

TEACHING METHODS AND EXAM METHODS IN MARITIME EDUCATION

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Author note

This master thesis is the final assignment in the study master in maritime management at Vestfold University College. The thesis has given me the opportunity to investigate pedagogical theory, teaching methods and assessment methods, to see how this affects students learning effect and results at a final exam. To accomplish this task, there have been several persons involved, both with their professional guidance, facilitation and patience.

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Abstract

A majority of the marine engineer students begin their education without having any basic knowledge of or experience in the tasks they are expected to perform in the future. Engine room simulators are therefore a significant teaching and learning tool and are today described as an approved method of demonstrating competence in the “International Convention on Standard of Training, Certification and Watchkeeping for Seafarers” (STCW – Convention and Code). Although simulators are seen as the “hub” in the education, the final assessment is conducted by means of a written exam only. The differences between teaching methods and exam methods are a contributory factor to some student’s significant deviation of evaluated competence at part assessment, compared with the results in the final exam. Further, using only a written exam is described as a “narrow” method to demonstrate and evaluate total competence in the vocational education at University College.

This thesis aims to investigate students and teachers’ satisfaction with the written exam as form, and if they are not satisfied, the proposal that an assessment method where the simulator is included would provide a better overall competence demonstration and evaluation.

There were 18 (n = 18) participants at operational level and 11 (n = 11) participants at management level in the survey conducted among the students. Interviews were conducted among three teachers at operational and management level to triangulate the results.

The results show some differences between students at operational level and management level. Students at operational level are moderately satisfied with the written exam, but they believe this method is of limited scope, while the students at management level are not satisfied with this method to demonstrate competence. 55.6 per cent of the students at operational level and 90.9 per cent at management level believe an exam involving simulators is a better way to demonstrate total competence.

Teachers at operational and management level believe that assessment methods where simulators are involved in combination with other forms would provide a better total competence evaluation. The teachers pointed out the extrinsic conditions as a reason not to conduct assessments where simulators are involved.

Introduction

This thesis aims to examine certain opinions held by students and teachers regarding assessment methods practised during the education of marine engineers at Vestfold University College. Firstly, it will consider the extent to which the written exam as a method differs from the methods used in the lectures and secondly, it explores the values of an alternative form of assessment that would enhance the way whereby students show their overall competence.

Background

The main objective in maritime officer education in Norway is to ensure a supply of qualified personnel suited to the tasks required on board the vessels. This is a major contribution to reducing the number of accidents related to human errors.

The maritime engineer officer education has traditionally used theoretical teaching in classrooms, where the students had acquired practical maritime experience prior to entering the schools. The admission requirement for entering the marine officer engineer level in the maritime educational system was practical seagoing experience of several years. In the 1980s, when internationalization of seafarers on ships flying the Norwegian flag was a reality, the Norwegian seafarer was financially non-competitive due to high salaries and their demands regarding shorter working periods on board vessels. The entry level requirements in maritime schools were amended and a larger number of students were now without any seagoing experience before they started their education.

On account of the students' lack of practical experience there was a demand in the maritime education to find solutions to approach a practical understanding and knowledge in the education. These initiatives, combined with the technological development, resulted in engine room simulators, which today are an important pedagogical tool, both nationally and internationally.

A number of studies have been conducted to discover how simulator-based education affects the learning process among maritime students. Research done by Muirhead (2002), Kluj (2005) and Cross (2001) indicates that simulator-based learning is effective in terms of high quality learning with a high level of taxonomic knowledge among the students. A study by Kobayashi in 2005 describes simulators in a positive way as a method in final assessments and Tuna, Cerit, Kisi & Paker (2009) clarifies in their study the importance of problem-based learning in maritime education. These studies describe the maritime engine room simulators as an effective tool, both in learning and competence evaluation perspectives.

Fosbæk (1997) has in his vocational pedagogy master thesis, discusses the problems related to differences in teaching methods and final exam methods. He describes some of the

education as based on practice, problem-based learning and projects, while the final exam is only conducted as a written test. His opinion of vocational education and written exams is that they provide an insufficient evaluation of the students' practical and theoretical competences. He suggests a final assessment method comprising practical skills used in combination with a written exam. The students then have to describe and justify their practical work in a written exam, to demonstrate their competences in knowledge, skills and attitude.

Paulsen (1997) has also discussed a similar topic in his pedagogical master thesis. His students want to be evaluated in relation to practical assignments that are relevant to their prospective professions, instead of a written exam. The students consider that there is a significant part of their vocational knowledge, skills and attitude which cannot be evaluated solely by means of a written exam. They claim that a written test as an exam method does not correlate with the different teaching methods in the education. This is a study conducted on students in the vocational schools but is also transferrable to maritime education in university colleges. Maritime education is vocational based, with an academic structure, described in the international convention.

Simulators are now described in the STCW Convention and Code as an approved learning tool and are also approved as a means of demonstrating competence (STCW Convention and Code, 2010). The students then may have a significant part of the learning process related to simulators instead of practice on board vessels.

Simulations have become considerably more realistic in relation to the operations and processes on board ships. Accordingly, the International Maritime Organization (IMO) has established a committee called Inter Sessional Working Group (ISWG) to structure and organize simulator related topics. ISWG's description of a simulation is as follows:

“Simulation is a realistic imitation, in real time, of any ship handling, radar and navigation, propulsion, cargo/ballast or other ship-system incorporating an interface suitable for interactive use by the trainee or candidate either within or outside the operating environment, and complying with the performance standards prescribed in the relevant parts of this section of the STCW Code.” (IMO, ISWG, 1994)

Vestfold University College promotes itself as a leading maritime education institution in Norway, with well- educated teachers possessing extensive practical experience as marine officers. During recent years the college has invested heavily in engine room simulators to fulfil the requirements laid down in the STCW – Convention and Code. Although traditional teaching methods such as lectures, group assignments and ordinary theoretical exercises still

form a large part of the education, there is now a greater part that is related to simulators than previously. This is now done to provide the students not only with theoretical considerations but also to provide them with a better knowledge, understanding and skills in problem-based learning situations. Students have to demonstrate competence by compulsory tests in different forms, both written tests and simulator tests, throughout the year. If they pass the tests they will be permitted to sit the final exam in Function 1 – marine engineering at operational level and Management level.

The final exam form consists only of a five-hour written test where the students have to demonstrate their total competence in the function. A passed or failed exam result determines if the students are ready to start their seagoing career, and finally are allowed to be issued with marine engineer certificates. The reason for using this exam form may be related to economic reasons, logistics, availability of simulators during the exam period, or simply that the teachers' opinion are related to a written exam form as the best solution to demonstrate competence.

A number of teachers and students have expressed their dissatisfaction with the written exam form, and in some academic years there is a high failure rate among the students. There are also some cases of surprising results where students have achieved a divergent result compared with their expected competence.

In this master thesis I will map students' and teacher's opinions concerning current teaching methods and exam forms. Further, I will use this information, pedagogical theories and research to discuss which examining form or combination of forms maximize the assessment of the student's overall competence.

Research question

Is the written exam form sufficiently adapted to the teaching methods applied, and is a written exam a proper way of evaluating the marine engineer student's overall competence? Is it feasible to compile a final exam using a combination of different methods, to evaluate the students in a better way? Based on these questions and the foregoing details, the following two research questions emerged:

1. Are the students and teachers satisfied with only a written exam to demonstrate and evaluate overall competence in marine engineering?
2. Do the students and teachers believe a combined exam form involving simulators is a better solution to demonstrate and evaluate overall competence in marine engineering?

Theory

A number of theories have been developed on how applied teaching and learning may be carried out to provide a satisfactory learning outcome and how to evaluate this competence. Learning occurs in many forms, depending on the subject and prerequisites. This chapter aims to examine theories related to learning, teaching methods, forms of assessments and evaluation methods in final assessments. In combination with some of the theories described, I will elaborate using examples from Vestfold University College, marine engineering, to point out how learning and assessment is practiced in the daily based teaching.

Learning and Learning Processes

Learning and learning processes are words used in pedagogical expressions referring to what we are learning and in which way we are learning it. The word teaching is used in the daily based language, in official or in an academic context, because it is more congruent with the teaching subjects and what is learned. The word learning is defined in the psychological - pedagogical dictionary as: *“a relatively permanent change in behavior as a result of experience and training”*.

According to Illeris (2009, pp. 13-16) a learning process is an interaction between an individual and the material and social surroundings, which is directly or indirectly a prerequisite for the internal learning processes. This is a theoretical way of explaining the word learning process. I will therefore try to explain it with an example from a simulator session.

A student is involved in an interaction with his surroundings in a simulator exercise. The teacher explains the start-up procedures of the main diesel engine and the student is enthusiastic and is asking questions, listening, understanding and learning the procedure. The interaction process consists of the teacher's explanations and the student's detailed questions. A process occurs in the student that includes the teacher's explanation of the start – up procedure that has to be adapted to the student's own understanding. This is then related to the student's experience of knowledge and understanding of the topic.

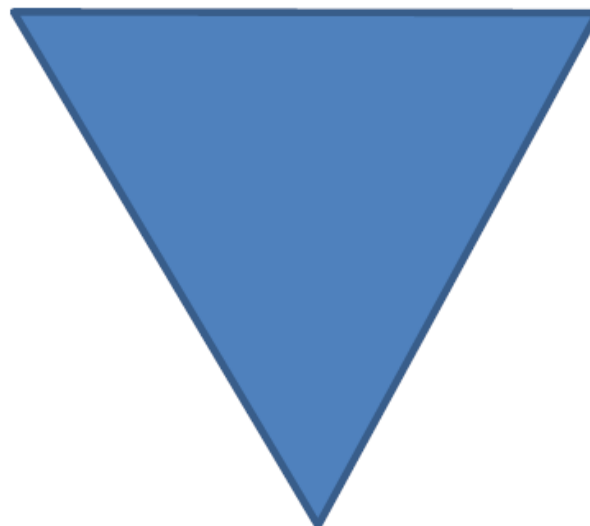
This example shows an interaction between the student and his surroundings and an internal dedication that result in a preparatory process leading to the result of learning. When the process is ideal the result is a learning effect where the students have absorbed and understood the teacher's explanations in a way where the procedure of start - up would be absorbed in the brains memory centre, and under certain conditions brought to the brains surface again and reproduced (Illeris, 2009, p. 15).

The Three Dimensions of Learning

Illeris (2009, pp. 16 -23) describes learning in three dimensions and, in his opinion, learning can be considered and analysed, based on three different angles. Firstly, when there is learning there are always skills or a meaningful content where the content results in a cognitive process. Secondly, there is always a psychodynamic process involving psychic energy disseminated by feelings, attitude and motivation that mobilizes and at the same time affects the learning. Thirdly, there is an interaction between human beings in a social process. From Illeris's (2009) understanding of concept learning every learning process is combined in these three dimensions and is stretched out between three angles of approach.

Cognition

Psychodynamic



Socially process

Figure 1: Polarization between the three dimensions in learning

As shown in the figure above, there are two psychological poles placed in the top corners of the learning triangle, so they together fulfil the psychological process of obtaining knowledge and skills in an individual. The social factor is an underlying opposite pole where the social interaction is in connection with the process of obtaining knowledge and skills. It is important to emphasize that these three dimensions are integrated in every practical learning situation and are not segregated as separate functions (Illeris, 2009, p. 19).

Wenger`s Social Theory

Wenger (2004) has developed a social theory regarding learning, and believes there is a frame of concepts which is usable to describe the principles to understand socialization in a learning process. There are a great number of pedagogues who consider learning to be an individual process where the learning is a result of teaching. Wenger (2004) elaborates in his theory the concept of learning as a social participation in a social practical activity. Further, he assumes that learning is a natural fundamental basic need, such as the need for food and sleep. He believes that if we have an opportunity, we have a great potential to learn, it is only a matter of social participation in a social practical activity.

