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Challenges regarding digital distance learning of operationally- oriented professions, due to Covid-19 pandemic

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ABSTRACT

The focus on challenges related to digital distance learning has become particularly relevant since educational institutions had to close due to the Covid-19 pandemic. Teaching related to operationally oriented professions, such as e.g., aviation and nautical represent educations that have faced extensive challenges. Education portfolios for such professions contain subjects that require transfer of competence based on experiential-based learning leading to in-demand knowledge, skills, attitudes, and sustainable understanding. Such operative-oriented competence is difficult to acquire through exclusively digital distance learning. This paper highlights challenges related to the operationally oriented topics of maritime education and training (MET). Traditionally, operationally oriented learning associated to MET has been carried out based on "on-scene" transfer of experience i.e., inexperienced sailors have gained experience by being guided by experienced sailors. Modern MET has evolved towards more passive "off-scene" learning activities. As a replacement for reduced "on-scene" learning activities, modern simulator and laboratory-based learning platforms have been developed within maritime and other operationally oriented educations. Learning platforms like these are probably the most challenging to find digital distance teaching substitutes for, regarding the Covid-19 pandemic closure. The purpose of this paper is to show whether the rapid change of learning context due to the pandemic closure affected the instant knowledge displayed in exam grades. In addition, the paper addresses possible challenges related to the loss of experience-oriented simulator and laboratory-based teaching activities, due to the pandemic closure.

1. Introduction

Throughout history, the intention of education has been divided between the following: develop people intellect, to serve social needs, to contribute to the economy, to create an effective work force, to prepare students for a job or career, to promote a particular social or political system to prepare students to practice a profession (Foshay, 1991).

Qualifying for practicing a profession is both about how students acquire a complete competence through education and how this competence relates to requirements and expectations for later professional practice.

Teaching and learning activities regarding this preparation have traditionally taken place in schools and universities. During March 2020, most of the worldwide society, including schools and universities, closed because of the Covid-19 pandemic. The closure of educational institutions led to a rapid reorganization of learning contexts. To maintain education, large parts of the teaching world had to convert to digital distance teaching. This led to challenges for the entire teaching and education society, especially for practice-oriented educations. Central questions, such as how to give students high-quality teaching related to practice-oriented competence acquisition, become more relevant.

For practice-oriented educations such as the nautical, teaching activities must reflect the complete competence needed to perform the profession. To achieve aforementioned complete competence aspects, students must be mentally challenged by situated experiential-based learning platforms. According to Kolb (1984), experiential learning describes the ideal learning process that invites you to understand yourself as a student and gives you the opportunity to take responsibility for your own learning and development. For the nautical education, these learning platforms are represented by simulators and different laboratory-based training platforms located within school and university areas.

Like other professions, the nautical profession has its own ideal or art of exercising professionally based competence. This ideal is encompassed within the term "seamanship" and somehow equal to, e.g., the term "airmanship", which is the ideal for executing competence in aviation. Kern (1997) defines airmanship as follows:

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Airmanship is the consistent use of good judgement and well-developed skills to accomplish flight objectives. This consistency is founded on a cornerstone of uncompromising flight discipline and developed through systematic skill acquisition and proficiency. A high state of situational awareness completes the airmanship picture and is obtained through knowledge of one`s self, aircraft, team, environment, and risk.

According to this definition of airmanship, aviation may represent a profession based more systematically on specific well-developed skill acquisition, compared to the nautical profession. Another important aspect of airmanship-based practice is that human failure by airmen often leads to more catastrophic consequences than for seafarers, i.e., in accidents, airmen mainly die, while seafarers mainly survive. But, for both professions, the high level of situation awareness, situation assessment and situation understanding forms the basis for professional performance.

There are a lot of definitions of the meaning of seamanship. A random internet search shows e.g., following definitions:

The Oxford English Dictionary (OED):

The art or practice of managing a ship at sea

The Encyclopedia Britannica:

The art of sailing, maneuvering, and preserving a ship or a boat in all positions and under all reasonable conditions (Kemp, 1983).

The Wikipedia:

The art, knowledge and competence of operating a ship, boat or other craft on water.

These selected definitions describe seamanship as a form of art. The human perspectives of seamanship competence are important and defined by different researchers. After studying seafarers from an anthropological point of view, Knudsen (2005) defines seamanship as:

A blend of professional knowledge, professional pride, and experience-based common sense.

In this definition, the demanded seamanship competence criteria contain of both human and anthropological perspectives. The importance of the human perspectives can be updated by respectively Hanzu-Pazara et al. (2008) and Rothblum (2000) research, showing that 75–96% of maritime accidents are directly or indirectly caused by some form of human error.

