level of the students in the pilot test can be considered comparable to the level of those completing the main research, due to the fact that they had completed the exact same education one year in advance. It should in this context be mentioned that there was no chance to complete a pilot research in the Philippines. This lead to a consequent risk that misunderstandings due to cultural differences could arise, more aspects of this are mentioned in the discussion of methodology.

There were three students and four experienced teachers participating in the pilot research. Both the students and the teachers provided good feedback. Some questions had to be clarified and some spelling mistakes corrected. The degree of difficulty seemed to be at an appropriate level. The time for fulfilling the questionnaire was set to 30 minutes. When all corrections were completed, the questionnaire was considered ready to use.

3.2.3 Selection

The selection process may be described as systematic. This selection method is a variant of the unbound random selection, where selecting units from the sampling frame (Bryman, 2011). This means that certain classes were chosen, but which students from each class were beyond our control. In Sweden there are only two universities offering the master mariner programme. For practical and timesaving reasons it was decided to conduct the inquiry only at Chalmers University, where there is only one class for each grade. By the time for conducting the questionnaire there were all in all 57 students registered in the final year class. The goal was to collect answers from as many students as possible in order to raise the reliability. In the Philippines there are, as described in the background, two different ways of education. There are the sponsored classes and the regular classes. Since the knowledge level was probable to differ significantly between the two, one class of each was asked to perform the test. The regular and sponsored classes were chosen randomly in accordance to the systematic selection process.

Low response rates are sources of error, which does not concern the actual selection process, for example as some respondents refuse to cooperate or do not show up to the survey (Bryman, 2011). The students of the sponsored class were all present during the inquiry. In the regular class, as well as the Swedish class, there was a loss of answers. This can be explained by the fact that the inquiry was conducted at one single occasion in order to prevent cheating. In Sweden the questionnaire was handed out on a non-mandatory lesson, meaning that some students were not attending class. However, all the students attending the lesson did answer the questionnaire. Concerning the regulars in Cebu, they were informed about the inquiry quite abruptly, leading to some students missing the information and thereby not attending.

In Sweden answers from 31 students were received, giving a response rate of 54%. In the Philippines all 25 students from the sponsored class answered. In the regular class 36 students participated, giving a response rate of 90%.

3.2.4 Performing the questionnaire

In the end of September 2012, the study was performed at Chalmers University. Access was granted to the last 30 minutes of a lecture in leadership. A short introduction to the purpose of the inquiry was given along with instructions for the questionnaire. We remained present during the entire test to control the process and help if questions arose. All students answered the questionnaire within the 30-minute limit.

In mid-October the study was performed at UCLM (Figure 1). The visit began with an introduction to the school management. Captain Smart, one of the teachers at the university, provided guidance and helped to overcome practical obstacles on the way. After lunch the sponsored students performed the study. Before commencing the inquiry an introduction to the thesis and the reason to our presence was explained. General instructions were given and the participants were encouraged to ask questions if any ambiguities arose. The time given was, like in Sweden, 30 minutes. No questions were asked during this time. The same procedure was then performed with the regular students. In summary the overall performance of the questionnaires proceeded without major mishaps.



Figure 1 – Introducing the questionnaire to the regular students at UCLM.

3.3 The simulator study

The purpose with the simulator study is mainly to serve as a compliment to the questionnaire. It is intended to indicate however the theoretical knowledge reflects the actual performance on the bridge. By bringing forth points of interest from the questionnaire to put in relation to the simulator study the relation between theoretical and practical performance can be discussed, thus improving reliability. Practical skills have previously been defined by the terms understanding and proficiency (section 2.1). In an empirical study, it is valuable to include such skills in order to provide a more complete picture of competence.

The simulator study in Sweden was carried out on the final year officer students at Chalmers University in March 2012. For practical reasons the study was made in conjunction with the examination of the final year students on the scheduled bridge simulator course. During two days 14 cases were recorded and documented. The study was carried out in a Transas Navi Sailor 5000 full mission bridge simulator. The students were at this time on the final days of their theoretical education.

In the Philippines the study was performed in October at UCLM in Cebu. Due to pre-bookings and other practical reasons we were only allowed access during one single day, which limited the amount of students tested to 6. The simulator was a Kongsberg full mission bridge simulator. The students were attending their last year of education at the NSA-sponsored officers' programme.

3.3.1 Preparations

Before commencing the study in Sweden, one day was spent in the simulator to familiarize with the equipment and the standard procedure for the examination run. Discussions were made with the simulator instructors about what to look for and how to evaluate the result in the most efficient way. An observation scheme for evaluating the actions was elaborated according to the three areas of competence mentioned in the background. The original form used can be found in Appendix 1, containing judgement on the main parts of:

- Chart work ¹
How well the route is prepared, accuracy in position etc.
- Compliance with COLREG ²
- Radio communications ²
Channels watched, VTS reports etc.
- Radar preparations ³
Settings used in both radars
- Settings awareness of radar ³
How the two radar screens are set up and integrated to achieve the highest efficiency and safety of navigation
- Activity in radar during navigation ³
How efficient and frequent the equipment is used during the voyage

The superscript figures symbolize which of the three competence areas the point corresponds to.

A quantitative study can reach a higher level of reliability and validity than a qualitative study (Thurén, 2010). Quantitative data is built on figures and presented in diagrams or tables. It allows for little interpretation and is therefore relatively easy to compare (Denscombe, 2000).

The observation scheme was, like the questionnaire, constructed to be easily quantifiable. This was achieved by making each point of judgement limited to a few pre-determined alternatives. Areas of interest not being answerable by these premises were simply disregarded. By making the simulator study result in quantitative data the aim was to make it easily comparable to itself and the results of the questionnaire.

3.3.2 The process of selection

As for the questionnaire survey the goal was to select participants to reflect the average skill level of the final year students. Realizing the potential difference in quality of education, thus difference in competence, between the schools, the selection of students was directed to the same institutions as the questionnaire. Performing a case study it is of great importance to get a representative selection. This may be achieved by consciously cross-selecting people to represent an average of the whole population of study (Denscombe, 2000). For practical reasons it was not possible to go very deep in the selection of participants. This fact made it hard to work out a representative selection by subjective choice. The most convenient way to reflect the average skill level in this case was decided to be by letting chance decide. By including at least 10 students from each class the goal was to reflect the general skill level though, not consciously controlling the selection.

In Sweden the two days for performing the study were selected randomly. The registration of students to perform the test during these days was completely out of our control and knowledge. Thereby the selection is considered to depend completely on chance.

In the Philippines only sponsored students were selected. This was due to the limited access to the simulator. In consultation with the school administrator the students were randomly selected from a list of a sponsored class. To be noted is that the same students were attending the questionnaire the day before. However, it is doubtful if this had any affect on the study.

3.3.3 Performing the test

The methodology used to perform the simulator study can be defined as systematic observation. This type of study is built on direct observations of an event or series of events and commonly related to quantitative data and static analyses. By using an observation scheme it enables systematic and thorough recording of the data. Performing a systematic observation it is of great importance that the conditions are equal in all cases (Denscombe, 2000). The goal was to perform the test under the most equal conditions possible to create a fair ground of assessment. However, due to several circumstances the conditions turned out to differ quite a lot between the countries. The reason for this is described further in the discussion of the methodology.

As mentioned before the bridge simulator examination case in Sweden was used to carry out the study at Chalmers University. This was a case already prepared by the instructors of the course, still quite appropriate for the purpose of the study. The original thought with the case as part of the course was to test whether the students were able to handle a watch on their own under normal conditions. This meant testing the students on an operational level, in conformity with our goal. An important aspect was that the students were alone on the bridge, enabling data recording not coloured by the aspect of cooperation. From the conditions in the case the observation scheme was used to keep record of each of the participating students. After finishing each run a short discussion was held to complete the points of judgement and

carry out a simple self-assessment. Log files from the radar screens, conning display and CCTV, along with documentation and pictures of the paper charts were saved for future assessment.

For quite a while the conditions and possibility to perform the same test in the Philippines were unclear. The NTC was contacted to sort out the possibilities on site. The original thought was to copy the case file from the simulator in Sweden and bring it to the Philippines where the exact same case could be run. This required access to a simulator of the same brand having the same chart area installed. The response from the NTC was that a Transas Navi Sailor 4000 was accessible at one of the academies, though the sea area used for the case was not available. With support from the Swedish simulator instructor discussions were held and preparations made for how to create a similar scenario in another sea area, realizing the circumstance would decrease validity of the study.

After further discussions with the NTC on site the main part of the research was dedicated to UCLM in Cebu. The simulator in this academy was not a Transas, but a Kongsberg. However, this was considered to have little affect on the study, since the original case was not transferrable anyway and it was said to be a full mission simulator of equal standard.

Arriving at the academy the simulator study was planned for the second day of visit. A short introduction was made in the afternoon of the first day. By this time it turned out that the simulator was equipped with only one radar, a fact of great consequence to the assessment.

On the second day the study was performed as agreed. The possibility of familiarizing with the equipment was limited since the participating students were booked from early morning. To shorten the preparation work an already prepared case from the academy was used for the assessment. During the quick preparation it turned out that the radio communication between the bridge and the operator's station was malfunctioning. The problem was tried to be solved during the first runs, unfortunately with no success.

Disregarding the differing conditions of sea area, simulator type and equipment available, the case was as far as possible adapted to the original case from the simulator course in Sweden. The students were initially left alone on the bridge to prepare the paper chart and setup the bridge equipment, all in accordance with the case instructions from Sweden. As the simulation started records were made according to the observation scheme, though lacking the aspect of using two radars.