Teaching and Learning

When people define teaching and learning the answer is often that teaching is to give out knowledge, while learning is to receive and save knowledge and then use this knowledge on other occasions, for example in an exam or in a practical situation. This is the overall understanding of teaching and learning, but it can be elaborated far more. To provide a more correct description of the terms teaching and learning I will explain the meaning of the word knowledge, and then elaborate on the different levels of knowledge such as; remembering, understanding, applying, analysing and evaluating, in the context of Bloom`s taxonomy.

Knowledge

Knowledge involves the recall of specifics and universals, the recall of methods and processes, or the recall of a pattern, structure, or setting (Bloom, 1956, p. 201).

When parts of single knowledge are combined into complex knowledge it is known as cognitive knowledge (Hofset, 1995, p. 110). If there is a cognitive objective where the student`s goal is to obtain knowledge as regards the function of a diesel engine, there is a possibility to analyse the cognitive objective by separating it into parts of specific single knowledge objectives. By dividing the single knowledge objectives into component name, location and function, the student finally obtains a cognitive knowledge and understanding of the diesel engine functions.

Bloom`s taxonomy

Bloom divides his taxonomy into different levels and this has become a well - known and accepted concept of classifying knowledge. His taxonomy is divided into quality levels of knowledge, where every level is elaborated, for applying it to practical understanding and use. I will present Bloom`s way of thinking and further elaborate with some practical examples from my everyday teaching experience.

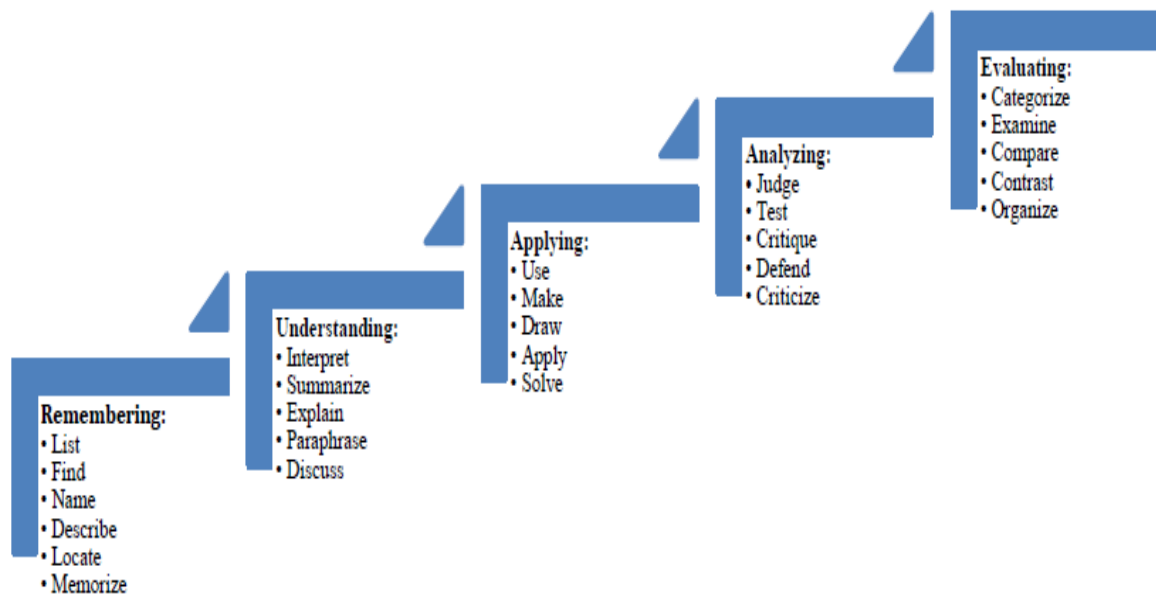


Figure 2: Bloom`s taxonomy

Remembering

Bloom defined remembering as the lowest level of knowledge in his taxonomy. To remember is to reproduce single knowledge such as facts. At this knowledge level the student has no cognitive understanding of the subjects presented, but is only able to reproduce it in its original forms. To reproduce formulas, rules and years from a book, are examples of the level of remembering.

In the first year of maritime education, at operational level, some part of the course contents is based on learning of knowledge at remembering level, regarding basic maritime knowledge, such as maritime laws and regulations, name of components and remembering of formulas. The reason is the student's lack of practical experience. Thus it is important to have a teaching and learning approach where the students are familiar with common maritime expressions and terminology and are able to use this knowledge in a more cognitive learning situation later on in the education.

Understanding

When a person is able to express something from a textbook, not only as a reproduction but in his own words and is able to explain drawings and diagrams, he possesses the knowledge level of understanding.

At this level the students acquire a more complex understanding of how the technical systems and installations are constructed by single components, and their mode of operation. Tables, figures and diagrams relating to engines and systems are applied in the lectures. Theory of rules and regulations put in a context are of great importance to provide the students with the knowledge of understanding in maritime education.

Applying

When knowledge is applied in practical use, where the students are using formulas in calculations, illustrating figures, and use diagrams, tables and figures, to explain a topic, they possess a level where the students apply their knowledge.

To provide the students with a wider knowledge- based understanding in maritime subjects, it is essential to use the engine room laboratory and simulators as learning tools in the teaching. The students are then able to work on more complex tasks on a higher taxonomic level. Start – up procedures of engines, maintenance, disassembling and assembling of engine parts, use of formulas in engine calculations and interaction in student groups are examples of applied knowledge level.

Analyzing:

At this taxonomic level it is expected to have a knowledge level to “break down” or fragment the cognitive knowledge into parts, such as the ability to explain a formula significance in a calculation; describe the basic elements of a material, or sort out single elements in a presentation and use these single elements in arguments in a discussion.

Tasks with a high level of complexity where the students have to apply theory in practical situations both in the engine room laboratories and engine room simulators are usually conducted late in the first year, at operational level and in second year, at management level. Parameters such as temperatures, pressure and flow are analysed to make conclusions. Responsibilities and consequences related to performance, where attitudes are related to health, safety and environmental issues are examples of analysing level.

Evaluating:

Evaluations are when a person is able to combine parts of his knowledge in one subject with knowledge in other subjects to find a new combination or solution. Connecting

and combining science from e.g. mathematics, construction and production to find a new solution of an environmental technical problem is an example of evaluation knowledge. This is the highest level in Bloom`s taxonomy.

The students have to investigate and solve operational failures, take action and come up with solutions to the process problems. In major projects where the objective is to run a vessel with efficiency with regard to fuel economy, safe operation and environmental issues, the teachers are able to force the students to evaluate all their actions. This will increase the student`s ability to conduct cognitive thinking and increase the quality of knowledge, skills and attitude, because they are able to understand the consequences of their actions.

Skills

Skills are related to how we perform tasks in different situations. To change a fuel valve in a diesel engine or to use a computer are skills. Because of the interaction between senses and motions the term is psychomotoric skills (Hofseth, 1995, p. 34). In everyday language the term skills or capabilities are used in a broader way. To drive a car, repair an engine or skiing are examples of skills. By elaborating this subject we will understand that the skills we are performing have to be related to knowledge. The term skills consist not simply of what we are doing, but how we are doing it, and what kind of knowledge we possess, to perform it. Skills are not learned from a book or by listening to a lecture, and in the context of the maritime education it is not possible to educate an engineer providing only theoretical knowledge in the form of textbooks and lectures. We have to apply it into practical work and situations by training on simulators, in the engine room laboratories or by practice on board vessels. Only then we can provide them with the quality of skills and knowledge required in the STCW Convention and Code.

Attitude

Attitude is the capability to think, feel and take action in connection with specified situations or related to persons, things and ideas among others. An attitude may be positive or negative, strong or slight. It is possible that a student`s attitude is positive towards the education he is undertaking, but his attitude to homework is slightly negative. According to Hofset (1995, p. 35) there is always an emotional component in attitudes, where like, dislike, love, hate, disgust, despise or admire are involved.

The attitudes student`s holds when they begin their maritime education are not absolute and can be changed. A person`s attitudes are formed as a result of social and knowledge impulses received from his former experience. A person`s attitude can change in

direction, increase or decrease by external impulses. Schools and University Colleges are therefore environments where the objective is to point these attitudes in a positive direction by relating attitude to knowledge and skills in the education.

A naval officer today operates in an international environment where interaction with other individuals from various nations is vital. To succeed in these interactions it is crucial for the students to evolve attitudes that are positive with regard to the environment they will be face.

There is a considerable focus on environment and safety on board vessels. The University College has to ensure that students hold positive attitudes related to practical work and responsibilities. If a person knows what to do and is capable of doing it, but still does not do it, it may be the person's attitude that restricts him.

Teaching methods

The choice of teaching methods has always been discussed in the educational system among the pedagogical staff and students. Which method provides the greatest learning effects on students and what kind of method contributes to attitudes in a positive way. The conclusion is that the method adopted may be superior in some teaching situations, while other methods are more effective in a different scenario.

In maritime education, as in every education, the students are exposed to several teaching methods every day. Some of them are particularly successful, while other methods do not have the same effect in a learning perspective. The choice of method depends on miscellaneous factors related to; curriculum, size of the group, equipment, learning objectives, teachers and student's qualifications (Solerød, 2005, p. 185).

Lectures

"The teacher who possessed all the knowledge, read and told the students, when the students listen and took notes at their best" (Hofset, 2009, p. 208).

This is the perception of lectures in many ways. Lectures have been used as a teaching method for thousands of years and the force of oral communication has always been seen as the most important and distinguished way to communicate. In a teaching situation it is also more common with information delivered from the teacher to the students than vice versa. According to Hofset (1995, p. 208) lectures as a teaching method may be viewed as follows: *One way communication = lectures = method of nature*. His explanation is that a lecture is like water; it is essential to all living creatures and plants, but too much of it can cause flooding and destruction. Lectures as a teaching method is in his opinion an excellent method

if it is conducted in appropriate quantities and for the right purpose.

Pure lectures are a one- way communicative teaching method where the lecturer speaks and the students listen. Hofset (1995, p. 2009) describes three limitations with pure lecturing.

- 1. The students will be passive recipients where they are not actively participating in any discussions. They may take notes, if they want to, but the lecture is moving forward without the possibility of students to influence the lecturing. Another problem often seen is a contagion of passivity from one student to another.*
- 2. A lecture will provide all the students with the same information at one pace. There are no considerations taken of each individual`s needs regarding basic knowledge, speed of learning or other abilities.*
- 3. Feedback with regard to the perception and learning effect during the lecture is very poor in a lecture – student perspective. Both lecturer and students may have the impression of a better learning effect than in reality because misunderstandings are not solved, not even detected.*

Hofset (1995, p. 209) has also given an account for possibilities with pure lectures. When structuring parts of subjects, covering essential and central parts, or explaining complex parts of subjects that are difficult to understand, pure lectures are an effective method. Further, when the teacher wants to supplement with extra subjects or multidisciplinary subjects, pure lecturing is an acceptable way to teach.

At Vestfold University College, maritime education, one – way communicative lectures are rarely used as a method. There is an understanding among the teachers that lectures in a two – way communicative setting, where the teacher allows questions and discussions during the lectures, is a reason for reducing the problems described previously. This form of lecturing may also be called conversational lectures (Hofseth 1995, p. 219). Because of the differences in the student`s basic knowledge and background, it is important to observe the students` understanding of the subjects presented constantly during the lectures, to ensure an optimal learning effect. Teachers also have the possibility to elaborate on subjects and actively start discussions when appropriate. This kind of lecture will also create a significantly more active student group compared with a pure one - way communicative lecture, because the students are challenged to discuss and reflect.