There are many nautical rules and regulations that influence a seamanship-related practice of the profession. The collision rules (COLREG) of the International Maritime Organization (IMO, 2020) regulates how seafarers should practice navigation. According to COLREG, rule 2 (the responsibility rule) is supreme in relation to navigational aspects of seamanship. In the book, Farwell's Rules of the Nautical Road, Allen (2005) names this rule as:

The rule of good seamanship and the general prudential rule.

Allen's definition links good seamanship to one of the central Aristotelian virtues, prudence. Following the Hovdenak and Wiese (2017) interpretation of the Aristotelian works Nicomachean Ethics, there are many definitions of prudence, and it seems to be a sort of a context-dependent term. In relation to seamanship, prudence may be the ability to judge between actions with regard to appropriate actions at a given time i.e., acting in association to practical wisdom. Exercise of practical wisdom is special relevant in cases that can be interpreted differently, and therefore also resolved in different ways (Brunstad, 2017).

According to perform a prudent practice hence practical wisdom, the COLREG`s, rule 2 requires you to follow both the COLREG`s and "the ordinary practice of seamen" by the following:

Your responsibility is not only to follow the COLREG`s – you are also responsible for doing everything necessary to avoid the risk of collision and the dangers of navigation (Allen, 2005).

Considering the complexity of seamanship competence criteria, it seems obvious that practicing ship officers must always use common sense, act with prudence and with pride and show good character, which somehow can be associated with good performance of seamanship-based competence. It seems obvious that seamanship-based competence is difficult to achieve through exclusively digital distance teaching. Aspects of these criteria can only be achieved through real experiential-based learning activities, followed by the establishment of deeper and retainable knowledge, and understanding.

As mentioned, the nautical profession is highly practically oriented and requires an education portfolio that reflects the complex competence needed, consisting of a combination of practice and theory. Different navigational subject topics in the education portfolio make it almost impossible for students to acquire proper competence without using simulators to practice skills, and to achieve experience without being exposed to challenges.

This paper will not focus on navigational subjects but on a subject connected to the ship engineering segment of the education portfolio. The subject has originally been taught in a combination of traditional teacher-centered classroom learning, supervision connected to problem solving and three experientially based laboratory exercises. The competence goal for the subject is to achieve a deeper retainable knowledge and basic understanding, in addition to calculation skills. The level of retainable knowledge and understanding of the subject is meant to be supported by the mentioned experiential-based laboratory learning activities. These learning activities are based on realistic cases where students must actively work with problem solving as well as discussions regarding problem solving strategies. Through data collection based on the laboratory event, students must present results, as well as discussion and reflections in a final report.

The learning outcomes of such learning activities are well documented by several research, such as, learning by doing by Dewey (1929), lifelong learning through exemplary principles by Klafki (2016), Experiential learning by Kolb (1984), and teaching for enhanced learning by Biggs (1999). Dewey and Biggs`s research shows that learning activities, in which students get actively involved in their own learning, lead to a deeper level of retainable knowledge and understanding of issues which they can meet when practicing their profession.

However, there must be a link between the students' experience made in the laboratory and the goals for achieving learning requirements. Teachers must therefore link decisions regarding laboratory themes, activities, materials and teaching strategies to the desired outcomes for these learning requirements (Hofstein & Kind, 2011).

According to Hovdenak and Wiese (2017), The Greek philosophy Aristotle expressed the following in the relation to the ability to practice knowledge:

We can have plenty of knowledge, but if this knowledge cannot clearly be displayed and used in practice, it is really useless.

If we take note of this expression and put it in the context of the complexity of the performance of seamanship competence, then the ability to clearly display and use knowledge requires basic experiential-based understanding in how to, e.g., judge between appropriate solutions. Therefore, Aristotle`s expression concerning knowledge is still adequate and must be taken into consideration.

A deeper level of retainable knowledge and understanding based on

experience may enable the establishment of an inner knowledge-based image of the whole. Molander (1996) states that the actual work tool for the practitioner is represented by this inner image of the whole, which enables the practitioner to judge, as well as predict the consequences of the practice of, e.g., seamanship.

According to Molander, inner knowledge-based images are exclusively established through practice-related experiences in a way that is open to changes through, e.g., changed experiences or consciousness. The level of deeper retainable knowledge, basic understanding and inner knowledge-based images is hard to detect just by evaluating examination results. Learning outcome based on a deeper knowledge and understanding can, in some cases, only be detected when the student meets challenges after long-term practice of a profession. The presented examination results in this paper will therefore just represent a summative assessment of superficial knowledge and calculating skills and not the level of deeper experiential knowledge, skills, attitude, and sustainable understanding.