In the Kongsberg simulator it was not possible to save logged files, meaning the data recorded was limited to our ability of assessing the performance while simultaneously and gradually familiarizing with the equipment and operator's controls of the simulator. Support was given from the simulator instructors when present, but the main responsibility of controlling the simulator was put on us (Figure 2). The limitations of the equipment and short time for preparation made it difficult to assess the students on an equal and fair basis. Despite this, notes and photos were taken during the day and collected together with the observation schemes for further assessment.



Figure 2 – Overlooking the progress of the simulator scenario at UCLM.

4. DISCUSSION OF METHODOLOGY

4.1 The questionnaire

The choice of method for testing knowledge stood between using a questionnaire and performing interviews. Several factors contributed to the choice. The interview may seem confidence inspiring and effective. However, there is research made showing the opposite, that the interview is hard to handle, has many deficiencies and in addition can be relatively expensive. It needs to be very well structured to provide good and reliable information. From a question perspective a well-structured interview differs little from a traditional test, though the interview allows for an interaction that may be requested in some cases (Sjöstrand, 2009). Considering the possibilities of developing the assessment form, and the data desired for the research, a questionnaire survey seemed most appropriate.

A quantitative study can reach higher level of reliability and validity (Thurén, 2010). This fact was a clear advantage for the research. A qualitative study could raise other aspects of interest, but limited resources and a tight timeframe contributed to our choice. It was desirable to test a considerable amount of students to reach a response rate representing the general level of knowledge. On this point, the quantitative method was most appropriate, consequently further promoting the choice of the questionnaire. The fact that written tests constitute a proven and commonly used method for assessment was also considered. Chalmers University itself commonly uses written exams to certify students for sea service ⁶. Being a recognized, method it was quite obvious that using a written test was acceptable in this case. Even if not necessarily best practice, that assessment approach served the purposes of this research. With easy access to prior exams it was convenient to find frames and guidance to develop reliable and valid questions.

Another important factor for using quantified facts was to make the comparability to the simulator study easier. The three areas of competence were chosen considering the limitations of data recording possibilities in the simulators. This directed the questions in the questionnaire to the points of view listed in section 2.2.1.

In the Philippines the questionnaire was handed to both a regular class and a sponsored class. The majority of master mariner students are regulars ⁷. However, ships from the northern countries commonly have sponsored students, since the NTC is providing seafarers to the Norwegian shipping companies. With this in mind, it was considered of great importance to assess the sponsored students as well, though they contribute only a very small part of the maritime officer students in the Philippines.

Some of the questions had a very high percentage of wrong answers, likely due to the fact that the instructions of how to correctly fill out the answers were misunderstood or neglected. For example, some of the respondents ticked two boxes even though the instructions clearly stated that only one box should be ticked. This fact may, in its turn, contribute to reduced validity. The answers received from the Philippine students were on this point overrepresented. The fact that no pilot research was done in the Philippines may have contributed to this fact. Had a pilot research been conducted, and the instructions adjusted or questions rephrased, these misunderstandings could have been addressed.

⁶ Representative from Chalmers University

⁷ Representative from the NTC

4.2 The simulator study

4.2.1 Choice of methodology

In a qualitative study focus is put on single events, where small details can be dedicated relatively large attention (Thurén, 2010). A qualitative study includes an interest for behaviour patterns and the way individuals interpret situations (Denscombe, 2000). In the case of this study it was apparent that a large amount of factors outside of the framework for the assessment would affect the performance of the students. Such factors could, as stated by Muirhead (1997) in section 2.3.1, be the aspect of mental preparedness, ability to deal with stress, experience to work alone on the bridge. These are all angles of approach that may be more appropriate for a qualitative study. However, they may very well be of interest for competence area. Considering the time available, as well as the need to make the data easily comparable to the results of the questionnaire, it was however not an option to include in this research. To limit the number of aspects and produce straight comparable data, a quantitative approach was needed.

The systematic observation is good for gathering direct data effectively. The reliability is generally high when performed in the right way. It excludes the aspect of intentions and measures only the actual performance. A disadvantage may be the simplifying affect risking to leave important aspects at the side (Denscombe, 2000). In the case of this study a simplifying method was desirable. Being aware of its disadvantages, a systematic observation was considered to be the most appropriate methodology. To this the observation scheme constituted a framework, limiting the study to the area of most relevance.

To summarize the choice of methodology, as described previously, the study was assessed to gain quantitative data for putting in relation to the questionnaire. A wider aspect may be interesting but not applicable in this case.

4.2.2 Complications in reaching validity

There are several conditions in the simulator study that in varying rate affects the validity and reliability of the results. Many of these circumstances have been beyond our control. To declare the all in all affect on the study the important factors are listed below:

- For practical reasons, such as very limited availability to the full mission bridge simulator, the survey in Sweden had to be done as early as in March 2012. This was before the actual preparation for the research had been done. The project was in a state of spawning and general discussion. To make up for the impossibility of proper preparation, as much data as possible was gathered during the simulator runs. Questions were asked and notes were taken just in case, to be evaluated and put in context later on. This introduction of the research was a must to enable the study at all, though resulting in a wide and non-scientific basis of data.
- The recording possibility in the Transas simulator did not allow logging the ECDIS data file. Even though not being recordable, the system may have an affect on the usage of the radars, since the two systems are integrated and can be used separately or in conjunction, for example by using radar overlay in the ECDIS screen. Integrating the two systems, the intention and setup planning may differ between users, as long as

the systems together fulfil the safety demands. The limitations in recording of the ECDIS lead to a source of error where the overall safety of navigation was not possible to properly assess.

- The navigational area used in Sweden was not possible to transfer to the Philippines. This meant quite a lot to the validity of the research, since it disturbed the common conditions needed to make a fully fair comparison.
- Two different brands of simulators were used at the two academies. In Sweden a Transas simulator was used, while in the Philippines a Kongsberg simulator was used (Figure 3). Initially this was not considered a problem as long as similar equipment was available. The limitation in radar equipment was upon arrival unknown. Having put a lot of focus on the radar configuration and effective integration of two radars in the observation scheme, lack of double radar equipment seriously affected the validity of the study. Furthermore there were no possibilities of using integration functions like radar overlay, which successfully could be used in the Transas simulator in Sweden.
- The radio equipment in the Kongsberg simulator was not working properly between the bridge and operator's station. A temporary solution was to communicate directly through an open window to the bridge. It should also be noted that there were no reporting points or other obstacles in the sea area requiring radio communication.

Limitations disregarding practical reasons

- In Sweden the students were well prepared for the case. They were several days in advance introduced to the instructions for the examination including demands on knowledge and preparation. This was not the case at UCLM, where the students were picked out the day before the study was conducted. They were introduced to the case as it was being performed. This difference in preparation could most likely affect the performance.
- The time for familiarization of the bridge equipment was unequal between the groups. A part of the bridge simulator course in Sweden is dedicated to bridge familiarisation while the Philippine students had no such preparatory opportunity. According to Barnett (1997) this may very well have an influence on the performance.
- At UCLM the case was slightly modified between the runs. This was necessary to gain data on all three areas of assessment. However, it did further intrude on the common and fair foundation of assessment.
- It was not possible to log the files of the equipment on the Kongsberg simulator, thus leading to limited access to data in a later state of the research.
- At UCLM only 6 persons were tested. To gain good reliability the plan was to study at least 10 students from each academy.

4.2.3 The simulator study as contribution to the research

Considering the factors mentioned above, it is obvious that using the simulator study as a significant contribution the results is not possible. The sources of error were during the process of research building up and working against a scientific approach of the subject. As mentioned in the background the measurement of such study must be systematic, reliable and valid. This was not the case. Since several of the basic principles for carrying out an observation study were affected during the process, this part of the research cannot be considered scientifically valid. The desired result of the study was not reached, and it will therefore not constitute an extensive part of the results.

Though not contributing as planned, many observations and conclusions were made during the time spent in the simulators. All students answered the same questions and performed the self-assessment. The initial intention was to support the results of the questionnaire with reliable quantitative data. This goal cannot be fulfilled. As an outcome of the circumstances described earlier, the data included in the results (section 5.2), will be limited to points of subjective judgement. However, the study may still be able to emphasize varieties derived from the questionnaire by these general observations. In this case it must be clearly stated that the arguments are build on subjective judgement and are not scientifically established.



Figure 3 – The simulators. To the left is the simulator used at the University of Cebu and to the right the one used at Chalmers University.

5. RESULTS

The presentation of the results is made to be as objective and transparent as possible. The data is presented in tables and in charts with related notes. The questionnaire data is divided into three sections, first the '*total score*', followed by '*results per area of competence*' and ending with '*questions of specific interest*'. The last section of the results includes the observations from the simulator study.

In the results section the Swedish students are referred to as 'Swedish', the Philippine sponsored students as 'sponsored' and the Philippine regular students as 'regular'. The colours blue, red and green are throughout representing the same group of students.

5.1 The questionnaire

The results are presented in points and percentage of the average score, leaving the option to the reader what information to use. It is throughout the section clearly stated what kind of data that is presented. Furthermore both mean and median score is presented to give an idea of their relation to each other and to give the opportunity for the reader to use either data.

5.1.1 Total score

The total score is presented with related data in Table 1 and visualized in diagram form in Figure 4. Table 2 emphasizes the total score difference. The maximum score is **53 points**.