Problem- Based Learning

The main objective of vocational education at a University College in today's complex society is to make the students achieve and contribute and inspire them to identify and solve problems in the professional and academic world. The students have to develop a knowledge base to use in different situations at work. They have to evolve attitudes in a way where they are interested in and curious to expand their process of learning, also after they have completed their education.

Problem- based learning can be described with some keywords; working method, the tasks and how it is organized. These are the fundamental elements of teaching and the learning process (Lycke, 2002, p. 22).

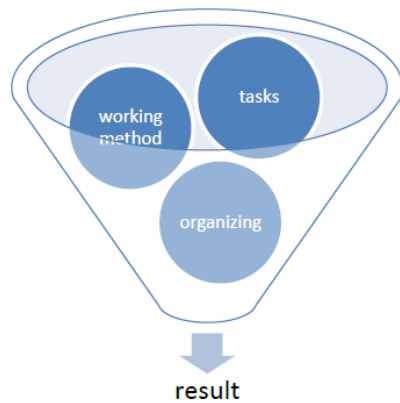


Figure 3: Fundamental elements of the teaching and learning process

Research done by Feltovich, Spiro, Coulson & Feltovich (1996) has shown that public educational institutions, to a lesser degree than expected, are able to develop this competence in the students' minds. There is a lack of several parts of the knowledge, and some of the knowledge is incorrect. Further, a large number of the students have problems to remember what they have learned after a while, and because of this, they cannot utilize the knowledge in a complex setting. In addition, there are a lot of students that do not know their level of knowledge and skills, and therefore are unaware of the level of competence they hold. Problem- based learning is conducted as a teaching method to approach and alleviate this problem and it is geared at the main objectives of vocational education at University College.

In problem- based learning it is emphasized that the students regulate their own learning with guidance from the teacher. Students mainly work in groups where the teacher

has more a role as a supervisor to guide the students in their tasks and problems. My descriptions of group work and project work can also be related to problem-based learning because group work is often used in problem-based learning and vice versa.

Working in Groups

Working in groups is often used at all levels of the educational system. When six – year- old children are starting their education they learn to work and collaborate in groups. This is performed all through the school system and is a common way of working and learning, also in the University Colleges. The objective is to give them abilities to interact, reflect and respect, and to be able to gain knowledge and achieve goals. When students are working in groups the teacher often has a more neutral role than in a common teaching situation. It is expected that all of the students are serious in their assignments when they are working in groups, so the group can interact to achieve the objectives, and then provide each individual in the group with the knowledge and understanding required.

Group work, on some occasions, is frustrating, while other times it can be very motivating as a method. Hofset (1995) elaborates on the evolvement of interaction abilities and social abilities as key factors to effective learning in the teaching environment, and as important factors in group work. Group- related assignments may also be a stimulating and motivating form that provokes reflection and learning on a high cognitive level. One disadvantage of group work is the perception of an ineffective and time- consuming way of working, where some of the group members do not make an effort. Therefore it is vital to prepare the group work properly before the task is conducted, taking into account the structure and organising and visualizing of the objectives of the group work.

Project

Project- related work is a common way to attain a goal both in research, private industry and public institutions. Schools and University Colleges are frequently using project-based learning to achieve objectives in the curriculum and the similarities between “real life” are in many ways comparable. The different phases in project- related work regarding problems with cooperation and progress are comparable. The differences are that whereas industry is focusing mainly on the result, there is a focus on both process and result in school-based projects. Students are expected to achieve learning both academically and in a human perspective. Hofset (1995, p. 229) has described some criteria to achieve satisfactory results when conducting projects in a school-based situation;

1. *It is conducted in groups.*
2. *The duration is adjusted to suit the projects complexity and when the students are working with the project there is sufficient time allotted.*
3. *The project is supposed to be controlled by the students. The teacher is a person with resources of knowledge but it is the group's responsibility to be active and search for solutions related to most of the problems.*
4. *A project is supposed to be problem based.*
5. *A project has to be relevant to the study and cover required subject areas.*
6. *The project assignment has to be relevant to the participants in such a way that the student's experience of the task is meaningful. This is significant in terms of motivation and commitment.*
7. *The project assignment is supposed to be multidisciplinary to create synthesis and evaluation of knowledge at several areas (highest level in Blooms Taxonomy).*
8. *The project has to have relevance whereby specific practical problems are realistic.*

In maritime education one objective is to conduct project- based learning in multi-disciplines. An example of this is to link project assignments on simulators with the maritime industry, involving student contact with ship owners or the shipping industry. This is an effective combination of commercial information, use of simulators and theory, to create learning. The following scenario elaborates on this:

A group of students are assigned a ship as a project. The ship is making a voyage and then it is supposed to end in a dry dock for repairs. In this assignment the students have to plan the voyage with regard to bunkers, oil, lube oil, spare parts and maintenance. During the voyage there are several incidents that the group has to deal with and solve. Furthermore, they have to plan and conduct dry-docking of the ship.

This is a complex task where the students have to contact ship owners to receive information and use this information in combination with simulators and theory. The students then have to analyse and evaluate the complex information to accomplish the assignment. In this specified project the topic may be; *“How to plan and conduct a voyage and a dry-docking in an economical, maintenance and operational perspective?”*

Tuna, Cerit, Kisi & Paker (2009) has in their research studied elements that are incorporated into a maritime project assignment where problem- based learning is used. If we imagine the project described previously, most of the elements have to be included and will further stimulate the learning process to answer the assignment's research question.

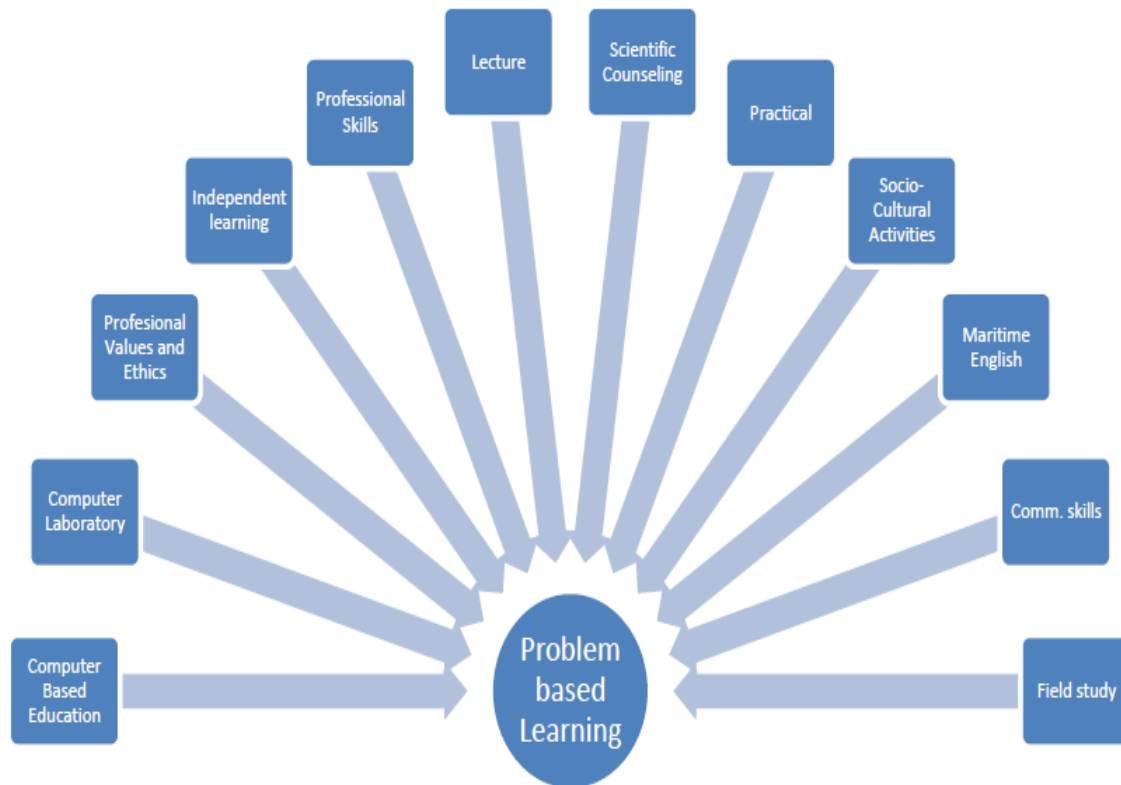


Figure 4: Elements of subjects in problem- based learning

Figure 4 illustrates how the students utilize elements in their already learned knowledge to acquire new and cognitive knowledge on a high level in Bloom`s Taxonomy. The complexity of elements shown here is mostly included in projects related to management level, but smaller projects with less complexity are conducted at operational level.

Assessment

Teachers are constantly making observations regarding the student`s level of knowledge and understanding, and their participation in group assignments and projects. In the maritime education at University College level, no objective grades are given that relate to the work and achievements done during the year. The grades are only dependent upon final assessments. To ensure that the competences of the students are as required in STCW – Convention and Code in every function, part competence assessments have been introduced where the students have to show their competency by demonstrating knowledge, understanding and skills in all competences defined in the STCW Convention and Code. The students have to pass all of the part assessments in order to comply with the requirements for entering a final assessment. This is done as a quality assurance of the students` competence,

where a pass in every part assessment qualifies them for final assessment in each function. There are four functions described in the STCW – Convention and Code related to marine engineers and these requirements laid down by the maritime authorities must be complied with (see appendix 3 & 4).

Exam Process

To succeed in the exam process there are three requirements to fulfil in respect of design and contents (Muirhead, 2002).

- 1. The reliability of the exam results are not affected by randomness or coincidence, luck or bad luck.*
- 2. The exam has to be valid. The validity is to which degree the results correspond with the intention of the assessment objectives.*
- 3. It has to reflect to what extent the student has accomplished the objectives in the subject.*



Figure 5: The process of an exam

Written and Oral Assessments

Written and oral assessments are frequently used methods to evaluate competence because the ability to express both in a written and oral way is considered to be significant in a modern society. Accordingly, written and oral abilities are considered as overall objectives at university colleges. The method used in an assessment is dependent on the character and

objectives of the subject. Normally we relate a vocational subject to a practical assessment method, to achieve an optimal evaluation. In addition to the vocational abilities, it is important to have abilities to communicate and explain in a written or oral form. This is due to the fact that the perception of an individual's knowledge, understanding and skills often is based on the written or oral abilities (Hofset, 1995, p. 300). The result is a vocational ability assessed in written or oral form, where the perception of the student's written and oral abilities are compared with his vocational practical skills. This is a common perception among some teachers, but not a universal truth.

Many students have difficulty showing their competence in a written or oral form in an assessment. Although there is a focus on developing students' abilities to express themselves in these forms, there are still a large number of students with problems to express themselves with regard to this assessment method. Therefore this method is seen as an advantage to those with high ability to express themselves in a written or oral form, and a disadvantage for those with a lower grade of abilities. The assessment methods are usually based on a time interval where the students have to show their competence in three – five hours where many students experience a high level of pressure on themselves to demonstrate and show their actual knowledge.

Group Work and Project Work

Projects in groups or group work are usually assessed with a collective group grade, where one of the main objectives is to increase the ability to interact and help individual group members to achieve. This is common, but to some extent rather a controversial assessment method. Hofset (1995, p. 303) justifies this controversy with an emphasis on interaction and cooperation among the group members as a main objective, but from an evaluation point of view not rarely accounted for. In Hofset's (1995) opinion a group assessment is a typical example of evaluation methods where consideration related to learning objectives and assessment are conflicting, because it is difficult to evaluate the competence of each group member's competence. On the other hand, interaction in groups is designed to achieve a mutual goal that is common in most professions and therefore it is essential to develop these abilities among the students.