The main challenge or problem regarding this paper's focus is the lack of active and experiential-based learning facilities due to the Covid-19 closure. According to e.g., Edgar Dale, the outcome of retained learning depends on the level at which students are exposed, activated, and engaged by concrete and memorable experiences (Dale, 1969). He meant that experiencing and actively participating in an event through testing, touching, and trying is essential for retained learning outcome and that the degree of such learning outcome depends on one actually participating and not acting as a semi-observant observer, (Dale, 1972).

On the basis of his belief, he formed a cone of experience (Fig. 1), which is a visualization of his classification of varied types of mediated experiential-based exposure related to degree of retained learning outcome. More specifically, it shows the gradation of retained learning related to degree of experiential-based teaching activities, from the most abstract (at the top) to the most concrete experience (at the bottom of the cone).

The common theme represented by this cone is that learners are exposed to different levels of experiences. The peak of the cone (Tell) represents the most abstract experiences of e.g., non-realistically visual symbols or verbally by listening to the spoken words.

The middle of the cone (Show) is less abstract due to learners realistically observing the experience. These two levels are differentiated from the lower level of the cone, because learners do not interact directly with the event.

The further you go down the cone against (Do), learners interact more with the event which increases the probability that the learning outcome is retained.

It is worth mentioned that the relevance of Dale`s grading cone of retained learning are questioned, and challenged by research like i.e., Masters (2013) and Subramony et al. (2014d). Despite questioning the relevance of Dale`s cone, it is well documented by e.g., Biggs (1999), Kolb (1984), Dewey (1929), Klafki (2016), and Eison (2010), that the degree of activation (Do) in the learning process is decisive for the degree of retained knowledge and understanding that is achieved. Eison (2010) mention the following two proverbs that actualize the content of Dale's simple cone of experience model:

Tell me and I`ll listen. Show me and I`ll understand. Involve me and I`ll learn.

(Teton Lakota Indians)

I hear, and forget. I see, and I remember. I do, and I understand. (Asian proverb)

Bearing in mind the purpose of the learning activities of this specific profession, aspects concerning clarifying, identifying, and perhaps shaping and building the students' character, in order to gain the ability to exercise their competence, should also be considered. This particularly applies to subjects related to the International Maritime organisation (IMO) - Convention on Standards of Training, Certification and Watchkeeping for seafarers (STCW) (IMO, 2020). According to Brunstad (2009), our character says something about what characterizes us

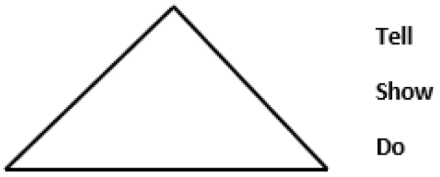

Fig. 1. Simple model of Dale's Cone of Experience (Dale, 1946).

as individuals and is independent and unique of our personality, as well as an expression of the values we try to identify with. These are values that guide us to, e.g., prioritize between appropriate situation-dependent actions. Regarding personal character, relevant questions concern the extent to which it is possible to shape, build and change people's character. Brunstad claims that one can change the way one sees, assesses, and interprets, in relation to one's own history and experiences. Character, attitudes, and action patterns can be transformed in relation to these aspects. Personal character can be changed through the way one thinks about events in one's own experiences. Through changes in established thought patterns, we can change the typical-for-us way we react when facing specific situations. In addition to the other mentioned aspects, the character aspects of the profession are challenging to establish exclusively through digital distance teaching activities.

In conclusion, the aspects concerning the sailor's complementary competence (seamanship) can be divided into a combination between hard skills and soft skills. According to Wats and Wats (2009), hard skills are discipline specific skills needed to perform basic duties at work like, knowledge of concepts, principles, methods, procedures and techniques. Soft skills define the individual`s approach to work related challenges or problems. More specific, sought out behaviors and characteristics that individual`s demonstrates unconsciously and routinely while performing duties. Appropriate application of both these skills is essential for proper practice and in this way, they are interdependent (Costin, 2002).

2. Teaching context

The main focus for all teaching and learning contexts is how to create enthusiasm and engagement among undergraduates. This study dealt with the practice of two different teaching contexts, related to before and after the Covid-19 closure, both focusing on engagement as a prerequisite for learning achievement. According to the engagement aspect, Kearsley and Shneiderman (1998) state that students are intrinsically motivated to learn due to the meaningful nature of the learning environment and activities. Therefore, all teaching activities must focus on how to inspire and engage most undergraduates. In respect to the prerequisite of creating engagement, it is better if one can vary between different learning activities and have the opportunity to be together face-to-face with the undergraduates. The possibilities for aspects of variation and face-to-face togetherness are limited when exclusively practicing digital distance learning.