Table 1 – General data for the total score

Group of participants	Total number of participants	Mean score value	Median score value	Standard deviation
<i>Swedish</i>	31	38.16	38	5.51
<i>Sponsored</i>	25	35.20	36	5.77
<i>Regular</i>	36	28.67	29	3.96

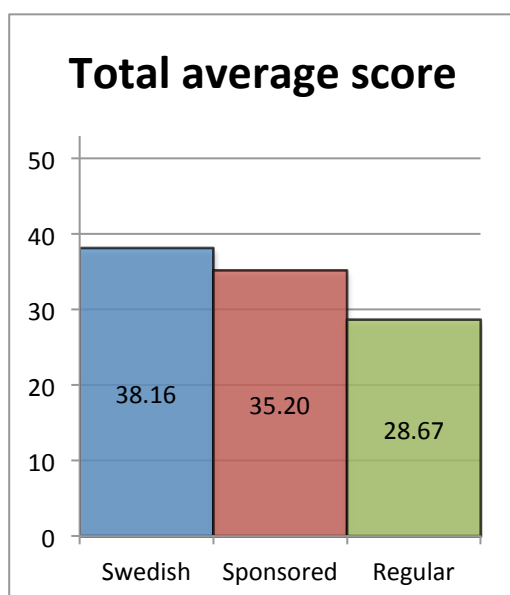


Figure 4 – Total average score. Values are derived from the mean score in Table 1.

Table 2 – Total score difference

X	Swedish	Sponsored	Regular
Swedish	X	5.6 (PPT)	17.9 (PPT)
Sponsored	2.96 (AS)	X	12.3 (PPT)
Regular	9.49 (AS)	6.35 (AS)	X

The difference is presented in average score (AS) and in percentage points (PPT). The difference is put in relation to Figure 4.

Distribution of the score

Figure 5 presents the average score in percentage of the maximum score of each part. By comparing the relation between the three staples of each group of students the distribution of the total score difference (Table 2) is indicated. Comparisons of the three groups within each area of competence show how the relative achievement of that area is visualized.

As shown in Figure 5, the results are generally lower on the terrestrial and coastal navigation part. The Swedish and sponsored students are in all three parts fairly equal in relation to each other. The most remarkable result is the regular students' score on the terrestrial and coastal navigation part, which is significantly lower than for the other two groups.

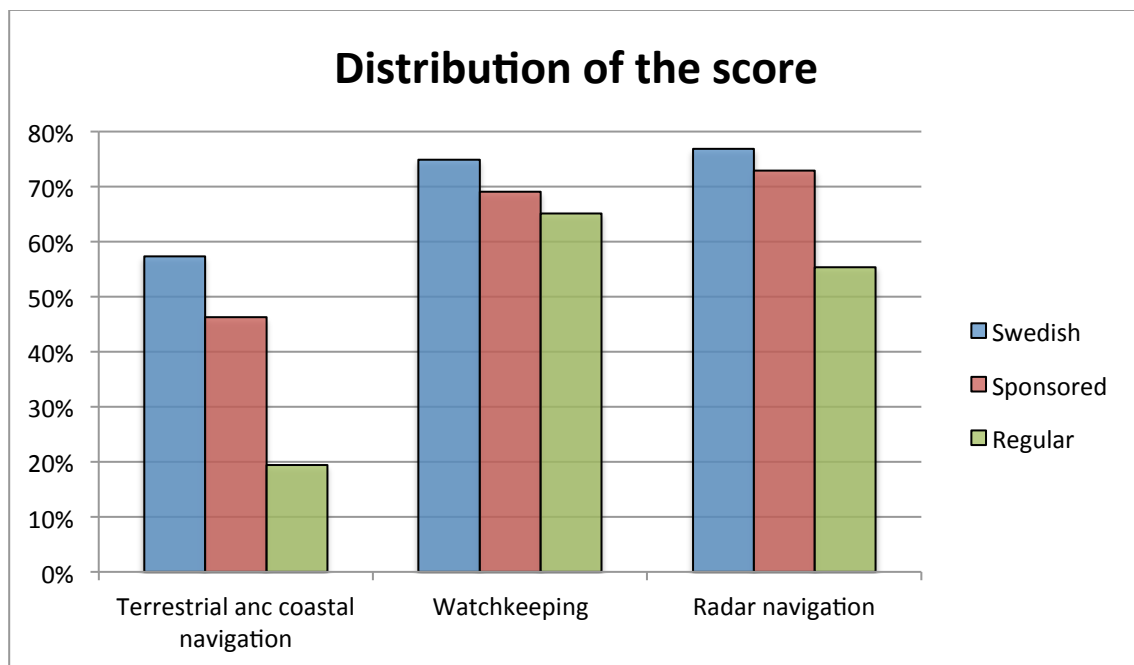


Figure 5 – Distribution of the score.

Significance of the results

The significance of the results has been verified with a T-test. The following values indicate the probability that the differences in total average score between the students depend on coincidence.

Swedish/Sponsored.....**5.7%**
Swedish/Regulars.....**0.0000000011%**
Regulars/Sponsored.....**0.000016%**

A result can be considered real and not depending on coincidence when below 5%. (Denscombe, 2000). The results of the Swedish/regular and regular/sponsored groups are well below the limit and their relation can therefore be considered reliable. The relation between the Swedish and sponsored students shows just over the 5% limit. What this means will be further analysed in the result discussion (section 6.1).

5.1.2 Results per area of competence

The results below are categorized after the three selected STCW standards of competence, described in the background (2.2.1). The heading of each area corresponds to the headings in the questionnaire (Annex 1), which in its turn represents each of the three STCW standards.

The results are for each competence area presented in a chart for each group of students. In addition, a Table presents general statistics per area. The general statistics include mean score, median score (med. score), standard deviation (SD) and maximum score (MS).

The purpose with this section is to show the average score per area of competence. It also aims to visualize the distribution of the results within each group for each area of competence.

The maximum score per part is:

Terrestrial and coastal navigation.....9 points.

Watchkeeping.....27 points.

Radar navigation.....17 points.

Results from 'terrestrial and coastal navigation'

Table 3 shows the general data, where the standard deviation is connected to the spread of the score visualized in Figure 6. The figure shows the percentage of students in each group who got a specific score. Each diagram reflects the distribution of the score within the group.

Table 3 – General statistics part one

	Mean score	Mean score (%)	Med. score	Med. score (%)	SD	MS
Swedish	5.16	57.4%	5	55.6%	1.13	9
Sponsored	4.16	46.2%	4	44.4%	1.57	
Regular	1.75	19.4%	2	22.2%	0.90	

In Figure 6 it is apparent that the regulars have a more unified result, while the sponsored students represent the most spread score distribution. However, no result is significantly distinguishable from the rest in any of the groups.

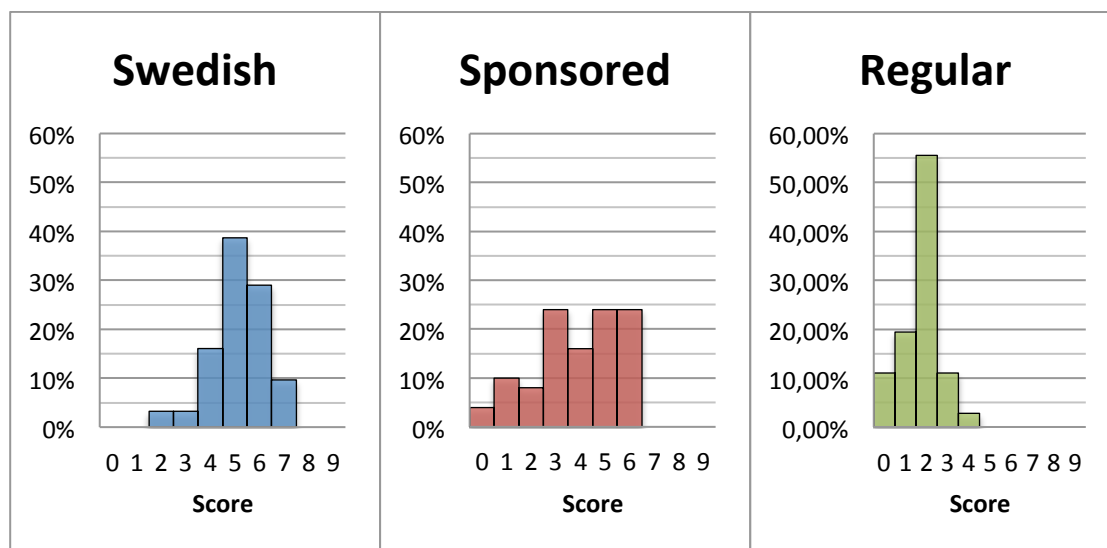


Figure 6 – Results from 'terrestrial and coastal navigation'.

Results from 'watchkeeping'

Table 4 shows the general data where the standard deviation is connected to the spread of the score visualized in Figure 7. The figure shows the percentage of students in each group who got a specific score. Each diagram reflects the distribution of the score within the group.

Table 4 – General statistics part two

	Mean score	Mean score (%)	Med. score	Med. score (%)	SD	MS
Swedish	20.23	74.9%	21	77.8%	4.36	27
Sponsored	18.64	69.0%	19	70.4%	2.75	
Regular	17.58	65.1%	18	66.7%	3.10	

Figure 7 shows that the distribution of the score is clearly most spread among the Swedish students. Both the Swedish and regular students show some values that are significantly lower than the mean score, while the sponsored students' results are more gathered.