Arguments against group-related assessment include the lack of visibility of the student's individual competence level, described in the diploma. The prospective employer expects the level of competence described as a description of the student's individual competence but the grade is actually a description of a group competence.

If group- related work is used as a method in teaching and assessment a common problem is that some students lack inspiration and participation in the workload expected of them. Dissatisfaction of group member's effort or reluctance to add their part of the work will often lead to accusations or disagreement that creates friction within the group. Problems like this are often difficult to detect to an assessor because the external loyalty is often significant. If some of the group members decide to inform the assessor of other group members' bad working morale etc. it is hard to understand the full picture of the correct reality. The reason is the group members' diverging perception of participation and work effort.

With an individual oral or written assessment in combination with the group assessment, it is possible to evaluate a student's individual abilities. In objectives where it is important to determine a student's individual abilities, this is a commonly used method. Examples of combinations are when the group work accounts for 40 per cent of the grade and an individual oral or written assessment accounts for 60 per cent. As a final result these single grades will be combined into a final grade described in the diploma. This method is not frequently used in maritime education at Vestfold University College.

Practical Work and Simulation

Practical assessment, where the students demonstrate their competence by assembling an engine or overhauling fuel valves is not done at operational or management level at Vestfold University College. A more academic approach in teaching methods is used and therefore it would not be an appropriate method to demonstrate competence because of the wide deviation in teaching methods applied and this method.

As described earlier, STCW – Convention and Code approves simulators as a method for demonstrating competence. Simulators are the most realistic learning tool in the maritime education and they are comparable to real operations and processes on a vessel, and in that context it is related to practical work as an assessment method.

The simulators at Vestfold University College are utilized to a great extent in the education. According to Muirhead (2002) studies, simulators are the most significant educational tool to provide the students with a cognitive understanding of process and maintenance on board ships. Simulator training sessions are seen as practical training in a virtual world and the comparison to the aviation industry is direct and correct. The aviation industry has used simulators for many years to teach pilots to fly new types of aircraft by assessing their competence, and to practise in emergency situations that is impossible to do in reality.

Muirhead (2002) clarifies the importance of simulators as a learning tool provided the sessions are planned and conducted correctly. The training is so realistic and in his opinion, the simulator has an optimal effect to evaluate competence in a final assessment.

When simulators are used as a method to demonstrate competence, it is possible to evaluate students from a subjective or an objective point of view. The simulators have an optional program where the student's performance is measured in points and time. This is then calculated to a grade, depending on the student's achievement. This is an objective evaluation method where the assessor only is present to monitor the performance, but has no influence on the grade.

A subjective assessment method is when the assessor evaluates the student's execution of a task given on the simulator and asking questions to measure competence by reflections in the answers received. The assessor grades the student based on performance and reflections.

Method

This chapter aims to explain the choices I have taken and elaborate on the reasons for taking these choices in my research. The theoretical aspects concerning quantitative and qualitative methods are described and an explanation shows how the study is conducted. I have also prepared a research design to decide how to conduct and who and what to investigate. Further, ethics and quality are clarified to give credibility to this study.

Quantitative Research Method

Quantitative research methods aim to measure a phenomenon. The theory supporting quantitative methods explains that when measuring a phenomenon with a high degree of accuracy it is possible to achieve a higher level of reliability of a phenomenon in the research. Quantitative research is usually conducted in a controlled environment to achieve results with a high level of objectivity and unaffected by the surroundings. Quantitative work is more preoccupied with “preaching” the results, than describing them, as in qualitative research (Langdrigde, 2006).

In my study conducted on the students I have chosen to use quantitative research method because there is a total of 29 students. A qualitative research method among the students would create too much work both in the execution and the analysing parts. In addition, the text and data records are more structured in a quantitative study (Grønmo, 2007, p. 341). There are also benefits in a quantitative research with regard to a clearer and more structured base of information that facilitates the analyzing work in the respondents’ answers. In addition, it provides a greater possibility to compare the answers given from a greater number of respondents in a survey (Grønmo, 2007, p. 128).

Qualitative Research Method

Johannessen, Tufte & Kristoffersen (2010) describe qualitative research method as being well suited for studies of individual’s perceptions and not hard facts described in numbers. Qualitative research is based on textual data collection, for instance, by interviewing a small group of people, in a semi- structured or structured way. According to Grønmo (2007) the material collected in a qualitative content analysis is systemized by a selection of the contents in the text, with the aim of enlightening specific research questions. Because of the small number of teachers in the study, I chose to examine them more deeply to understand the answers given by the students. The teacher’s point of view could then be used to support or to argue against the data collected in the student survey.

Triangulation of Methods

As earlier described I have used two different methods in my research study. Both qualitative and quantitative methods with similar objectives collected simultaneously. Even if there are great differences between these methods they are often combined into a common analysis by using triangulation as a method (Ringdal, 2007).

Social studies are often based on a triangulation method by conducting different research methods simultaneously. Triangulation method involves a certain social phenomenon studied from different angles with different point of views. The purpose is to enlighten a research problem by a variety of data and methods. To increase the reliability of the conclusion it is important to combine several methods because perceptions and opinions in society-related research are often complex and diverse. The reason for increased reliability by using triangulation is, according to Grønmo, (2007, pp. 53 – 56);

1. Analyses based on different data and methods with identical results create a great confidence to the results reliability and validity.
2. Triangulation may form a basis to academic renewal if there is great deviation in the results based on different methods. This may stimulate new interpretations and may contribute to development and new approaches.

Quality of Research

The quality of research in social science data cannot be evaluated in a general way. The quality of the data collected has to be related to the purpose of the data. How related the data are to enlighten the research question depends on a number of factors (Grønmo, 2007, pp. 217 – 218).

1. The collected material has to be based on the principles of the research commitment of truth.
2. The data collection has to be based on scientific principles with regard to logic and language.
3. The selection of subjects in the study has to be selected with prudence.
4. The selection of desired information in a study has to be systemized.
5. The implementation of data has to be collected properly.

Credibility

To increase the credibility in my research process and results it is appropriate to use several sources to explore criteria that are related to evaluate my data collection and results. Grønmo (2007, p. 33) points out that credibility in a study is related to the credibility discovered in the empirical information of a study. This is information based on the collected data. It is significant that a researcher creates credibility for strengthening the analysing results. Therefore it is important not to reflect subjective judgements or randomness. Grønmo (2007) claims further that the research design is a significant factor in providing credibility to the research.

Reliability

If an observation or measurement is gauged with the same instrument repeatedly and the result is similar every time there is reliability in the results. The information in this thesis is collected in quantitative and qualitative methods by questionnaires and interviews. Johannessen et al. (2010) points out the importance of reliability in every research project. To strengthen the reliability of my study I have;

- Described how the data were collected
- Described the context of the collected data.

Further I will;

- Provide interested parties with the opportunity to obtain documentation related to data and method.
- Not let the results of the data collected be biased by my personal opinions.

Validity

Validity is the relation between the quality of the information collected and the research question. There are different forms of validity. Validity relevance in both a qualitative and quantitative research is termed obvious validity. Obvious validity evaluation is based on the understanding of pattern in the information collected and the result of the research problem (Grønmo, 2007, p. 221).

Competence validity is based on the scientist's competence in collecting information with quality. Grønmo (2007, p. 234) explains the degree of the scientist's experience and qualification in strengthening or weakening the validity of the results.

A high degree of communicative validity is significant when the information collected

is discussed. Dialogue or discussion among scientists or other individuals concerning the data's relevancy to the research question will strengthen the communicative validity. By communication it is possible to uncover problems or deficiencies in the data and then correct them (Grønmo 2007, p. 235).

In my research I have liaised with and been supervised by several colleagues holding special competences in order to achieve a high level of validity.

Ethics

To achieve a high degree of credibility the ethics in how studies are conducted is always significant. Johannessen et al. (2010) refers to Norway's own national committee with the purpose of enacting research ethical guidelines. These guidelines describe the responsibility a researcher has to take into account in research work. Grønmo (2007, p. 19) elaborates on research ethical norms which have been developed through the years. This includes seven points of ethical norms;

- Full transparency in the research work
- Organized scepticism and critical discussions
- The research is not supposed to be governed or controlled by stakeholders etc.
- The research has to be evaluated only from a professional point of view.
- The research is supposed to contribute with new knowledge.
- The researcher is supposed to be aware of and explicitly clarify his limits in his professional competence.
- The research has to be committed to the truth.

In the research I have done my best to comply with these ethical norms; the thesis will be presented and defended publicly in the University College auditorium. The research paper will be published in the University College library. Preparation of the questionnaire, interview guide and analyses are done with guidance from professionals and a supervisor at Vestfold University College. The research work is independent of the University's management or other stakeholders. By guidance and collegial assistance the independence in my research is increased to be more objective. The research contributes to new knowledge in maritime education at Vestfold University College.

Research Design

It was conducted two different surveys based on the research question. A questionnaire among the student`s and interviews among the teachers in the marine engineer department. The reason for conducting research with different methods is the difference in the number of participants in each group. According to Grønmo (2007, p. 56) it is also an advantage to combine quantitative and qualitative research to compensate for the weakness in each method.

The research is done to collect information on the students and teachers' perceptions regarding teaching methods, current final assessment form or optionally new forms of final assessment. It is of empirical character, where empiricism is characterized as information concerning actual conditions in the society, where this information is based on experiences of these societal conditions (Grønmo, 2007, p. 33). This description is transferable to the students, their educational conditions and their experiences and perceptions with methods used in teaching and final assessment today. At the same time, it provides information regarding their ideas of improvements in this subject.

The collected information, combined with pedagogical theory and previous research, will hopefully provide a greater understanding of the importance of the relation of teaching methods and assessment methods, and how this relationship can be improved to optimize assessment methods.

Questionnaire

The questionnaire (see appendix 1) also characterized as a survey (Grønmo, 2007, p. 127) was designed in a structural form and consisted of 27 questions divided into themes and then given to the students at operational and management levels. The questions were designed as statements and the student was able to answer in six levels, from totally disagree (1) to totally agree (6). Since there are different perceptions at each level, based on the difference in experience, the questionnaire was divided into operational and management level.

There were 18 respondents at operational level and 11 at management level. To be able to answer my research questions, it was crucial to design the questions with the right approach and content (Johannessen et al. 2010). To minimize linguistic misunderstandings in the questions, the questionnaire was compiled and issued in Norwegian. This is a significant factor to reduce misunderstandings of the perception in each question of the survey. Before each student was given the questionnaire they were informed of its purpose and the reason for the survey. According to Grønmo (2007), it is important to provide participants in a survey with this information. Information will create a deeper understanding among the respondents

to answer with a greater seriousness. If the respondents do not understand the purpose of the survey, it may create ignorance where the answers do not correspond with their true opinions. In an extreme consequence, it may result in wrong assumptions or conclusions in research. It is therefore important to provide the respondents with knowledge, background and purpose of the research (Halvorsen, 1987). Since this survey was conducted among students at marine engineering, in the second and third years, an interest is expected in this research as well as an understanding of the objective of this research. Experience in teaching and assessment methods applied in their education have formed their opinions and given them understanding in what is effective, ineffective, satisfying or dissatisfying. Thus a high level of seriousness is expected in the responses.

They were encouraged to answer the questionnaire as individuals and not to communicate during the session. As researcher I was present during this session.

The weakness in quantitative research is when the optional answers do not correspond with the respondent's perception. The result may be an incorrect answer regarding to the student's opinion. Further, comments may appear in addition to the structured answers given. This may create a conflicting analysis of the answers given, by the researcher. Among my respondents there were two questions in total, answered with comments. The comments are not taken into account.

Interview`s

Interviews were conducted among three teachers, teaching in theoretical subjects and using simulators at operational and management level. This method is referred to as a qualitative method, because it is conducted as a communicative process where the influence from the interviewer is minimized. According to Sander (2004) this method is especially useful when mapping or studying phenomenon and events for reasons we are unable to observe by ourselves.