2.1. *Before Covid-19 closure*

As mentioned in the introduction, the context of the learning activities before the Covid-19 closure was a combination of traditional teacher-centered classroom learning, compulsory work, supervision, and visual instruction regarding problem solving, and four experientially based laboratory exercises. These learning activities represent a basic setup of the plan, in accordance with the ideals of the Dale`s simple model of cone of experience. More specifically, the plan involves:

- Traditionally teacher-centered classroom learning – This is the learning activity for reviewing theory and professional discussion regarding theory. More specifically, there is the presentation of theory, using PowerPoint and ordinary blackboard teaching, at 45-

minute lecture intervals. These activities represent the most passive learning processes related to the cone of experience. The professional discussion aspect is based on the theory that has been reviewed. Through this discussion, to reduce passivity, the students are challenged to participate. It seems that most students become more activated and engaged through this additional activity. Related to the Dale`s simple cone of experience, these activities (classroom and discussion) probably lead most students somewhere between the peak and the middle area of experience-based retained learning outcome.

- Compulsory work – In this learning activity, students work with problems related to theory in review and reviewed theory. More specifically, through seven compulsory assignments, students have to activate themselves and grasp knowledge and understanding at a higher level than ordinary passive (classroom and discussion) activities. In order to further emphasize the learning aspects, students have to self-assess their own assignments and, in this way, perhaps increase the retainable learning outcome.
- Supervision and visual instruction regarding problem solving – This is a learning activity focusing on problem solving, i.e., calculation and solution strategies related to compulsory work, supported with visualization through images and sketches to illustrate the issues. Related to Dale`s simple cone of experience, these activities (compulsory work and supervision) probably lead most students into an area of higher retainable learning outcome.
- Experientially based laboratory exercises – The laboratory exercises consist of cornerstones of the subject and represent the learning activity in which students are supposed to learn, at the highest possible level, experience-based learning (Do). More specifically, students have to participate and interact in three laboratory exercises, followed by completing a reflection-based report. According to Dale`s simple cone of experience, hopefully, by performing real tasks, most students will achieve the highest possible experience-based retainable learning outcome. This activity has similarities with problem-based learning (PBL), which roughly involves confronting students with practice-oriented problems intended to stimulate learning (Boud & Feletti, 1997).

2.2. After Covid-19 closure

The overall teaching context after the closure was digital distance teaching. The former plan from before the Covid-19 closure then had to be re-evaluated and re-constructed with respect to the same criteria as before, i.e., retainable learning outcome with respect to seamanship competence criteria. The main challenge regarding these criteria was to set up a plan for the highest possible experience-based learning, without using laboratory facilities. The teaching activities had to try to compensate for the loss of this learning activity.

The basic principles from the teaching context before the closure formed the plan for the digital teaching context. As before the closure, a combination of traditional teacher-centered classroom learning, compulsory work, supervision, and visual instruction regarding problem solving formed the basic plan. Adjustments regarding the presentation of theory, compulsory work and how to supervise had to be put in place in accordance with highest possible experience-based assimilation. More specifically, the plan for this digital distance context involved:

- Teacher-centered presentation – The digital distribution platform for this and the other learning activities above was Teams. As before the closure, this was an activity for reviewing theory and an attempt to professionally discuss theory. The lectures were presented in PowerPoint, divided into four sections each day, in 20-minute intervals. In the final interval, relevant questions were added, related to the reviewed theory. In the first interval of the following lecture, a solution proposal and strategies were reviewed. In addition to pre-closure practice, in this activity the students were recommended to read current theory and sometimes watch current external videos before specific theory cornerstones were reviewed, in a sort of flipped classroom activity.
- Self-study work – To replace compulsory work, a more comprehensive and coherent portfolio of self-study was introduced. The intention of this introduction was to let the students work actively and coherently with theory and the general content of the topic. As before the closure, students had seven self-study assignments that followed the progression of the theory teaching.
- Supervision and visual instruction regarding problem solving – As before the closure, the overall principle of this activity was to clarify, regarding the same aspects, i.e., theory, calculation and solution strategies related to self-study work, supported with visualization, through images and sketches, to illustrate issues. As a sort of compensatory measure for the loss of laboratory facilities, this activity was more comprehensive and given more attention than before the closure.