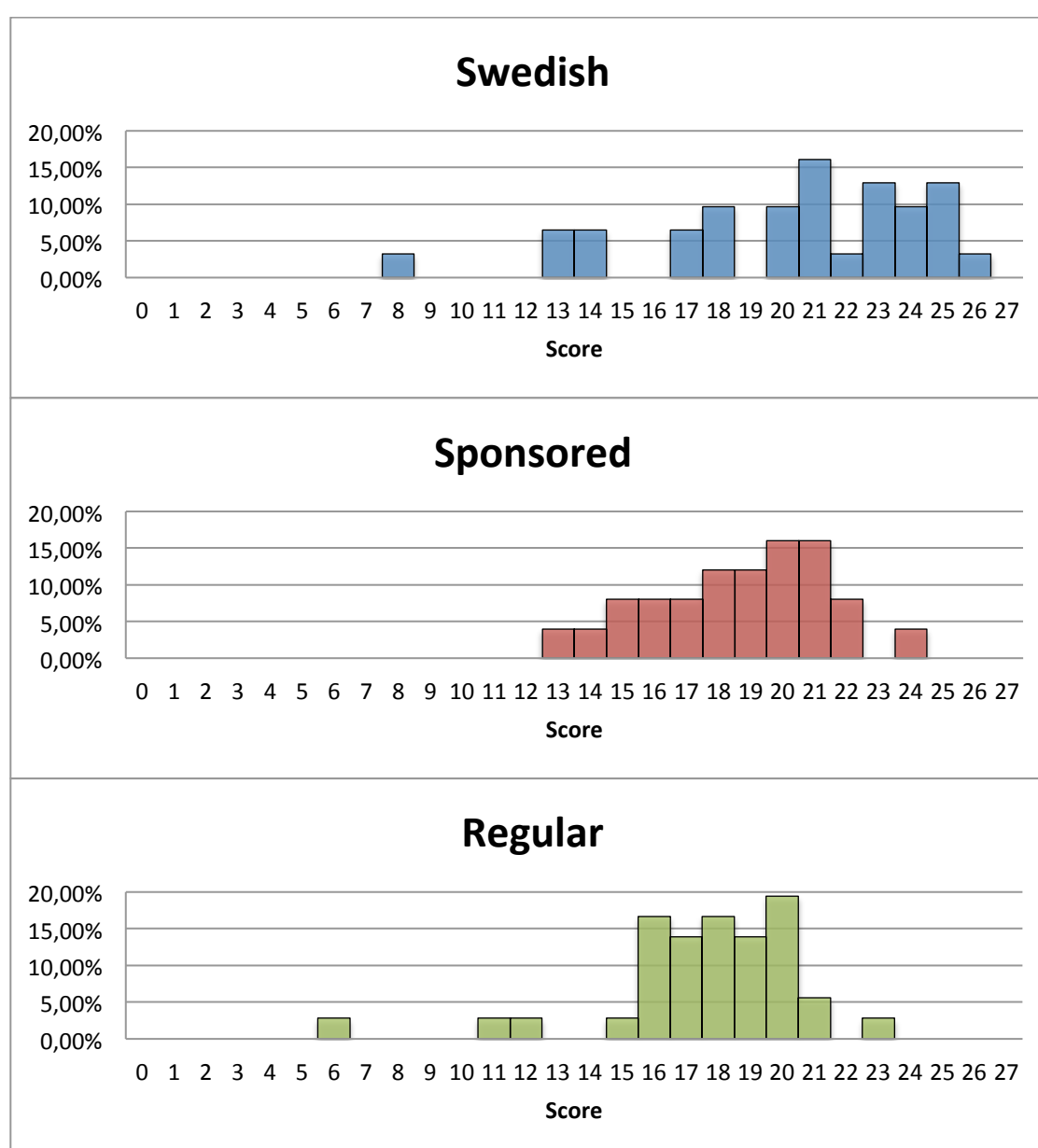


Figure 7 – Results from 'watchkeeping'.

Results from 'radar navigation'

Table 5 shows the general data where the standard deviation is connected to the spread of the score visualized in Figure 8. The figure shows the percentage of students in each group who got a specific score. Each diagram reflects the distribution of the score within the group.

Table 5 – General statistics part three

	Mean score	Mean score (%)	Med. score	Med. score (%)	SD	MS
Swedish	13.06	76.9%	14	82.4%	2.50	17
Sponsored	12.40	72.9%	13	76.5%	2.57	
Regular	9.42	55.4%	10	58.8%	2.37	

Figure 8 shows that the spread of the results are not substantially remarkable for any group and they all stretch over a similar score range. However, the Swedish and sponsored group show some distinguishably low results relative to the mean scores.

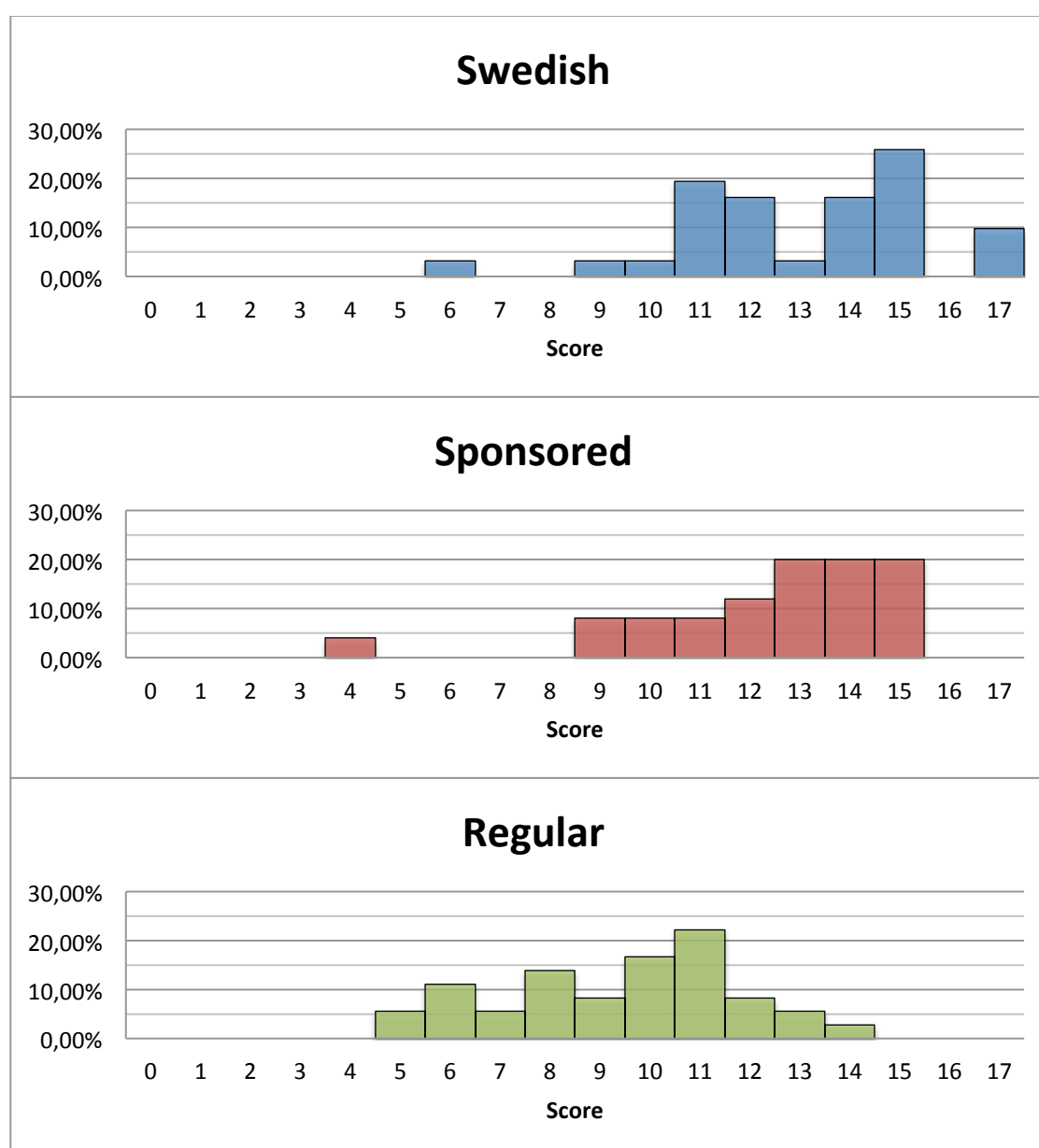


Figure 8 – Results from 'radar navigation'.


5.1.3 Questions of specific interest

Question 1 under 'watchkeeping'

1. The two vessels in each of the two cases are a distance of 4 M from each other, therefore they are able to take action in good time. In the first case ("good visibility") they are proceeding at full speed, in the second case ("restricted visibility") they have already reduced speed. Please mark the most appropriate action for each vessel in these two cases.

Own ship is marked with a white dot!


a) Good visibility



Own ship Other ship

<input checked="" type="checkbox"/>	Alter course to starboard	<input type="checkbox"/>
<input type="checkbox"/>	Alter course to port	<input type="checkbox"/>
<input type="checkbox"/>	Reduce speed	<input type="checkbox"/>
<input type="checkbox"/>	Stop	<input type="checkbox"/>
<input type="checkbox"/>	Maintain course and speed	<input checked="" type="checkbox"/>

b) Restricted visibility



Own ship Other ship

<input checked="" type="checkbox"/>	Alter course to starboard	<input checked="" type="checkbox"/>
<input type="checkbox"/>	Alter course to port	<input type="checkbox"/>
<input type="checkbox"/>	Reduce speed	<input type="checkbox"/>
<input type="checkbox"/>	Stop	<input type="checkbox"/>
<input type="checkbox"/>	Maintain course and speed	<input type="checkbox"/>

Figure 9 – Question 1 from the questionnaire. Correct answers are marked with orange.