The aim of the interviews was to detect the teachers' perceptions, experience and knowledge, regarding teaching and assessment methods. With their long experience and knowledge related to the profession, teaching and assessment, it was important to illuminate their opinions. The information in the interviews was applied in addition to the information received from the surveys, to use in a form of triangulation. According to Grønmo (2007, p 211) this contributes to strengthening the confidence in the results.

Prior to the interviews an interview guide with topics was prepared (see appendix 2). Each teacher was properly informed of the research purpose and intention. The implementation was done with a Dictaphone and is characterized as an unstructured form of interview, where the interview is conducted in an informal style. The interview guide made it easier to remain focused on the interviews purpose, in this case the teachers' opinions and perceptions of teaching and assessment methods.

Both the interview guide and the interview were based on the Norwegian language to reduce communicative linguistic barriers and to reduce incidents of misunderstandings between the interviewer and the interviewee. Further, the interview was emphasized to adapt a situation where the essence of elaborations was highlighted.

To receive useful and honest information it was important to create an atmosphere based on trust by spending time on building up confidence before the interviews. This was done by emphasizing my research as an independent work, in relation to my master degree education, with no connection to the University College management or any other stakeholders. Further, it was important to inform the participants of their anonymity, and not to create any fear of negative actions related to what they declared. The interviews were conducted individually to provide the participants with the opportunity to express them, based on their own perceptions and opinions.

Results

In this chapter I will present a summary of the results bearing the greatest significance to the research questions. This information will then be elaborated and discussed in the following chapter. The results are divided into three main topics split into operational level, management level and teachers groups, followed by comments.

The student group consisted of 18 ($n = 18$) respondents at operational level and 11 ($n = 11$) at management level. The questions are designed as assertions, where one (1) is totally disagreeing and six (6) are totally agreed. Further, the tables show mean values (σ) and deviations of the mean value (τ). To keep the teachers' identity anonymous their names are fictive.

Simulators as a Learning Tool

Muirhead (2002) clarifies in his study the importance of simulators in maritime education, provided the exercises are optimized in design and preparation. Hofset (1995) elaborates on the importance of learning effect by problem-based learning and Okan et al (2009) describe the importance of interaction between elements incorporated.

Students

Firstly, it was important to receive information from students and teachers concerning their perception of the simulator as a learning tool, the nature of the learning effect and their satisfaction with the exercises conducted.

Table 1:

Level:	Question:	Mean (σ):	Std. dev. (τ):
Op. lev.	<i>In my opinion, the simulator is an effective learning tool.</i>	5.72	0.461
Man. lev.		5.55	0.688
Op. lev.	<i>In my opinion, the learning effect is effective in time scheduled simulator teaching.</i>	4.83	1.383
Man. lev.		4.55	1.293
Op. lev.	<i>In my opinion the exercises in time scheduled hours on the simulator are very instructive.</i>	5.17	0.857
Man. lev.		4.00	1.342
Op. lev.	<i>In my opinion, the use of simulators is a factor to increase my competence to do my work better in my forthcoming profession.</i>	5.72	0.461
Man. lev.		5.45	0.82
Op. lev.	<i>In my opinion, the learning effect is high where simulators are combined with written tasks, projects and calculations.</i>	3.61	1.577
Man. lev.		4.18	1.888

The survey shows that both the students at operational and management level opinion are positive towards the simulators as an effective learning tool ($\sigma_o = 5.72$, $\sigma_m = 5.55$) in the education. At operational level the student's perceptions of the learning effect in scheduled hours is slightly more positive than at management level ($\sigma_o = 4.83$, $\sigma_m = 4.55$). Students at operational level are more satisfied with the learning effect related to scheduled simulator exercises ($\sigma_o = 5.17$, $\sigma_m = 4.00$). Students from both levels indicate the simulator as an

important learning tool, in relation to being more competent in the work in their professional career ($\sigma_o = 5.72$, $\sigma_m = 5.45$). Although both groups show a positive perception of the simulator as an effective learning tool, there are no significant results which enhance learning effect by written tasks, calculations, projects in combination with the simulator ($\sigma_o = 3.61$, $\sigma_m = 4.18$).

Teachers

Illeris (2009) believes in three dimensions in the learning process and describes the cognitive acquisitions, psychodynamic process and a social process. The social process describes the interaction between individuals, which is related to the cognitive acquisition process achieved in an individual. To optimise the students' learning effect, teachers have to be a significant part in the social process, so that the students are able to achieve a satisfactory level of learning.

The perception of teaching methods and how to conduct a satisfactory setting to achieve effective learning are important to illuminate from different angles. In the interviews with the teachers I have therefore emphasized their perceptions of a simulator as a learning tool.

Mr. Smith: *“The students learning effect is very good and significant, but actually it could be better. With a greater number of teaching hours in simulators and more of the theory related to the simulators, the learning effect would be improved even more. This is of course a question of financing because simulator exercises are far more expensive than lectures. In addition, the simulator laboratory is not equipped to conduct exercises with a full class. The students have to sit together, in groups of two at each simulation station, which results in lack of individuality in the exercises. The result is a reduced learning effect which is revealed in the compulsory assignments. We are strict regarding the student's attendance in scheduled simulator exercises because it is such a significant part of the education. Another problem is the simulator laboratory's design and the supply of fresh air when the number of students present is too high. The temperature rises and the air quality falls below acceptable limits. The result is students with headaches and loss of concentration after a while”.*

Mr. Johnsen: *“The learning effect is very good and it is not a question of reducing the number of lessons on the simulator, it should actually be increased. This is relevant at both levels, but especially appropriate at operational level. Learning effect*

both in lectures and simulators can be increased by a better understanding of systems and processes learned in simulator exercises, which in turn gives a synergy effect in theory lessons and vice versa”.

Mr. Hansen: *“The learning effect is satisfactory, but the number of simulator stations available in the simulator lab is a problem. The students have to sit in groups of two and this might be a factor that reduces the learning effect. The result is some students becoming inactive. They are only watching their fellow student, without thinking or learning.*

Especially at operational level the student’s competence is in some cases not as required. Some of these students pass the mandatory tests, maybe because we are not as strict as we should be regarding these assignments. They do not have the competence expected, at this level, but have still passed the assignments. It is therefore important to conduct these assignments in a more formal setting, to control their competence in a better way. I suppose it is the human factor that kicks in, because we do not want to lose many students in the education”.

There are no results that enhance the students’ perceptions regarding learning effect by combining calculations, group tasks or projects into simulator exercises at operational level ($\sigma_o = 3.61$). The results among students at management level are slightly more apparent ($\sigma_m = 4.18$). Evidently, their perception of a combination of methods is slightly more positive.

In the interview with the teachers it was also important to reveal how or if teaching methods in combination are conducted on both levels.

Mr. Smith: *“I am concerned with simulator teaching because I have utilised the simulators as a tool in combination with theory. As an example, the students are theoretically calculating on different conditions, based on the simulator’s parameters. This is a much better approach than calculating directly from a textbook because the students have to calculate and then evaluate the calculations according to the simulator’s parameters. These parameters are up to date and are comparable to real parameters. Calculations concerning rate of excess air or heat balance of an engine are examples of calculations done by the students where the calculations are controlled by the simulator’s parameters. To be more specific, by means of the MC 90 simulator, we conduct heat balance calculations on the main engine and boilers. The students exercise is to calculate, evaluate and control their calculations on the*

simulator. The calculations done by the students must not deviate more than two per cent from the simulator's parameters, and usually correct results are achieved from students following the correct procedures. To summarise, it is my intention to link up the theoretical teaching with the simulator to learn more theory. That is the reason for my desire for increased time for scheduled simulator lessons. This discussion is related to the students especially at management level.

At operational level the exercises and lectures are based more on theoretical facts and the learning of process and procedures. Finally, I will emphasise the importance of the simulators as a learning tool, to provide the students with the knowledge and understanding in these major complex systems which they will face on a modern ship. It is 100 per cent certain, even more complex tasks at the simulator, even better”.

Mr. Johnsen: *“In my opinion it`s an important combination which provides effective learning. The students are analysing data in simulator exercises and in addition they have case studies including calculations. Parameters as pressure, tension, speed, fuel consumption and analysis are performed as projects in combination with the simulator. There are several examples to refer to. In case studies like this, all these elements are implemented. The students have to use simulators to analyse and calculate. This is mostly done at management level. At operational level the focus is related more to process and procedures and therefore case studies and calculations are relevant”.*

Mr. Hansen: *“At operational level where I have performed most of my teaching, this is not used as a teaching method. We are of course doing some troubleshooting and related to that, they have to submit reports. I believe there is a potential to develop tasks and case studies, also at this level, but it is mostly conducted at management level”.*

According to the teachers, simulators are a satisfactory learning tool and simulator exercises provide effective learning. They point out the potential of a greater learning outcome in the education if the proportion of teaching with simulators had been greater. If so, the theory could be more related to simulator exercises. To achieve an education with a greater proportion of teaching where the theory is applied and more integrated into simulator exercises, the University College has to make some changes. They substantiate it with the

number of simulator stations which is too low and a combination of reduced air quality and high temperatures in the simulator laboratory when they are working. In the teachers' opinions, this is related to economy at the University College or the management's lack of understanding of the simulators importance in maritime education.

Because they have to work in groups of two, it's hard to detect active or inactive students in the groups. Nevertheless, there are mandatory assignments in the course program where the student has to demonstrate competence. There is always a possibility where students without the required competence pass because of the informal assignment method applied. This can cause problems achieving a pass in the final exam for some students. This is especially related to the students at operational level.

Calculations, written tasks, and projects in combination with the simulators are performed at management level, and according to the teachers this provides a great learning effect. At operational level this combination is not applied to the same extent, because they are more focused on learning of actual data and processes, so called basic knowledge and understanding.

Final Assessment

I have described the simulator as the “hub” in learning and education, where teaching related to simulators are the closest to the “real thing”. Studies conducted in vocational professions at University Colleges describe a significant problem in part assessment and final assessment methods, and the relation to its profession. Fosbæk (1997) describes problems with using only a written assessment method in vocational professions. In his opinion assessment based on a written test only is insufficient to measure student’s practical and theoretical overall competence.

Students

My aim was to examine the student’s satisfaction with the final assessment method, which only consists of a written test. Further, I wanted to examine if they perceive this method as a satisfactory method, to show their overall competence. The following questions were asked;

Table 2:

Level:	Question:	Mean: (σ):	Std. dev. (τ)
Op. lev.	<i>In my opinion a written exam is a satisfactory method to demonstrate competence.</i>	4,67	1,237
Man. lev.		3,18	1,722
Op. lev.	<i>In my opinion, there were an excessive proportion of calculations in the function 1- marine engineering exam.</i>	4,28	2,052
Man. lev.		4,64	1,859
Op. lev.	<i>In my opinion, the content in the written exam gave me an opportunity to demonstrate my overall competence.</i>	3,17	1,724
Man. lev.		2,91	1,868

This part of the survey shows that the students at operational level are more satisfied with a written exam as an assessment method than the students at management level ($\sigma_o = 4.67$, $\sigma_m = 3.18$). Both group`s perceive the contents in the final assessment as slightly narrow because there are too many calculations ($\sigma_o = 4.28$, $\sigma_m = 4.64$). There were no significant results that support the statement of a written final assessment as a satisfactory method to show overall competence ($\sigma_o = 3.17$, $\sigma_m = 2.91$).