The overall achievement of these teaching and learning activities was to satisfy the minimum demand of knowledge, skills and competence regulated by STCW, and additionally to achieve a deeper sustainable knowledge and understanding regarding seamanship-based competence.

3. Method

This study was based on a specific subject of the nautical education portfolio which intends to cover the criteria of demanded STCW requirements and the mentioned seamanship-based competence. Originally, this subject is developed in an "ordinary" teaching context related to before the Covid-19 closure. After the closure, this context had to be transferred to a totally digital distance-teaching context. The focus of the study was to present data that showed and compared examination results obtained by two student populations within this specific nautical subject, and to identify challenges related to exclusively distance teaching of the practice-oriented nautical profession. The two student populations were divided into group 1, associated with MET school 1, and group 2, associated with MET school 2.

3.1. Methodological approach of learning theory

First, the methodological approach of this study started with a sort of narrative mapping, regarding deeper and retainable learning of professional nautical practice and aspects of how to teach, in relation to these aspects. Different research was collected using internet-based search engines like Sciencedirect, Researchgate, Academia, Elsevier, Google Scholar, etc. Selected well-known researchers, such as Dewey, Biggs, Klafki, Kolb, Schon, Eison, Dale and Molander were given most attention because of their connection to, inter alia, Aristotle's philosophy about prudence and wisdom. As for all studies of professionally based learning, aspects of Aristotle`s Nicomachean Ethics were used as a basis for research.

3.2. Methodological approach of the study

The total number of students participating in this study was 67, distributed in two individual groups of respectively 40 participants in group 1 and 27 participants in group 2. The only teaching and assessment aspect that separated these groups was the form of teaching context their examination results were based on.

3.2.1. Prerequisites for both groups were

- Same teacher
- Same examination form
- Same examination assignments

- Same criteria for assessment

3.2.2. Difference between groups was

- Teaching context

3.2.3. Group 1

This group consisted of 40 participants who followed the "ordinary" teaching context from before the closure. The participants of this group are connected to the nautical bachelor study program at MET school 1.

3.2.4. Group 2

This group consisted of 27 participants who followed the digital distance teaching context from after the closure. The participants of this group are connected to the nautical bachelor study program at MET school 2.

The professional admission requirements for both of this nautical study programmes are comparable i,e., general bachelor study competence. In addition to professional admission requirements, the participants in group 2 are selected both on the basis of former grade achievement and according to personal characteristics.

3.3. Data sample collection

Data from both groups consisted of collected average examination results, which were then compared, with a view to uncovering similarities or differences in terms of goal achievement. The purpose of the approach was to highlight any outcome similarities or differences, followed by reviewed teaching context. The examination for both groups consisted of five separate main tasks with sub-tasks; all tasks had a fundamentally equal degree of difficulty, and the assessment of all examination answers had a fundamentally equal emphasis.

4. Results

The results of both groups were based on the following criteria, shown in Table 1. Each grade was represented by the following percentage achievement intervals. Grade A represents the highest score with the percentage interval of 90% - 100%, and grade F (fail) represents the lowest, with a percentage interval of 0% - 39%:

Both groups were assessed by the same Excel-based scheme, as shown in Table 2. In this scheme, all participants were assessed individually by the percentage goal achievement of each main task and sub task. The main tasks dealt with specific topics related to the content of the subject. Each sub task were connected to the main tasks, differently weighted with increasing degree of difficulty. In this way, the students could show how much they had learned of the topics related to the main tasks. As Table 2 shows, each main task consisted of different number of sub tasks, respectively 1, 4, 3, 4 and 3. The "Σ Score%" in the table show the sum of the percentage score of each main task based on the percentage score of each sub task. The "Total percentage score" in the table show the sum of the percentage score of each main task, followed by a release of a letter grade, based on the total percentage score (0% - 100%). Each percentage score and letter grade were automatically calculated in the Excel scheme.

Table 1
Examination result criteria.

Grade	Percentage achievement
A	90%–100%
B	80%–89.9%
C	60%–79.9%
D	50%–59.9%
E	40%–49.9%
F	0%–39.9%

4.1. Result group 1

4.2. Result group 2

The bars in the bar chart shown in Fig. 2 represent each participant's percentage achievement. The dotted line (timeline) in the figure indicates the average percentage achievement for all 40 participants in this group. The exact value of the average percentage achievement of group 1 was 80.0%.

The bars in the bar chart shown in Fig. 3 represent each participant's percentage achievement. The dotted line (timeline) in the figure indicates the average percentage achievement for all 27 participants in this group. The exact value of the average percentage achievement of group 2 was 89.5%.