Figure 10 shows the percentage of correct answers on the question (Figure 9) and the contribution to the total result from each of the two parts. The question has been selected since the results differ significantly, especially on part b.

An important fact affecting the results of this question is that the sponsored and regular students have ticked more than one answer for each vessel in the case resulting in failure according to the correction frame. This fact is further analysed in the discussion of results.

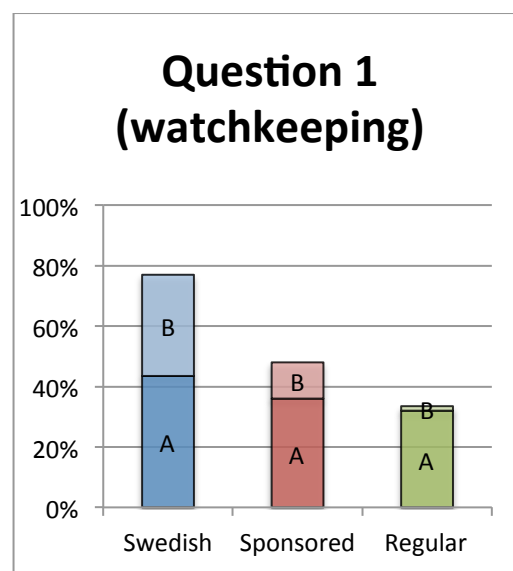


Figure 10 – Score question 1. See Annex 1.

Question 5b under 'watchkeeping'

5. The four cases below (1-4) represent four different vessel light combinations. Please put a cross in the correct box for each case at each statement. Each statement should result in four crosses.

○ White light
● Yellow light
● Red light
● Green light

Case 1

Case 2

Case 3

Case 4

Statement A		Case nr				Statement B		Case nr			
Navigational status of vessel		1	2	3	4	Making way through water		1	2	3	4
Pilot vessel						Yes					
Power-driven vessel						No					
Sailing vessel						Not evident					
Vessel constrained by her draught											
Vessel engaged in fishing (not trawling)											
Vessel restricted in her ability to manoeuvre											
Vessel engaged in towing operation											
Vessel engaged in trawling											
vessel not under command											

Statement C		Case nr				Statement D		Case nr			
Side shown		1	2	3	4	Sound signal in restricted visibility		1	2	3	4
Starboard						D (– •)					
Port						T (–)/M (–)					
Straight forward											
Straight aft											
Not evident											

Figure 11 – Question 5b from the questionnaire. Correct answers are marked with orange.

Figure 12 shows the percentage of correct answers per case of the question (Figure 11) and per group of students. The question has been selected since it shows a major difference in the results of case 2 and 3.

A remarkable pattern is that the sponsored and regular students frequently have ticked 'yes' in all four cases. The result is further analysed in the discussion of results.

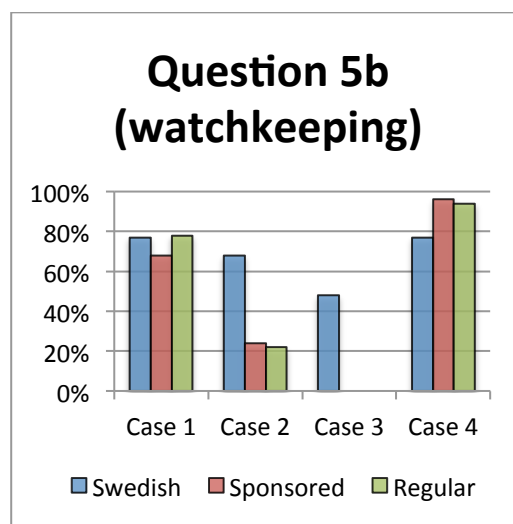


Figure 12 – Score question 5b. See Annex 1.

Question 4 under 'radar navigation'

4. What speed data shall be supplied to the ARPA for anti-collision purpose?

☒ Speed through water

☐ Speed over ground

Figure 13 – Question 4 from the questionnaire. The correct answer is marked with orange.

Figure 14 shows the percentage of correct answers of the question (Figure 13). It is selected since the results differ remarkably.

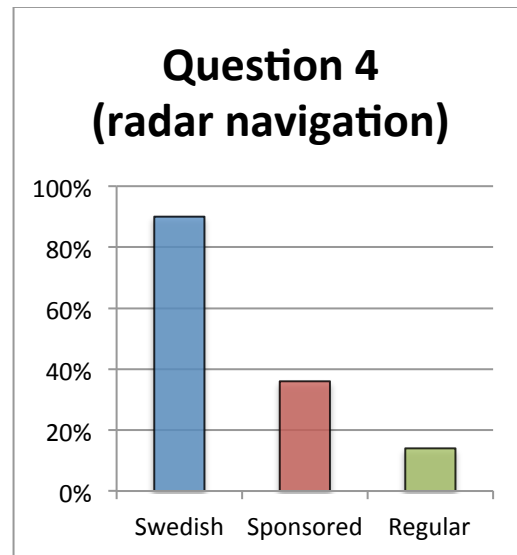


Figure 14 – Score question 4. See Annex 1.

5.2 The simulator study

The results from the simulator study are, as mentioned in the discussion of the methodology (section 4.2.3), built merely on own observations and conclusions. This limits the data to subjective and not scientific statements.

The results are built on 14 observed cases in Sweden and 6 observed cases of sponsored students in the Philippines.

The evaluation form used for the study can be found in Appendix 2. Since not all points of the form were measurable each time, all aspects included therein will not be considered in the results.

The low number of participants makes it hard to tell if the following statements are relatable to reality or more depending on coincidence. Please be aware of this fact and note the statements made in the methodology section when reading the following statements.

- No major deviation from the standard procedures in preparing and carrying out a navigational watch was noticed.
- Among the Philippine sponsored students the knowledge level of the radar and its settings seemed slightly more varying than among the Swedish. Also, the routine of how to use the radar differed to a greater extent.
- In Sweden the setup and usage of the bridge equipment was fairly equal among the students.
- No student in any of the groups made any major mistakes or was unable to manage the exercise.

6. DISCUSSION OF RESULTS

Competence assessment and the STCW Convention as a guide to verification of maritime competence have been discussed in section 2.3.3. An important issue to discuss for the validity of the entire result is the adequacy of using the Convention as a main guide to competence assessment. As mentioned in the background (section 2.3.3), one of the key principles of the 1995 review was to clarify the standards of competence to be achieved, thus working against a competency based qualification system (Matthew, 1997). As this system is built on a broader perspective of the term competence, it is likely to be more up-to-date with the modern opinion as well. Therefore, the standards in the STCW Code seem appropriate to use as a main guide in the case of this study.

An aspect not treated in this thesis at all is the social and cooperative part of competence. As the study is built entirely on testing and observations of individuals acting alone, an extensive area included in the competence definition is excluded. Barnett (1997) mentions teamwork ability as one important factor to observe when assessing overall competence. It is easy to realize that the assessment would be a lot more complicated and the study more complex if this aspect was taken into account. Nonetheless, it is part of the STCW competence requirements and has been dedicated even more focus in the Manila amendments (IMO, 2013). Using the results of this thesis as an indicator of competence it is a good idea to consider this fact. A person performing well on a written test or alone on the bridge may not automatically be the best asset with respect to a holistic assessment of bridge team cooperation. On this point completely different factors, to include cultural background, communication abilities and other personal qualities, are likely as important as the basic knowledge and skills to create a safe and effective work environment.

The limitation of the results to represent the entire two countries is mentioned under delimitations (section 1.4). The varying quality of the maritime educations in the Philippines is important to bear in mind. The UCLM is one out of six institutions in the Philippines selected by the NTC for keeping a high standard, it is therefore very likely that the results reflect the better part of the country's maritime educations.

6.1 The knowledge level and its relation to the educational system

In the background section the limits of written exams as a tool for competence assessment are called to attention. Smith (1997) states that a written test cannot be considered to measure competence, but rather the knowledge and sometimes techniques that support it. Considering this fact it is clear that the results of the questionnaire cannot be said to reveal the students' total competence level. It is however stated as well, that basic knowledge demonstrated through written tests, is an important underlying foundation to the overall competence (Matthew, 1997). Such test must be accurately constructed and reflect the task required to be considered valid and reliable (Smith, 1997). On this point the questionnaire used in this thesis is, regardless of mentioned limitations, likely to meet the expectations. This argument is built on the support of a thorough preparation work using already applied and confirmed questions as a base. Criterion referenced assessment has been used in accordance with the STCW Convention and the three aspect points for multiple choice questions stated in the background (section 2.4) have been taken into close account. With this said, the results from the questionnaire are most likely a reliable indicator of knowledge, but may not be considered to cover the complete definition of competence.

A main source for the total score difference is likely connected to the diverse educational systems. Due to limited time and resources the educational systems have not been thoroughly investigated which sometimes prevents a deeper discussion, though some conclusions can still be analysed.

As shown in Figure 5, the results are in general lower on the terrestrial and coastal navigation part. The fact that all three groups of students have achieved a relatively low score could indicate that the difficulty of the questions is higher on this part. Another aspect is simply that the knowledge level here is generally lower. Both in Sweden and the Philippines greater emphasis is put on terrestrial navigation in the beginning of the education according to the curricula. The reason for this is probably that the knowledge is needed as a base for future courses. However some parts may not be very emphasized later in the education, thus running a risk of being hard to recall.