Teachers

The assessment methods used are determined by the teacher, in each function. If there are multiple teachers in a function, they decide together which assessment method to use. The most common final assessment method at Vestfold University College, marine education, is a written test. As earlier described there are several reasons and considerations related to this approach. In my research I wanted to examine the teacher's perceptions of this method regarding a satisfactory means of overall competence evaluation and the student's ability to demonstrate competence;

Mr. Smith: *“I don't think the students ability to demonstrate their competence is satisfactory by only conducting a written test. There are student`s which have shown a high level of competence during the education, but in the final written assessment, they have almost failed. For these students the written method is not satisfactory because there is a great deviation in the performance during the year and at the final assessment. I remember especially a student from last year. He lost all his abilities to demonstrate competence at the final assessment, and unfortunately he failed. He had demonstrated 100 per cent competence during the year. He was even an assistant teacher to third parties in simulator sessions. In my opinion his competence was at an engineer's level and he was absolutely able to work for the merchant fleet. Actually, we have discussed a combination of methods to demonstrate competence and assessment methods because of the problems mentioned.*

The overall competence evaluation is poor. It's not possible to evaluate the students' overall competence by this method alone. We are only evaluating a few competences in a narrow way at the final assessment”.

Mr. Johnsen: *“The overall competence evaluation is an important issue. In my opinion, a written assessment is not a satisfying method for evaluating overall competence. I should add that the final assessment is not the only assessment to demonstrate competence. There are mandatory part assessments during the course program. Of course, the grades awarded for these assessments do not appear on the college diploma, but still they have to pass all of them, both as written tests, projects and in combination with the simulator, to qualify for the final assessment. Many students have great problems to achieve a pass grade in these tests. To optimise the credibility on the part assignments, and to achieve a greater overall competence*

evaluation, we have to conduct the part assignments in a more formal setting. This is related to financial recourses at the University College. According to the Norwegian Maritime Authority, there are no guidelines concerning methods to demonstrate competence in the course program”.

Mr. Hansen: *“In my opinion a written final assessment as a method is a bit narrow. The grade from the final assessment should be supported by grades from part assessments and then combined to give a final grade. Some of my students are able to achieve B`s on all of their part assessments, but still don`t achieve a higher level than a D on their final assessment. That`s wrong!*

The contents and how the questions are designed in the final assessment are important to achieve an evaluation of relevance. In my opinion a written final assessment is not an optimal way of demonstrating overall competence. In relation to all the teaching methods used in the education my wish is to conduct the final assessment in other forms or a combination of other forms”.

According to the teachers it is not possible to evaluate overall competence by means of a final written assessment, but the competences included in the assessment are satisfactorily evaluated. The students` stress level, abilities to express themselves or other causes are factors that reduce some student`s abilities to achieve in the written final assessment. Some of the students, apparently with satisfactory levels of competence, have great problems to demonstrate this competence at the final assessment. According to the teachers it is also important to design the assessment appropriately with relevance to gauge the competence in the right way.

Simulators as Assessment Method

The survey shows a greater satisfaction with a written assessment to demonstrate competence among the students at operational level, than the opinions held by students at management level ($\sigma_o = 4.67$, $\sigma_m = 3.18$). This does not conclude which method or combination of methods they would prefer if they had the possibility to choose. Firstly, I wanted to examine their opinion of utilising the simulator in a final assessment. Secondly, I wanted to examine their perceptions of what influence the use of simulators would have on their grades.

Table 3:

Level:	Question:	Mean: (σ):	Std. dev. (τ)
Op. lev.	<i>In my opinion, it is important to use the simulator to demonstrate competence at the exam.</i>	3,33	1,97
Man. lev.		5,45	0,82
Op. lev.	<i>In my opinion, my grades had been improved if the simulator had been used at the exam.</i>	3,11	1,745
Man. lev.		4,64	1,567
Op. lev.	<i>In my opinion, the average grades in the class would be improved in the exam by using the simulator or the simulator in combination with other methods.</i>	3,67	1,715
Man. lev.		4,90	1,197

Students at management level show a significant interest in utilising the simulator in a final assessment ($\sigma_m = 5.45$). They believe to some extent an improvement in both their own grades ($\sigma_m = 4.64$) and the average grade in the group ($\sigma_m = 4.90$).

The survey at operational level does not provide a significant result regarding utilising the simulator in the final assessments ($\sigma_o = 3.33$). The answers do not provide any significant results regarding their own grades ($\sigma_o = 3.11$) or the average grade in the group ($\sigma_o = 3.67$). The standard deviation was significant regarding the three questions ($\tau_o = 1.97$), ($\tau_o = 1.745$), ($\tau_o = 1.717$). This is a result of a wide deviation in opinions in the group.

Choice of assessment method

Finally, in my research among the students I wanted to examine which method they perceive as the optimal method to demonstrate overall competence. There were six options, plus one to combine their own alternative. The students were urged to only select one alternative and the following result emerged;

Table 4 - Result Operational Level:

Assertion:

In my opinion the best assessment method to demonstrate overall competence in function 1-marine engineering is (select only one option):

Option:	Result:
Only oral assessment	0
Only written assessment	8
Only assessment by simulator	0
Written assessment in combination with simulator	6
Combination of oral assessment, written assessment and assessment on the simulator	2
Combination of oral assessment, written assessment, assessment on the simulator and project.	0
Another combination;	2

At operational level eight out of a total of 18 students (44.4%) selected only written assessment. The remaining students (55.6 %) selected other alternatives, but all of these students chose options where the simulator is involved.

Students that selected “*another combination*” made the following proposal; One student selected a combination of written assessment, project and part assessment during the year as a final grade and one selected only part assessments during the year as a final grade.

Table 5 - Result Management Level:

Assertion:

In my opinion the best assessment method to demonstrate overall competence in function 1-marine engineering is (select only one option):

Option:	Result:
Only oral assessment	0
Only written assessment	1
Only assessment by simulator	0
Written assessment in combination with simulator	5
Combination of oral assessment, written assessment and assessment on the simulator	2
Combination of oral assessment, written assessment, assessment on the simulator and project	3
Another combination	0

At management level there is one student (9.1 %) selecting only written assessment. The remaining students (90.9 %) select a combination of assessment methods involving simulator.

Teachers

As earlier described, there are several conditions and factors related to the reasons why only a written assessment is applied. I wanted to examine the teachers' opinions concerning an optimal method to evaluate overall competence and if and why another method would have any impact on the students' grades.

Mr. Smith: "Yes, by a combination of assessment on the simulator with a written assessment and oral assessment, we would be able to evaluate the student's competence in a much better way. We are using these methods today by conducting part assessments, but they don't have any impact on the final grade. A pass only allows the students to participate in the final written assessment and it's only the grade on this final assessment that describes the student's final competence. I think a greater number of the students would pass by means of a combination of assessments because it would provide a greater involvement and interest in the daily-based education. Maybe they would be pushed to a greater performance in all methods conducted. For instance, a motivating factor in simulator exercises is grading their

competence by demonstrating it on the simulator. This grade could be a part of the final grade in the function”.

Mr. Johnsen: *“An optimal method for an overall evaluation of the students would be a combination of assessments on the simulator, a project, and a written test. This combination of assessments would result in a final grade.*

I don’t think a different way to conduct the assessment would have any impact on the grades. The students with interest in the subject provided to them will pass this education anyway”.

Mr. Hansen: *“A written test in combination with assessment on the simulator is the best way to evaluate the student’s overall competence. Simulators are the most realistic learning tool in the education and in some respects it is comparable to a merchant ship.*

It’s hard to answer if a different assessment method would have any impact on the students grades. In 2013, there was a 42 per cent failure rate in the final written assessment, at operational level. In 2012, there was a 15 per cent failure rate. It’s not easy to relate these numbers to the method or students or other factors”.

All three teachers believe in a final assessment where the simulator is involved, in combination with other assessment methods such as oral assessment, projects and written assessment, to achieve a greater overall competence evaluation.

One teacher believes in a positive development in involvement and motivation among the students by grading the part assessments and then using these grades in a combination with the grades achieved at the final assessment. In his opinion this would result in an increase in the pass rate in the final assessment.

One teacher believes a combination assessment would not have any impact on the results because all the students interested in the topics would pass anyway.

One teacher points out the high failure rate in last year’s final assessment (42%), but in his opinion it’s hard to put the finger on the factors causing this high number of failures. He believes it’s difficult to “predict” how a new combination of assessment methods would impact the grades.

Discussion

Based on the themes in the thesis and the research questions, some basic questions have emerged to discuss; What are the students and teachers' perceptions of teaching methods conducted today? Is the current assessment method providing the teachers with a satisfactory overall competence evaluation, and are the students satisfied with only a written assessment to demonstrate overall competence? Which assessment methods do the teachers think would provide the best overall competence evaluation and what kind of method do the students choose to demonstrate competence?

In this chapter I will discuss the results generated from the survey and interviews. Theory and studies presented in previous chapters are applied to elaborate and support my discussion.

Teaching Methods

The survey shows that both students at operational level and management level are positive to the simulator, as an effective learning tool. Hofset (1995) describes the positive effect of cognitive learning by a practical approach in teaching and in marine engineer education simulators are the most realistic learning tool in many ways to this practical approach. Studies conducted by Muirhead (2002) shows that learning by practice on simulators provides a combination of a higher level of professional knowledge, and a greater understanding of the working situation they will encounter in their future.

Bloom's taxonomy divides knowledge into five different quality levels. The majority of the students at operational level begin their maritime education without any basic or practical knowledge related to their forthcoming course programs. Hence a significant part of the first year is based on basic learning such as occupational terminology, description and function of technical equipment and learning of start - up procedures given in lectures and on the simulator. A major part of the knowledge learned at this level is based on the levels of *remembering*, *understanding* and *applying*, described in Blooms taxonomy.

Simulator training creates confidence in practical related situations because procedures performed incorrectly do not result in any economic or practical consequences. As a result, they are able to practise in an environment where they are confident and where it is possible to create individual settings to optimize the learning process.

Bloom describes the two highest levels in the taxonomy as using knowledge to *analyse* and *evaluate*. Late in the educational year at operational level, and at management level the simulator exercises become more complex where the students are challenged to analyse and evaluate results as a consequence of their planning before and actions during the

exercises. This is a significant element in the learning process because knowledge, skills and attitude objectives are more implemented in this method of teaching. An additional advantage is the individual or group discussions with the teacher that are related to the students' results and their perceptions of these results. These discussions are important to do during or shortly after the exercises to increase the students' knowledge and their skills level, to affect their understanding of their actions. This is also strengthening their attitude to their actions and their careers.

Hiim and Hippe (2003) have pointed out problems with relevance in vocational education. This is because the traditional teaching is often perceived as less meaningful to the profession the students are supposed to perform in the future. Wenger (2004) believes that by social participation the individual's learning outcome is better in a practical setting. By simulator exercises the approach to the professions reality is significantly greater than by traditional teaching. This may cause the positive perceptions among the students learning and the learning effect in simulator- related teaching, and their perceptions of performing their prospective jobs in a better way. This is also a significant element in the student's motivation to learn and in the learning process that is confirmed by the teachers.

The students at operational level perceive the time scheduled teaching on simulators as more instructive than what was declared by the students at management level, but both groups agree when rating the importance of this teaching.

The reason for the deviation in these two groups may be related to external conditions and different levels in the education, and thereby different levels in the learning process. As previously described, exercises at operational level are mainly based on learning procedures and gaining a basic understanding of the technical systems on board ships. Students are more dependent on the teacher's support and guidance in every part of the exercises. This is caused by their knowledge level and therefore there are two teachers present in the training at this level. The learning outcome in this phase of the education will therefore be perceived by the students as more effective than at management level.