4.3. Grade comparison

The average percentage achievement for group 1 was 80.0%, which coincides with the boundary between the criteria for grade C (60% - 79.9%) and grade B (80% - 89.9%). According to Fig. 4, grade B represented the majority of the grades for group 1 with a number of 17, i.e., corresponding to 42.5%, followed by grade A 11 (27.5%), C 8 (20%), E 1 (2, 5%) and F 3 (7.5%).

The average percentage achievement for group 2 was 89.5%, which coincides with the boundary between the criteria for grade B (80% - 89.9%) and grade A (90% - 100%). According to Fig. 5, grade A represented the majority of the grades for group 2 with a number of 15, i.e., corresponding to 57.7%, followed by grade B 8 (30.8%), C 3 (11.5%).

The difference in percentage achievement between group 1 and group 2 was 89.5% - 80.0% = 9.5% in favor of group 2. The achievement of both groups falls marginally within the interval for grade B (80.0% – 89.9%). Both the intervals of grade B and A extend over 9.9% (80.0% - 89.9%) and 10.0% (90.0% - 100.0%) respectively. Therefore, achievements within these levels (A and B) represent approx. a whole grade.

Table 2
Examination assessment scheme.

Main task	1		2		3		4		5	
		5.00%		20.00%		15.00%		35.00%		25.00%
	Pts	Score%								
Subtask										
a	5	%	3	%	5	%	10	%	7	%
b			5	%	4	%	10	%	10	%
c			6	%	6	%	10	%	8	%
d			6	%			5	%		
Σ Score%		%		%		%		%		%
Total percentage score			**0.0%**							
Letter grade										

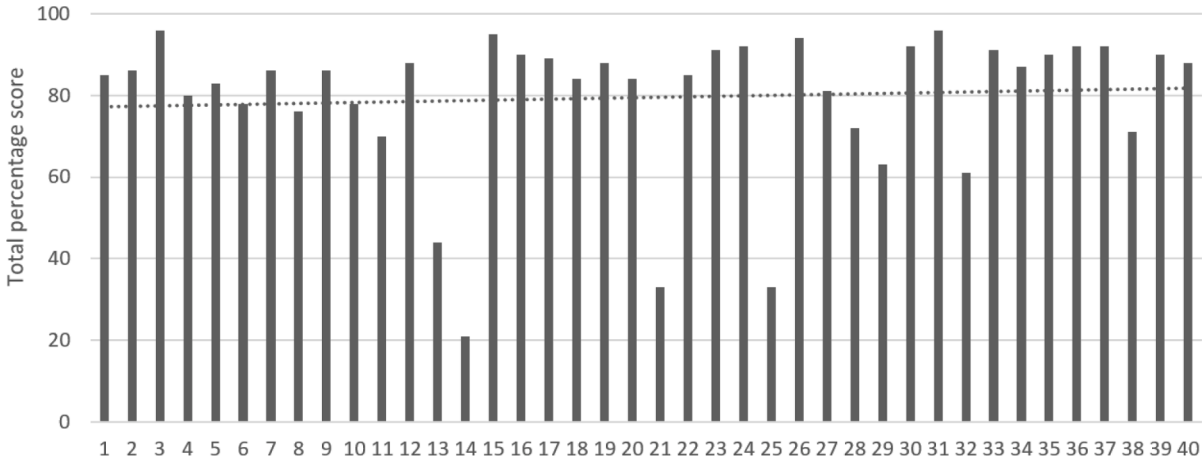

Fig. 2. Total percentage score distribution group 1.

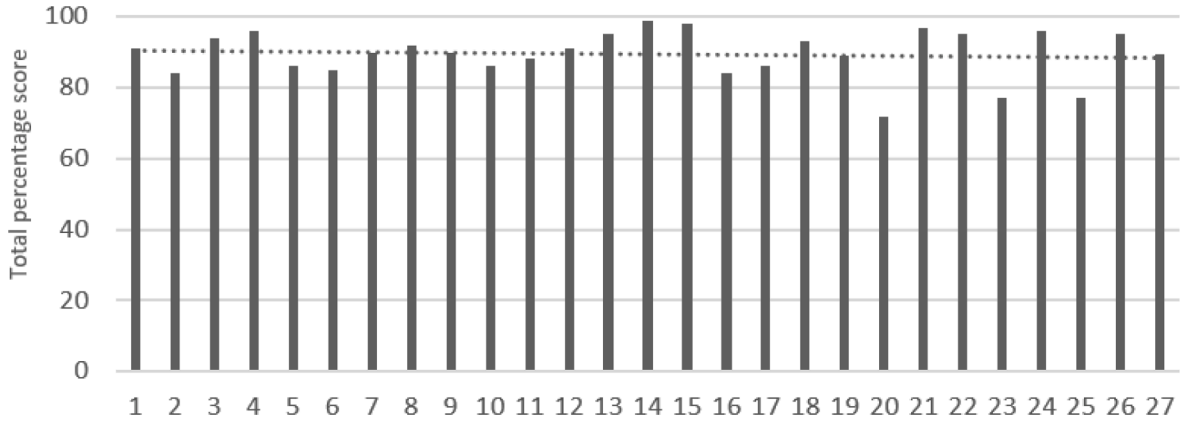

Fig. 3. Total percentage score distribution group 2.