The results show that there is a difference in theoretical knowledge between the students. The largest difference is noted between the Swedish and the regulars with a 17.9 PPT advantage to the Swedish students. The Swedish and sponsored students have performed fairly equally within all three areas of competence. The Swedish students have scores slightly higher throughout. The regular students are not far away on the watchkeeping part, but deviate more on the other two. Most noticeable is the regulars' score on the terrestrial and coastal navigation, which is significantly lower than for the other two groups. The reason for this is hard to determine. In relation to the sponsored students a contributing cause could be the extra education provided by NTC during semester breaks, which brings more repetition of previous knowledge. The generally lower score for the regular students could also be connected to the fact that they do not get any onboard training until the theoretical studies are finished. Mathew (1997) states that passage of time in the form of mandatory sea service not in itself is a valid indicator of competence. Regardless it does most certainly provide an opportunity to consolidate knowledge and does probably have some positive affect on the knowledge and competence as well.

In addition, the size of the classes may also affect the results, especially when put in relation to available teachers and training facilities. At UCLM there are two simulator bridges to share between the 2113 maritime students⁸. At Chalmers University eight simulator bridges are available for the 245 students⁹. The Swedish class is the largest, but the facilities and teacher availability allow for smaller groups when performing practical exercises. The teacher distribution and time spent in the simulator at UCLM is not known, however the facilities reasonably do limit the access to simulator based training. Furthermore the regular classes are almost double the size of the sponsored classes. These facts are likely to affect individual attention and learning possibilities thus the progress of learning.

Comparing the two Philippine groups the sponsored students have undergone series of tests including intelligence evaluations before getting approved for sponsorship¹⁰. Muirhead (1997) mentions that many factors will affect the student's result, obviously the level of knowledge but also general intelligence and the student's health, motivation and stress level. It is possible that the sponsored students generally possess a higher initial intelligence and that this in its turn contributes to a better result. The possibility for the sponsored students to obtain employment after graduation is also greater than for the regular students¹⁰. This could possibly increase the motivation level during the education, which would likely have a positive effect on results.

⁸ Representative for the NTC at UCLM

⁹ Representative for Chalmers University

¹⁰ Representative for the NTC

As mentioned in the background (section 2.6), a difference in the level to which the education extents exists. The Philippine students follow the STCW's standards for the operational level while in Sweden the education extends to the management level¹¹. This fact was however taken into account when the questionnaire was developed as it was consequently designed to follow the requirements of the operational level. Therefore it is not likely that this difference will affect the results but it can also not be disregarded.

A deficiency in the execution of the questionnaire is the lack of a pilot research in the Philippines. How this has affected the results is an interesting question that is not easily answered. A lot of work was spent to prevent misinterpretation of the questions, despite that there are some answers pointing at this possibility. A frequent mistake is that several answers were ticked where only one was requested. The Philippine students stand for the majority of responses rejected due to this fact. The misinterpretations would likely have decreased to some extent if a pilot research had been conducted in the Philippines as well. It is very hard though, to estimate what affect a pilot research in the Philippines would have had on the results.

The T-test shows two values well under the 5% limit and one that is slightly over. The differences between the Swedish/regular and the regular/sponsored students were shown to be clearly significant. The value between the Swedish and sponsored students is 5.7%, which is just above the limit. Strictly speaking this means that the difference cannot be considered beyond the risk of coincidence in accordance to the scientific limit (Denscombe, 1998). However, since the value is very close to 5%, it is, most likely to be significant as well, even though the value is considerably higher than for the other two comparisons.

Looking at the results per area of competence it is hard to make a deeper analyse due to the limited knowledge about the school systems. The mean score distribution has already been discussed and is once again displayed in the tables of each area. The standard deviation stands in relation to the charts showing the distribution of the scores for each group of students and each part. The score distribution shows that the different groups' marks deviate more depending on which part is examined. A thought is that the spread of results could be connected to the schools' ability to follow up and gather the knowledge of the students. A very spread result could mean that the students' progress depends more on their own ambition and initiative than on the school's control methods for ensuring the knowledge level. In connection to this should be considered the common way of using written tests for certifying competence. This method may be efficient, but is also criticized for often setting the standards by the examination system rather than by reference to the desired outcome of the education and training process (Matthew, 1997). However, it is, as mentioned, difficult to make any related conclusions without a deeper knowledge about the school systems. Also, no group tested deviates substantially in all three areas. Seeing no consistent pattern it is even harder to connect the results to the discussed subject.

There are some scores sticking out from the main part, in particular on the lower side. If the same student performs badly on all three parts or if different student stand for the lower results is not covered in the research. Muirhead (1997) mentions motivation as an affecting factor on the result. Looking at the extreme values it should not be excluded that the student may have put less effort on fulfilling the questionnaire, thus achieving a significantly lower score. In this case the result rather reflects the ambition of the student than the actual knowledge level.

¹¹ Former representative for EMSA at the Swedish Transport Agency

6.1.1 Questions of specific interest

Looking at the three questions of specific interest it is relatively hard to analyse the results in relation to the educational systems. The main reason for this is once again that a deeper study of the two educations has not been performed, leading to several parameters of possible interest not being covered. The discussion is built on the data presented in the description of the educational systems (section 2.6). A more thorough study of the course distribution, pedagogics, study routines, etcetera would be of great interest but was not possible to fit in this research. Due to this fact the discussion becomes a bit vague.

An interesting aspect is whether the questions have been poorly formulated thus hard to interpret, or if the results depends merely on differing knowledge levels. As already discussed the pilot research was performed only in Sweden. Realizing that possible interpretation complications among the Philippine students have not been tested, it is hard to tell if the results are reflecting pure knowledge level or if validity has been decreased. However a thorough work was put down to prevent misinterpretation, not only by performing the pilot research, but also by analysing the questions linguistically and theoretically in close collaboration with teachers specialized in language and the subjects of interest. In addition the introduction to the questionnaire clearly states the conditions for the test. The questionnaire can by that be considered constructed to minimize the risk of misinterpretation even though the possibility of the aspect contributing to misleading results cannot be completely disregarded.

Question 1 (watchkeeping)

As the chart shows the main contribution to the difference in score of the question is derived from part b, 'vessel in reduced visibility'. At a first glance this fact could be considered to eliminate the risk of misinterpretation discussed earlier. The construction of the question is exactly the same in both parts which points towards the idea that the difference should be equal as well if the results were affected by differing interpretation. Looking into each student's answer it is however clear that an extensive part of the answers from the sponsored and regular students are rejected for the same reason. A consistent pattern is that more than one alternative has been ticked, which in the majority of the cases is for the vessels to alter course and reduce speed. This action may in reality be most correct, especially in reduced visibility. However the conditions in the introduction to the questionnaire clearly state that only one answer is required unless else is said. Measurement of the performance is important to be systematic (Muirhead, 1997). Following the correction frame several answers have therefore been rejected even though the thought of action may not be irrelevant. Pointing at this fact it should be noted that not all rejected answers depend on ticking several options, though it would most certainly even out the difference presented in the results.

The benefits of using closed questions are presented in the background (section 2.4). A great advantage is said being the elimination of subjective judgement from the examiner (Stutman, 1997). The possibility to further assess such answers as in this case may however be beneficial for the fair presentment of the results. Muirhead (1997) discusses such aspects as the interpretation of questions affecting the performance. Since a significant part of the answers have likely been rejected due to this aspect the validity is most likely decreased as well.

Question 5b (watchkeeping)

In this case again the validity may as well be discussed. The entire question is quite extensive and feedback from the pilot research said that it seemed hard at a first glance. However no actual interpretation problems were affirmed after considering the question as a whole.

As stated in the results a co-occurring pattern is that the sponsored and regular students ticked 'yes' in all four cases. This raises the thought of whether there is an awareness of the question at all. Since using multiple-choice questions it is hard to tell if the answers are ticked believing to know the answer or chancing. Unfortunately there has been no possibility to unravel this question.

Question 4 (radar navigation)

Except from the two questions discussed above, this question stands for the biggest difference in the results. The question is straight forward and not believed being affected by interpretation issues. In the radar education for the Swedish students this knowledge is called to attention several times. Whether this is the situation at UCLM is unknown. Teachers may very well put more weight on other areas and not state this fact as clearly. With the background knowledge and questionnaire data in consideration the chart is however believed to show the actual knowledge difference. A more thorough analyse of the reason would be interesting but is not applicable in this thesis.

6.2 The skill level

The advantage of using a simulator study to assess performance is the possibility to create scenarios with relatively high fidelity. Considering the wide definition of competence defined by Mr R.C. Mathew (1997) and further described in the background section, such study could be a very effective tool for competence assessment compared to more traditional ways.

A thoroughly performed simulator study includes judgement of aspects like initiative, decision-making and teamwork, while still accounting for basic knowledge and skills (Barnett, 1997). It could therefore very well give a good indication of performance effectiveness, which according to Mathew (1997) is the ultimate focus of competence evaluation. However, by adding several new aspects, it also makes the assessment more complex. A fundamental requirement for performance assessment is the use of standardized scenarios (Barnett, 1997). Differing on this point most likely adds other aspects that are hard to detect and assess. The possible deficiencies in achieved data are thus likely not due to the method itself, but rather the conditions of the specific study. Unfortunately this study could not be performed without such deficiencies.