At management level they are expected to be more independent and self – reliant. This is related to problem- based learning, where studies conducted are positive to the diversity of elements learned and the learning effect by using this method. To achieve a satisfactory result the teaching has to be planned and performed correctly by the teachers, and motivation among the students has to be good. The teachers elaborate this with a low level of motivation among some students, and/or other external conditions, inter alia economic conditions, resulting in too few teachers present at the simulator exercises. Some students at management level will

therefore not get the help and guidance they expect.

Theory applied to practical teaching is seen as a good way of learning. I wanted to reveal the students' perception of their learning effect by applying calculations, projects and group tasks related to the simulator teaching. Students at management level are partly satisfied with the learning effect of this method. According to the teachers a large part of the tuition is based on problem-based learning in the form of smaller projects and calculations to perform. It is hard to pinpoint the result, but some reasons may be the adaptation of the teaching, the design of projects and calculations or the students' ability to utilise problem-based learning as a method. In addition to these reasons it cannot be ignored that some students are tired of simulator training at the end of their education, and therefore have a perception of a lower learning effect.

Students at operational level show a neutral attitude to the learning effect by applying theory to simulator exercises. This may relate to the teaching and learning process used at this level. According to the teachers they are working less with learning where projects, group tasks and calculations are related to the simulator exercises. Therefore they may not perceive this question as having any significant relevance to their education.

Written Assessment as Method

A written test as an assessment method is the most common way to evaluate student's competence because the ability to describe and express in writing is an overall objective in every profession (Hofset, 1995, p. 300). The students at Vestfold University College are no exception in this case, but a significant number of students express their difficulty in demonstrating competence by this method.

A large part of the students at operational level have described the final written assessment as a relatively good method to demonstrate competence, but they are not satisfied with the contents in the assessment. In their opinion the content was too narrow to demonstrate an overall competence because an excessive proportion of the assessment was calculations. A greater diversity in the tasks where the contents are fewer calculations and more theoretical questions; where the students have to describe technical systems and the functionality of these, would be more appropriate. The rest of the group are hardly satisfied with this assessment method. In their opinion, it is not possible to demonstrate an overall competence, compared with the topics in the function conducted by the daily based teaching.

Most of the student's at operational level have limited or no practical experience. The teaching is therefore designed and conducted based on their lack of basic knowledge and

experience. Basic learning at description and understanding levels is necessary and this is a significant factor in the design of the teaching. Lectures containing theoretical tasks, where the students have to describe and calculate, are often applied. In addition, a significant part of the part assessments is conducted by a written test. Although the simulator is implemented in the teaching, the students are aware of the written part and final assessment used. Illeris (2000, pp. 16 -23) describes learning in three dimensions and in his opinion learning can be considered and analysed, based on three different angles. The learning is then a result of a cognitive process. The cognitive process in the student's brain is dependent on which methods are employed in the teaching and at assessments during the year. By mainly performing written tests they may perceive this as a more acceptable method and may cause a factor which highlights their satisfaction with written assessment.

At management level the students are significantly more critical to demonstrate competence in only a final written assessment. They perceive the assessment as too narrow with an excessive proportion of calculations and therefore an assessment that does not give them the opportunity to demonstrate practical skills and understanding. According to the teachers, they are working with projects, group tasks and calculations related to the simulator especially in problem- based learning settings. This method contributes to a higher level of knowledge where the students can participate, resonate and solve problems in a professional environment. At the same time, this teaching method and part assessments methods performed at the simulator deviates from the written assessment form. The teachers confirmed this problem in their interviews. They have discussed new methods to conduct assessments at this level.

The management student's opinions are an assessment method where they are not given the opportunity to demonstrate overall competence. This may relate to the aberrance in teaching and part assessment methods and final assessment method, or the students believe in the fact that knowledge is more related to skills. For some students, it is difficult to demonstrate practical knowledge and skills in a written assessment. Therefore it is a disadvantage to the students with a lower ability to academically demonstrate competence.

The students' teaching is more related to the simulator at management level, where they also have to demonstrate knowledge and skills. This may cause dissatisfaction among the students because a major part of the teaching is related to practical knowledge and skills, but not demonstrated in the final assessment.

Choice of Assessment Method

The methods used are in many ways an essential factor to the results achieved in an assessment. In Fosbæk's (1997) opinion it creates problems in the education when a final assessment in vocational education is only conducted by a written test. In his opinion this is an inadequate form of evaluation of the student's practical knowledge and skills. An assessment form based on a combination of practical tasks and a written description where the students have to elaborate their actions and choices would provide a greater overall competence evaluation.

Students at operational level perceive the final written assessment as positive, but in their opinion the contents are too "narrow". The group is divided in their opinions of the use of a simulator in a final assessment. 44.4 per cent of the students would choose only a final written assessment if they had the opportunity. The relation between their satisfaction and the present method is significant among these students. The reason may not be a written assessment as the best method to demonstrate overall competence, but their belief in their abilities to demonstrate competence by theoretical questions and calculations. According to the teachers some of these student's abilities to demonstrate competence at the simulator are poor. They may expect complex simulator tasks at the final assessment resulting in a lower grade. The result among this group of students regarding assessment related to the simulator is therefore natural.

The other part of the group at operational level believes in a combination of written assessment and simulator, optionally in combination with other assessment methods. This shows that almost 100 per cent of the students want to demonstrate their competence in a written assessment, but 55.6 per cent of them want to conduct it in combination with the simulator and other forms. This is an indication of an unsatisfactory demonstration of overall competence by only a written assessment in this group.

The teachers believe that a combined assessment involving simulators and other assessment forms will improve the quality of the overall competence evaluation. They believe this would result in less deviation of the students' final grades related to the part assessments.

The results at management level are different from the results at operational level. There is only one single student that prefers only a written assessment while there are ten students preferring a combination of simulator and a written assessment or several methods in combination with these two. A study conducted by Feltovich et al. (1996) shows that students have problems related to remembering what they have learned after a while. They are not able to apply the knowledge they have achieved and utilise it when necessary. In addition, there is

a great deal of students that do not know their actual competence. Studies done by Feltovich et al. (1996) show an improvement by conducting problem-based learning. This indicates that the students at management level are more aware of their competence than the students at operational level because their teaching consists of more problem-based learning. This may have created a greater awareness of which assessment methods provide the greatest overall competence evaluation.

Limitations

Basically my research was based upon teaching methods and exam forms. The exam form or combinations of different forms are also essential to the quality of the total competence evaluation and there are of course peculiarities in every different field of studies. In my thesis I have chosen to limit my research to Vestfold University College, Maritime department for marine engineers, operational and management level. Further, I have chosen to limit my research to one function in each level, which is marine engineering at operational level (STCW – Convention and Code, 2010 p. 143 -145) and marine engineering at management level (STCW – Convention and Code, 2010 p. 153 – 155). In another context it could be interesting to do this research in a wider perspective, where all the maritime university colleges in Norway are incorporated with all four functions related to the STCW code and Convention.

As a marine engineer teacher it is vital to have a deeper knowledge and understanding of how the pedagogical functions are related. It is also my wish that this master thesis will be interesting reading for other teachers in my own and other university colleges.

The theory in the thesis is to a large extent controlled by the contents of the data collection which was gathered to obtain answers to my research questions. In order to make a reliable analysis of the results, I have chosen to thoroughly review the theory that appeared in the collection. The result is a few theoretical perspectives used in this thesis, where the theory used is given a qualitative description.

To do research among colleagues and students on my “home ground” may present some challenges. It is always difficult to criticise or pinpoint unsatisfactory conditions, especially when involving your own colleagues or the organisation. In my research I have involved both colleagues and students to illuminate my research questions. Even though efforts have been made to maintain objectivity, there is no guarantee of results with absolutely credibility, because the results may reflect my connection with the respondents.

The number of respondents in the survey is to some extent limited and therefore may

affect the result of the research. A larger number of respondents creates a stronger equalisation, and then as a result, greater reliability.

Competence validity describes the researcher`s level of competence, to collect data with quality. The researcher`s level of experience, prerequisites and qualifications are factors which enhance or impair the validity of the results (Grønmo, 2007, p. 234).

My experience in research work is relatively limited. To enhance the validity of my research I have received guidance from several colleagues with special competence in various fields. This is also described as communicative validity. When enhancing communicative validity it may result in greater competence validity.

Conclusion

The study reveals some differences between learning methods conducted at operational level and at management level. Both levels are using the simulator as a learning tool but teaching at operational level involves more basic learning, and is therefore to a wider extent conducted as “traditional” teaching. The students at this level are moderately satisfied with only a written exam as a method to demonstrate competence and they believe the scope of contents is too restrictive.

At management level the teaching is more based on problem- based learning. This creates a greater inequality between teaching methods and exam methods, and as a result, less satisfactory for only a written exam.

The teachers point out the differences in teaching methods and assessment method as a problem among some students because it creates a deviation between grades in part assessments and in the final exam. They do not believe that a written exam as the only method is satisfactory to evaluate the students.

The study shows that students at operational level are neutral to introduce simulators as an assessment tool, but 55.6 per cent of the group believe in an improvement of demonstrating overall competence by combining simulators in an exam with other methods.

Students at management level believe an exam involving simulators combined with a written exam would provide a better total competence demonstration.

Teachers at operational and management level believe that assessment methods where simulators are involved in combination with other forms would provide a better total competence evaluation.

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Appendix

Appendix 1 – Questionnaire students

Voluntary questionnaire regarding final exam methods and teaching methods conducted in maritime education.

The purpose of this questionnaire is to collect information from maritime students on the topic of methods used in final exam in **function 1 – machinery**, compared to pedagogical methods used in the lessons. The result of the material is to be used in a master thesis at Vestfold University College. The results of the survey will only serve as a part of a master thesis, which will be accessible for the general public at the university. Any participation is purely voluntary, so there is no obligation to participate, nor are there any consequences in participating or not participating in this survey for the individual participant. All participants will answer anonymously on the questionnaires. There will be made no identification basis name, age, sex or by any other means other than the name of the class.

All questions in the questionnaires are answered by setting an “X” in the boxes. The results of the questionnaires will only be available as a part of the master thesis and not in any other way. Once the responses to questions have been digitalized, the originals will be destroyed.

Jørn Otto Nilsen

I denne spørreundersøkelsen skal du gradere hvor enig du er I følgende påstander:

1. Jeg benytter simulatorene mye på fritiden bare for å lære.

Uenig Enig

2. Jeg benytter simulatorene mye på fritiden i tilknytning til pålagte studiekrav i funksjon 1 – maskineri.

Uenig Enig

3. Vi benytter simulatorene for mye i den timeplanlagte undervisningen i funksjon 1 – maskineri.

Uenig Enig

4. Vi benytter simulatorene for lite i den timeplanlagte undervisningen i funksjon 1 – maskineri.

Uenig Enig

5. Vi må benytte simulatorene for mye på fritiden, for å klare studiekravene, i faget funksjon 1 - maskineri.

Uenig Enig

6. Jeg synes simulatorene er et godt verktøy for å lære, i faget funksjon 1- maskineri.

Uenig Enig

7. Jeg lærer mye i den timeplanlagte undervisningen når vi har øving på simulatorene, i funksjon 1 – maskineri.

Uenig Enig

8. Jeg synes øvingsrekken som det er lagt opp til i funksjon 1 – maskineri på simulator er lærerik.

Uenig Enig

9. Jeg mener bruk av simulatorer i utdanningen vil gjøre meg mer kompetent til den jobben jeg skal gjøre til sjøs.

Uenig Enig

10. Jeg får konsentrert meg godt når vi har øvinger på simulatorene i funksjon 1 – maskineri.

Uenig Enig

11. Jeg synes jeg får tilfredsstillende med hjelp fra faglærerne i simulatorøvingene.

Uenig Enig

12. Jeg lærer mye ved å bruke simulatorer i tilknytning til skriftlige oppgaver, prosjekter, og beregninger.

Uenig Enig

13. Jeg lærer mye av skriftlige oppgaver, prosjekter og beregninger som ikke er tilknyttet simulatorene, i faget funksjon 1 – maskineri.