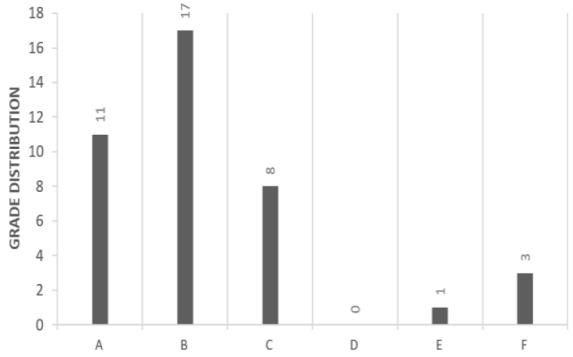

Fig. 4. Grade distribution of group 1.

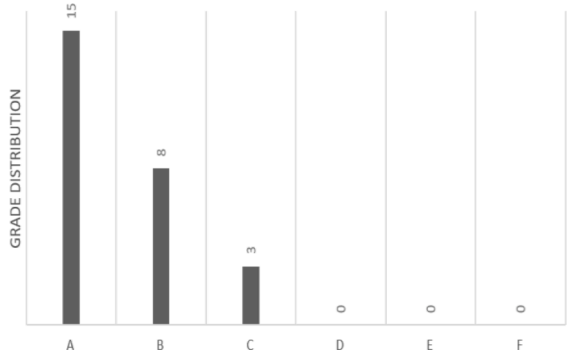

Fig. 5. Grade distribution of group 2.

5. Discussion

It seems surprising that group 2 ended with a higher average score than group 1, despite the teaching context differences. One might think that group 1 should achieve a higher score, due to traditional "on-scene communication" teaching aspects such as face-to-face classroom communication. Regarding this aspect, Sediyaningsih and Adara (2019) research is one example which shows that lack of this communication poses significant challenges in facilitating the process of teaching and learning. According to aspects of activation in learning processes, Freeman et al. (2014) comprehensive meta-analysis sheds light on exam-related student performance based on traditional lectures versus active learning. The results of this analysis indicate an average improvement of about 6% in sections for active learning compared to traditional learning. The same analysis shows that students in classes with traditional lectures were 1.5 times more likely to fail than students in classes with active learning. One might think that students participating in exclusively digital learning (group 2) are less activated in learning than by traditionally learning contexts but according to this study, those students must have somehow been activated through digital distance learning.

However, there may not be a specific cause for this surprising result but, rather, several possible causes. The answer for this "surprising" result could either deal with the content of the reconstruction of the

teaching context or by the participants' prior knowledge and prerequisite for this examination-related performance.

5.1. Reconstruction of teaching context

The reconstruction of the original teaching context from before Covid-19 was based on the following learning aspects:

(1) Synchronous digital distance presentation of theory and supervision.
(2) Students went through lecture presentations and watched relevant external videos ahead of the actual synchronous lecture, in a reversed (flipped) classroom perspective.
(3) Comprehensive self-study activities.

The teaching context for group 2 was not selected randomly but through the following: research, experiences undergone and in collaboration between teacher and students in a student-staff partnership, both in advance and through ongoing assessment. From the start, the students requested synchronously based teaching because of the possibility for consecutive communication, i.e., the presence of and dialog with the teacher. More specific, this meant active discussion, direct and immediate feedback related to exploration of topics and concepts, and regular opportunity for an interactive face-to-face or class discussions and direct guidance. The effectiveness of synchronous learning probably depends on a pre-agreed level of interaction achieved between teacher and student. One important aspect of synchronous learning is highlighted by Offir et al. (2006) research, showing that synchronous learning is more effective among students with a high cognitive ability than among students with lower cognitive ability.