In a simulator study the student's possibility for preparation most likely has an influence on the overall achievement (Barnett, 1997). As mentioned before the Swedish students had good possibilities to prepare for the run. Not only by prior instructions concerning the case, but also by recently going through the bridge simulator course aiming to provide the knowledge and skills needed to solve the examination run, which was used for this study. In the Philippines the students were gathered the same day and were not able to prepare for anything in advance. This fact most likely admits a clear advantage for the Swedish students and could also be the reason to their unified procedures and usage of the bridge equipment.

In addition to preparation possibilities it is likely that the sponsored students experienced a relatively high pressure from the fact that two foreign individuals put them to an unprepared test. Muirhead (1997) talks about the possible affect on performance from health related issues like stress. It is in this case likely that both groups of students experienced the affect of pressure and stress. However the sponsored Philippine students may have been affected in a larger extent due to pending circumstances. This could be a contributing reason to the noticed variance of their knowledge and usage of the radar equipment.

As stated in the results, no major deviation in performance was noticed and all students managed to complete the exercise without failure. By these observations it is clear that both groups in this case fulfil the requirements of skills to perform a navigational watch at the operational level. Beyond this, the results are, as already explained, too weak and unreliable to support a further discussion of the difference in level of practical skills.

6.3 The correlation between knowledge and skills

A main goal has been to compare the results of the questionnaire to the simulator study in order to see if the theoretical knowledge is reflected on practical scenarios. With consideration to the limitations of the simulator study it is hard to do this comparison. Some correlation would probably exist since the questionnaire is built around questions of fundamental need to know for the practical bridgework. Failure to answer the questionnaire would by that probably arise as failure of acting in the simulator study. However the simulator scenario is, regardless of mentioned limitations, not extensive enough to include all knowledge parameters. Furthermore it was performed only on sponsored students in the Philippines, which excludes one of the groups in the thesis. With this said a further discussion of the subject is not applicable.

6.4 Ideas for future research projects

As the thesis reveals there are several areas connected to this subject that for various reasons have not been included. Using this study as a base there are great opportunities to go even further into the subject of competence assessment and the comparison between countries or institutions. Carrying out such study does take quite some extra effort and ambition, but also gives a lot back in terms of experience and understanding. Relating to what has been discussed this thesis could be complemented by:

- Looking further into the competence level of Sweden and the Philippines by focusing on other areas of competence.
- Performing a more thorough simulator study to make the practical part of competence more solid and providing.
- Looking into the social aspect of cooperation and teamwork.
- Performing the study on other institutions or comparing other countries.

In the case of further related research the authors are glad to contribute with ideas, experiences and contact information.

7. CONCLUSIONS

This study concludes that there are differences in maritime competence between the final year students at the master mariner programmes of Chalmers University in Sweden and the University of Cebu in the Philippines. However, the differences do not represent other maritime universities in the two countries.

The definition of competence is very complex. A modern view includes several aspects in addition to just knowledge and skills. The results of this thesis represent only a part of the total definition.

All students tested in practical skills do reach the STCW's standards for navigation at the operational level. Differences in the performance occur, but those are not usable indicators of competence, since there are several ways to perform a watch in a safe and efficient way.

A correlation between the theoretical knowledge and the practical skills possibly exists but has not been completely ascertained.

The educational system does have an affect on the competence level. Yet the precise extent of this cannot be determined solely by this study.

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APPENDICES

1. The questionnaire
2. The simulator observation scheme

Questionnaire in nautical science

Purpose

This questionnaire is an important part of our bachelor thesis at the Master Mariner's Programme at Chalmers University of Technology in Sweden. The main focus is to compare the theoretical knowledge between the graduates of Sweden and The Philippines. We then hope to relate these differences to the educational systems in order to learn from each other, thus contributing to a better education.

Considerations

The data from this questionnaire will be handled anonymously.

General instructions

This questionnaire is based on the STCW competence requirements for officers in charge of a navigational watch. It consists of the following three parts:

- Terrestrial and coastal navigation
- Watchkeeping
- Radar navigation

The questionnaire consists of 18 questions. Please answer by ticking the boxes. All questions are limited to the available alternatives. In general there is only one right answer per question. If more than one answer may be correct, this is described under that specific question. If you would like to change an answer you have made, please make it clear by drawing over the wrong answer and ticking the new one.

Initial questions

Sex: Male ☐ Female ☐

Age: _____

Nationality: _____

Time at sea as cadet: _____ months

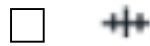
Time at sea altogether: _____ months

Do you have experience working as an officer any smaller vessel? Yes ☐ No ☐

Thank you for your time!

Terrestrial and coastal navigation

1. Please mark the chart symbol for “dangerous wreck, depth unknown”.



☐ Other

2. What navigational mark is this?



☐ Cardinal mark

☐ Lateral mark

☐ Special mark

☐ Isolated danger mark

☐ Other

3. Please mark the correct light character?



☐ Iso

☐ Fl

☐ LFI

☐ Oc

☐ Other

4. The following questions (a-f) are related to the electronic chart on the attachment. Please answer each of the questions with help from this chart.

Note that the object information window is derived from lighthouse nr 2!

a) What type of electronic chart is it?

☐ RASTER

☐ Vector

☐ Other

b) What is the nominal range of lighthouse no. 1?

See number 1 in the chart!

☐ 4 Nautical miles

☐ 12 Nautical miles

☐ 5 Nautical miles

☐ 10 Nautical miles

☐ Other

c) Observed from any vessel, at what true bearing does lighthouse no. 2 shift from the white to the red sector?

See number 2 in the chart!

☐ 3°

☐ 183°

☐ 44°

☐ 224°

☐ Other

d) What does the blue area symbolize?

See number 3 in the chart!

☐ Safety depth

☐ Safety contour

☐ Non-fishing area

☐ Drying tides above chart datum

☐ Other

e) What are you in general not allowed to do in a separation zone like the one marked by number 4?

See number 4 in the chart!

Several answers may be correct!

☐ Fishing

☐ Crossing

☐ Overtake a vessel following a traffic separation line

☐ Anchor while awaiting pilot

f) What does the striped area symbolize?

See number 5 in the chart!

☐ Fishing area

☐ Caution area

☐ Chart layer of different scale

☐ Offshore installation area

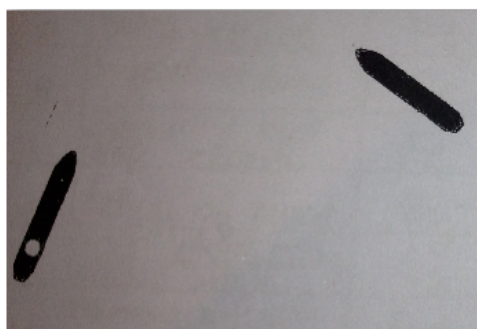
☐ Other

Watchkeeping

- The two vessels in each of the two cases are a distance of 4 M from each other, therefore they are able to take action in good time. In the first case ("good visibility") they are proceeding at full speed, in the second case ("restricted visibility") they have already reduced speed. Please mark the most appropriate action for each vessel in these two cases.

Own ship is marked with a white dot!

a) Good visibility



Own ship

Other ship

<input type="checkbox"/>	Alter course to starboard	<input type="checkbox"/>
<input type="checkbox"/>	Alter course to port	<input type="checkbox"/>
<input type="checkbox"/>	Reduce speed	<input type="checkbox"/>
<input type="checkbox"/>	Stop	<input type="checkbox"/>
<input type="checkbox"/>	Maintain course and speed	<input type="checkbox"/>

b) Restricted visibility



Own ship

Other ship

<input type="checkbox"/>	Alter course to starboard	<input type="checkbox"/>
<input type="checkbox"/>	Alter course to port	<input type="checkbox"/>
<input type="checkbox"/>	Reduce speed	<input type="checkbox"/>
<input type="checkbox"/>	Stop	<input type="checkbox"/>
<input type="checkbox"/>	Maintain course and speed	<input type="checkbox"/>

- Please arrange the responsibility between the vessels in open water. Do this by putting numbers (1-5) in the boxes, where number 1 is the least restricted and number 5 is the most restricted.

- ☐ Sailing vessel
- ☐ Power-driven vessel
- ☐ Vessel not under command
- ☐ Vessel restricted in her ability to manoeuvre
- ☐ Vessel engaged in fishing

3. In a crossing situation between two power-driven vessels, it is apparent that the give-way vessel does not take appropriate action in compliance with the rules of COLREG. The stand-on vessel is then allowed to take action. What action shall, if the circumstances admit, be avoided by the stand-on vessel in this case?

☐ Alter course to starboard for a vessel on port side

☐ Alter course to starboard for a vessel on starboard side

☐ Alter course to port for a vessel on port side

☐ Alter course to port for a vessel on starboard side

☐ Other

4. You are the OOW (Officer of the watch) when the master enters the bridge to check the progress of the voyage.

a) Who has the responsibility for the safety of navigation?

☐ The master

☐ The OOW

☐ Other

b) Who has the overall responsibility for the ship onboard?