Uenig Enig

14. Jeg synes det skulle vært mer teoriundervisning og mindre simulatorøving i den timeplanlagte tiden i funksjon 1 – maskineri.

Uenig Enig

15. Jeg synes ikke det skulle vært simulatorundervisning i vår maritime utdanning.

Uenig Enig

16. Jeg synes skriftlig eksamen er en god måte å ha eksamen på i faget funksjon 1-maskineri.

Uenig Enig

17. Jeg får vist hvilken kompetanse jeg har på en god måte, ved skriftlig eksamen, i faget funksjon 1 maskineri.

Uenig Enig

18. Jeg synes skriftlig eksamen passer bra med alle de undervisningsmetodene (simulator, prosjekt, oppgaveløsning etc.) vi benytter i faget funksjon 1 – maskineri.

Uenig Enig

19. Jeg synes det er vanskelig å beskrive det vi lærer på simulatorene, på en skriftlig eksamen i faget funksjon 1 – maskineri.

Uenig Enig

20. Jeg gjorde det bedre enn forventet på den skriftlige eksamen i faget funksjon 1 -maskineri.

Uenig Enig

21. Det var for mye beregningsoppgaver på den skriftlige eksamen i faget funksjon 1 – maskineri.

Uenig Enig

22. Jeg synes innholdet i den skriftlige eksamen gir en god oversikt over min helhetlige kompetanse, i faget funksjon 1 – maskineri.

Uenig Enig

23. Jeg synes vi også skulle brukt simulatorene for å vise vår kompetanse på eksamen, i faget funksjon 1 – maskineri.

Uenig Enig

24. Jeg hadde fått bedre karakter, i faget funksjon 1 – maskineri, hvis simulatoren også var benyttet på eksamen.

Uenig Enig

25. Jeg mener den beste måten å vise helhetlig kompetanse på eksamen, i faget funksjon 1 - maskineri på er (Velg kun et alternativ):

- Bare muntlig eksamen
- Bare skriftlig eksamen
- Bare eksamen på simulator
- Kombinert eksamen med simulator og skriftlig eksamen.
- Kombinert eksamen med simulator, muntlig høring og skriftlig eksamen.
- Kombinert eksamen med simulator, muntlig høring, prosjekt og skriftlig eksamen.
- Annen kombinasjon;

.....

.....

.....

26. Jeg mener at snittkarakterene på eksamen for klassen i faget funksjon 1 – maskineri hadde blitt bedre ved å benytte en -eller flere andre metoder på eksamen i faget funksjon 1 – maskineri.

Uenig Enig

27. Jeg mener at snittkarakterene på eksamen for klassen i faget funksjon 1 – maskineri hadde blitt dårligere ved å benytte en -eller flere andre metoder på eksamen i faget funksjon 1 – maskineri.

Uenig Enig

Appendix 2 – Interview guide Teachers

Interview guide – Marine engineer teachers

The purpose of this interview is to collect information from marine engineer teachers on the topic of methods used in final exam, compared to pedagogical methods used in the lessons in function 1 - machinery. The result of the material is to be used in a master thesis at Vestfold University College.

The results of the interviews will only serve as a part of a master thesis, which will be accessible for the general public at the university. Any participation is purely voluntary, so there is no obligation to participate, nor are there any consequences in participating or not participating in this interview for the individual participant. All the participants' will be anonymous in the master thesis and not published in any connections with this interview.

Jørn Otto Nilsen

1. Hvor lang fartstid har du før du begynte som lærer?
2. Hvor mange år har du vært lærer?
3. Hvordan mener du din yrkesbakgrunn virker inn på din undervisningspraksis?
4. Har du noen pedagogisk utdanning – i tilfelle hva?
5. Har du noen kommentarer til dine pedagogiske kunnskaper, relatert til den undervisningen du har? (eksempel; ønsker å lære mer pedagogikk, føler jeg kommer til kort i noen situasjoner)
6. Hvordan trives du i læreryrket?
7. Hvordan vil du beskrive din kompetanse i forhold til utnytte de mulighetene som finnes på skolens simulatorer? (Eks. Lage nye scenarier, bruk av objektiv vurdering, kopiering etc)
8. Hvordan vil du beskrive din kompetanse i forhold til forståelsen av simulatorenes programmer?

9. Har du noen tanker om hvorfor timetallet er vektet som det er mellom teori og simulator i funksjon 1- maskineri? (pedagogiske, økonomiske, logistikkmessige hensyn)
10. Mener du dette kunne vært vektet annerledes – i så tilfelle hvordan og hvorfor?
11. Hva er ditt syn på læringseffekten av teoretiske forelesninger i funksjon 1?
12. Hva er ditt syn på læringseffekten ved bruk av simulatorer i funksjon 1 - maskineri?
13. Hva er ditt syn på læringseffekten av å jobbe med teoretiske oppgaver, og prosjektoppgaver i tilknytning til simulatoren i funksjon 1?
14. Hvordan er studentenes mulighet til å benytte simulatorene utenfor timeplanlagt undervisning??
15. Har du noen kommentar til hvordan du synes studentene utnytter simulatorene utenfor timeplanlagt undervisning
16. Hva mener du er årsaken til at maskiniststudentene kun har skriftlig eksamen i funksjon 1 - maskineri? (pedagogiske, økonomiske logistikk messige årsaker)
17. Hvordan mener du innholdet i studiekravene og oppdragene er tilpasset innholdet i den skriftlige eksamen i funksjon 1 -maskineri?
18. Hvordan synes du læringsmetodene i utdanningen (bruk av simulator, prosjekter, oppgaver, forelesninger etc) er tilpasset en skriftlig eksamen som metode for å vise kompetanse?
19. Hva er ditt syn på metoden for å vise kompetanse (skriftlig eksamen) på slutteksamen i funksjon 1 – maskineri på operativt og ledelsesnivå.(bra, snever etc)
20. Hvordan synes du den helhetlige kompetansevurderingen er ved skriftlig eksamen i funksjon 1 - maskineri?
21. Er det andre metoder som ville gitt en riktigere helhetlig kompetansevurdering enn den som utføres i dag – i så fall hvilke og hvordan?

Eksempler:

- Bare muntlig eksamen
- Bare skriftlig eksamen
- Bare eksamen på simulator

- Kombinert eksamen med simulator og skriftlig eksamen.
- Kombinert eksamen med simulator, muntlig høring og skriftlig eksamen.
- Kombinert eksamen med simulator, muntlig høring, prosjekt og skriftlig eksamen.

Hvis andre metoder for å vise kompetanse hadde blitt benyttet, tror du det hadde forandret prosentandelen med beståtte i funksjon 1- i tilfelle på hvilken måte?

Appendix 3 – STCW – Convention and Code (2010, pp. 143 – 145)

TABLE A – III/1

Specification of minimum standard of competence for officers in charge of an engineer watch in a manned engine room or designated duty engineers in a periodically unmanned engine room

Function: Marine engineering at the operational level

Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
Maintain a safe engineering watch	<p>Thorough knowledge of principles to be observed in keeping an engineering watch, including:</p> <p>.1 duties associated with taking over and accepting a watch</p> <p>.2 routine duties undertaken during watch</p> <p>.3 maintenance of the machinery space logs and the significance of the reading taken</p> <p>.4 duties associated with handling over a watch</p> <p>Safety and emergency procedures; change - over of remote/automatic to local control of all systems</p> <p>Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems</p> <p>Engine – room resource</p>	<p>Assessment of evidence obtained from one or more of the following:</p> <p>.1 approved in – service experience</p> <p>.2 approved training ship experience</p> <p>.3 approved simulator training, where appropriate</p> <p>.4 approved laboratory equipment training</p> <p>Assessment of evidence</p>	<p>The conduct, handover and relief of the watch conforms with accepted principles and procedures</p> <p>The frequency and extent of monitoring of engineering equipment and systems conforms to manufacturers recommendations and accepted principles and procedures , including principles to be observed in keeping an engineering watch</p> <p>A proper record is maintained of the movements and activities relating to the ship`s engineering systems</p> <p>Resources are allocated</p>

	<p>management principles, including:</p> <ul style="list-style-type: none"> .1 allocation, assignment and prioritization of resources .2 effective communication .3 obtaining and maintaining situational awareness .5 consieration of team experience 	<p>obtained from one or more of the following:</p> <ul style="list-style-type: none"> .1 approved training .2 approved in – service experience .3 approved simulator training 	<p>and assigned as needed in correct priority to perform necessary tasks</p> <p>Communication is clearly and unambiguously give and received</p> <p>Questionable decisions and/or actions result in appropriate challenge and response</p> <p>Effective leadership behaviours are identified</p> <p>Team member(s) share accurate understanding of current and predicted engine – room and associated system state, and of external environment.</p>
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Appendix 4 – STCW – Convention and Code (2010, pp. 153 – 155)

TABLE A – III/2

Specification of minimum standard of competence for chief engineer officers and second engineer officers on ships powered by main propulsion machinery of 3000 kW propulsion or more

Function: Marine engineering at the management level

Column 1	Column 2	Column 3	Column 4
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
Manage the operation of propulsion plant machinery	Design features, and operative mechanism of the following machinery and associated auxiliaries: .1 marine diesel engine .2 marine steam turbine .3 marine gas turbine .4 marine steam boiler <i>Theoretical knowledge</i> Thermodynamics and heat transmission	Examination and assessment of evidence obtained from one or more of the following: .1 approved in – service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved laboratory equipment training	Explanation and understanding of design features and operating mechanism are appropriate
Plan and schedule operations	Mechanics and hydromechanics Propulsive characteristics of diesel engines, setam and gas turbines, including speed, output and fuel consumption Heat cycle, thermal efficiency and heat balance of the following; 1 marine diesel engine .2 marine steam turbine .3 marine gas turbine .4 marine steam boiler Refrigerators and chemical properties of fuels and	Examination and assessment of evidence obtained from one or more of the following: .1 approved in – service experience .2 approved training ship experience .3 approved simulator training, where appropriate .4 approved laboratory equipment training	The methods of preparing for the start – up and of making available fuels, lubricants, cooling water and air are the most appropriate Checks of pressures, temperatures and revolutions during the start – up and warm – up period are in accordance with technical specifications and agreed work plans. Surveillance of main

	<p>lubricants</p> <p>Technology of materials</p> <p>Naval architecture and ship construction, including damage control</p> <p><i>Practical knowledge</i></p> <p>Start up and shut down main propulsion and auxiliary machinery, including associated systems</p> <p>Operating limits of propulsion plants</p> <p>The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery</p> <p>Functions and mechanism of automatic control for main engine</p> <p>Functions and mechanism of automatic control for auxiliary machinery, including but not limited to:</p> <p>.1 generators distribution system</p> <p>.2 steam boilers</p> <p>.3 oil purifier</p> <p>.4 refrigerator system</p> <p>.5 pumping and piping system</p> <p>.6 steering gear system</p> <p>.7 cargo – handling equipment and deck machinery</p>		<p>propulsion plant and auxiliary systems is sufficient to maintain safe operating conditions</p> <p>The methods of preparing the shutdown and of supervising the cooling down the engine are the most appropriate</p> <p>The methods of measuring the load capacity of the engines are in accordance with technical specifications</p> <p>Performance is checked against bridge orders</p> <p>Performance levels are in accordance with technical specifications</p>
<p>Manage fuel, lubrication and ballast operations</p>	<p>Operation and maintenance of machinery, including pumps and piping systems</p>	<p>Examination and assessment of evidence obtained from one or more of the following:</p> <p>1 approved in – service experience</p>	

		.2 approved training ship experience .3 approved simulator training, where appropriate	
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