☐ The master

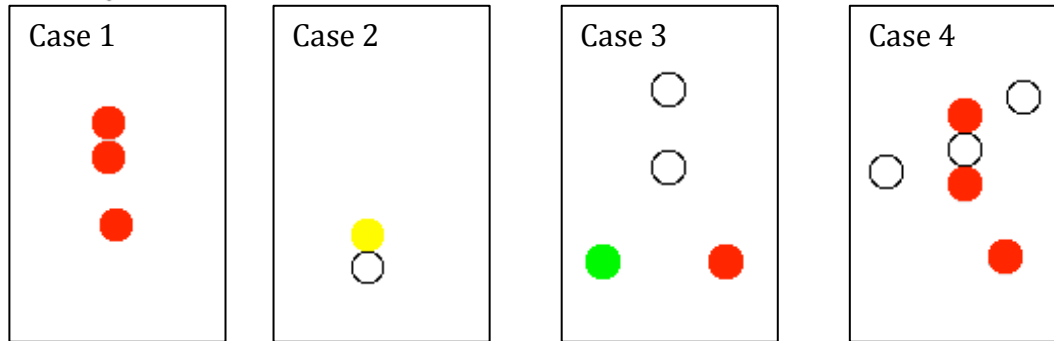
☐ The OOW

☐ Other

5. The four cases below (1-4) represent four different vessel light combinations.

Please put a cross in the correct box for each case at each statement. Each statement should result in four crosses.

○ White light
● Yellow light
● Red light
● Green light



Statement A Navigational status of vessel	Case nr				Statement B Making way through water	Case nr			
	1	2	3	4		1	2	3	4
Pilot vessel					Yes				
Power-driven vessel					No				
Sailing vessel					Not evident				
Vessel constrained by her draught									
Vessel engaged in fishing (not trawling)									
Vessel restricted in her ability to manoeuvre									
Vessel engaged in towing operation									
Vessel engaged in trawling									
vessel not under command									

Statement C Side shown	Case nr				Statement D Sound signal in restricted visibility	Case nr			
	1	2	3	4		1	2	3	4
Starboard					D (– – •)				
Port					T (–)/M (– –)				
Straight forward									
Straight aft									
Not evident									

6. What is the navigational status of a vessel showing this day signal?



☐ Sailing vessel

☐ Vessel restricted in her ability to manoeuvre

☐ Vessel aground

☐ Vessel engaged in fishing

☐ Other

7. What is the navigational status of a vessel showing this day signal?



☐ Vessel engaged in fishing

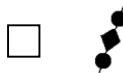
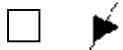
☐ Vessel not under command

☐ Vessel constrained by her draught

☐ Vessel aground

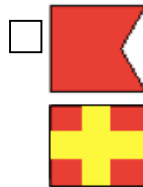
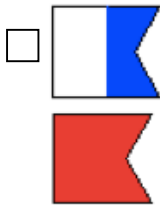
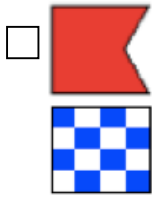
☐ Other

8. Please mark the day signal for a vessel proceeding under sail also being propelled by machinery.



☐ Other

9. Which of the following flag combinations is a distress signal.



☐ Other

10. What is the meaning of the sound signal U (• • —).

- | | |
|---|--|
| <input type="checkbox"/> I am operating astern propulsion | <input type="checkbox"/> I am altering my course to port |
| <input type="checkbox"/> You are heading against danger | <input type="checkbox"/> I intend to overtake you on your starboard side |

☐ Other

Radar navigation

1. The following statements (1-8) apply to either the X-band or S-band radar. Please put each number on the line that represents the correct alternative. The same pulse length is used in both cases.

X-band _____

S-band _____

1. Operates on a frequency around 9 GHz.
2. Operates on a frequency around 3 GHz.
3. Operates on a bandwidth of 10 cm.
4. Operates on a bandwidth of 3 cm.
5. Good to detect targets on a long range.
6. Good for detecting small targets.
7. Good at penetrating precipitation.
8. Best resolution.

2. Which pulse length is preferable when you navigate in coastal waters while weather conditions are clear?

☐ Short pulse ☐ Long pulse

3. What information shall the ARPA be able to provide about a plotted target? Put a mark for each correct answer.

Several answers may be correct!

- | | |
|--|--|
| <input type="checkbox"/> Calculated true Speed | <input type="checkbox"/> Calculated true Course |
| <input type="checkbox"/> Present range of the target | <input type="checkbox"/> Present bearing of the target |
| <input type="checkbox"/> Predicted target range at the (CPA) | <input type="checkbox"/> Predicted time to (CPA) |

4. What speed data shall be supplied to the ARPA for anti-collision purpose?

☐ Speed through water

☐ Speed over ground

5. Which statement is correct regarding the maximum time limit for the ARPA to provide target data?

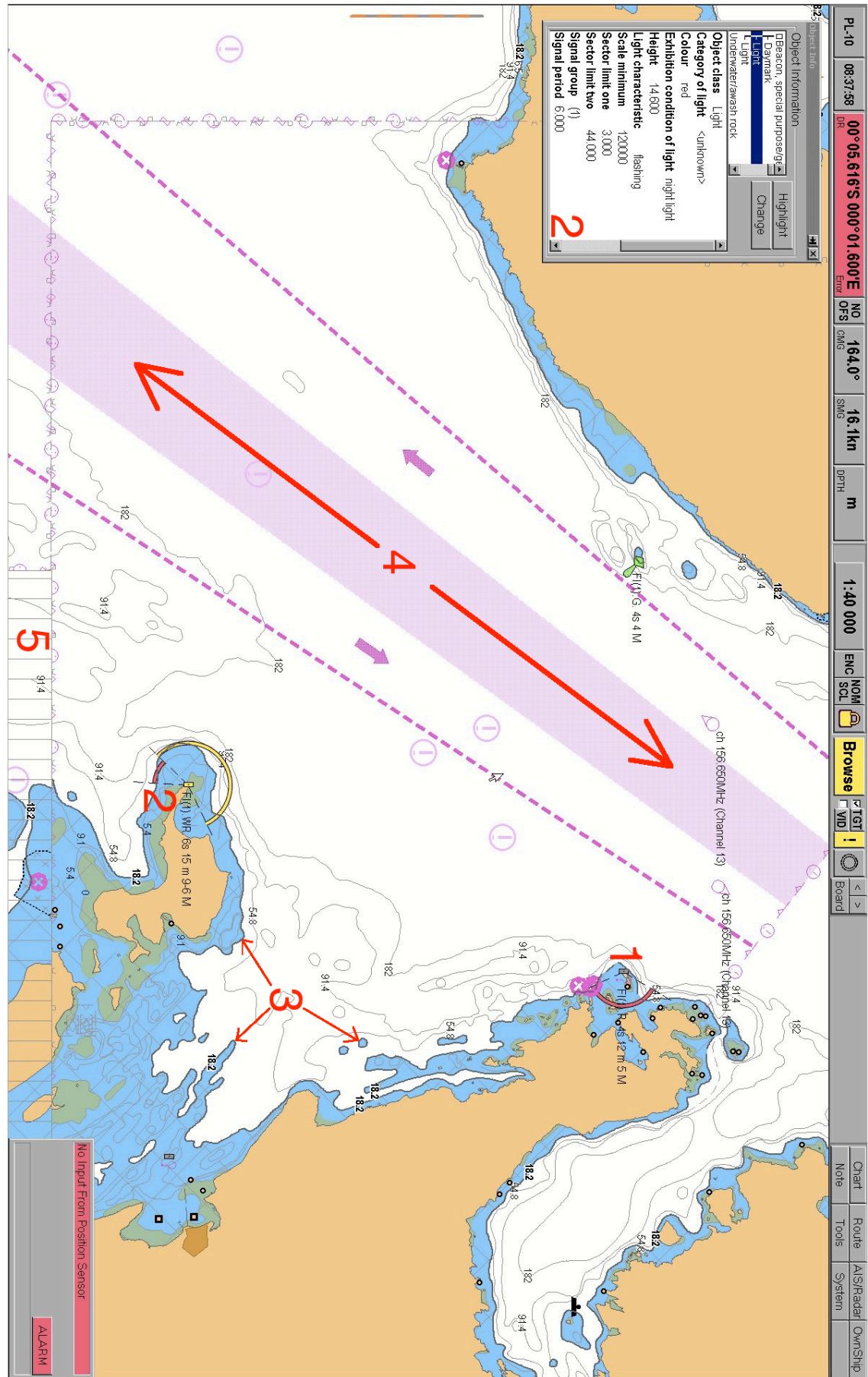
☐ Motion trend in 1 second, predicted motion in 10 seconds.

☐ Motion trend in 1 minute, predicted motion in 3 minutes.

☐ Motion trend in 30 seconds, predicted motion in 1 minute.

☐ Motion trend in 3 minutes, predicted motion in 5 minutes.

Terrestrial and coastal navigation, question no. 4.



Evaluation scheme for the bridge simulator study						
Pre-settings radar	Radar	Assessment scale	Notes			
Tune		Man/Auto				
Range		[M]				
Gain/Clutter		OK/NOK				
Stabilization		Sea/Ground				
Orientation		Nup/Hup/Cup				
Motion		Rel/True				
Vectors		Rel/True				
Trail		length [min] Y/N				
CPA limit		Rel/True				
TCPA limit		[M]				
Pulse length		[min]				
S-band/X-band	N/A	SP/MP/LP N/A				
<u>Functions used</u>						
ARPA		Y/N				
AIS		Y/N				
Chart		Y/N				
Map		Y/N				

Summary radar									
Settings awareness			Y/N						
Work actively			Y/N						
Other observations									
Position taking			Radar/GPS/2 means				Deficiencies:		
Route plan			OK/NOK				Deficiencies:		
COLREG			Y/N				Deficiencies:		
Radio Communication			OK/NOK				Deficiencies:		
Channels watched			16/XX						

<u>Related questions and self assessment</u>									
Self assessment (1(bad)-5(excellent))									
What went well?									
What went not so well?									
What would you have done different?									
How much time have you spent in the simulator so far?									