According to this research, the undergraduates in group 2 probably had a higher cognitive ability, which perhaps can be explained by the fact that this group was selected for this study on both grade level and personal characteristics. The length of each presentation was initially chosen based on research focusing on aspects of students' engagement in e-learning. Different e-learner and massive open online courses (MOOC) providers suggest that the optimal length of video lessons is 6–12 min and, for ordinary web-based presentations, somewhere between 15 and 30 min. No research supports or recommends an exact optimal length of presentations beyond this. For the group 2 teaching context, the presentation length was chosen in a student-staff partnership. The digital study started with a review of the content, workload, and minimum STCW-demanded learning outcome, as well as a proposal for a study plan, in a sort of workshop. On the basis of this workshop, the organization of a progress plan, i.e., study plan, presentation length, etc., was determined in a collaboration between teacher and students in a student-staff partnership setting. Neary et al. (2013) argue the benefit of student involvement in the production of digital materials for enhanced learning achievement. Bryson (2016), Curran (2017) and Mercer-Mapstone et al. (2017) represent other researchers that highlight the student-staff partnership as gaining momentum, for enabling student engagement in teaching and learning.

From a flipped classroom perspective, group 2 went through a systematic and comprehensive form of in-advance learning activity. The purpose of this focus was to provide students with prior knowledge intended as a contribution to participation in lecture-based discussion. Foon and Kwan (2018) meta-analysis of 28 eligible comparative studies shows an overall significant effect in favor of the flipped classroom over traditional classrooms for health professions' education. Different parts of the health profession can be compared to the nautical profession, and this is, thus, relevant. The outcome of this research was not decisive for the teaching context for group 2, but it shows the benefits of using in-advance learning activities. According to these perspectives, the in-advance learning activity may contribute to the surprising examination results of group 2. A sort of flipped classroom was also used for group 1 but in a less systematic and comprehensive form, i.e., just by posting the lecture presentations in advance of the real lecture.

The comprehensive self-study learning activity consisted of seven individual assignments related to progress in the subject. This activity was originally carried out in the teaching context of group 1 but restructured and adapted in a more comprehensive way for group 2. The focus on the reconstruction was to connect the self-study assignments more to the progress in the subject and do them more comprehensively. In concrete terms, this activity was carried out by handing out a self-study assignment every other Friday over a period of 14 weeks. A comprehensive proposed solution was issued at the end of each assignment, so that the undergraduates had the ability to assess themselves. The following Monday, after completing the previous assignment and self-assessment, the proposed solution was comprehensively reviewed and discussed. As for group 1, group 2 had to self-assess their own assignments, according to enhanced learning achievement, by:

- Reflecting on and critically evaluating their own progress
- Identifying gaps in their knowledge and understanding
- Discerning how to improve their performance
- Thinking critically

The effectiveness of this learning activity is well documented in comprehensive research, such as Boud`s book, *Enhanced Learning Through Self-Assessment* (Boud, 1995). Through comprehensive research into self-assessment, Boud defines the activity as follows:

Whenever we learn we question ourselves. `How am I doing?`, `is this enough?`, `is this right?`, how can I tell?`, `should I go further?`. In the act of questioning is the act of judging ourselves and making decisions about the next step.

However, activities like those mentioned are not unique and are, in some form, widely used by learning institutions. The focus of these specific learning activities was preferably to stimulate deeper and retainable learning and try to compensate for the loss of the experientially based laboratory exercises. According to the examination results based exclusively on distance teaching, these learning activities may represent an important contribution.

5.2. Participants' prerequisites regarding performance

The participants of this study had the same basic admission requirements but different additional specialization requirements. Group 1 had to meet additional requirements for specialization in mathematics and physics, while group 2 was selected, on both grades and personal characteristics. The undergraduates' average grades as a basis for admission to the study programmes are classified and will therefore not be discussed in this study. However, while differences related to average admission grades may of course have had an effect on the examination results, they will only be considered as assumptions.

5.2.1. Prerequisites, group 1

The following prerequisites represent some aspects that may have had an effect on group 1′s examination results:

- *Time consumption associated with laboratory experiments*. This learning activity consisted of a review of the content and purpose of the experiment, as a pre-activity; execution of the experiment, including data collection; and, finally, a written report based on the data collected by the experiment, as a post-activity. These activities represented a time consumption of approximately 15 h per experiment. The total time consumption of the three exercises then becomes 45 h.
- *Less comprehensive aspects of flipped classroom, self-studies, and overall supervision.* The teaching focus and time consumption on laboratory work led to a reduction in these aspects.
- *Less focus on examination preparation*. Compared to group 2, this group ended up with less joint time on examination preparation, due to time-consuming laboratory activities.

- *Job alongside study*. Most undergraduates in this group worked alongside studying, which represents both time consumption and possible reduced focus on and strength of study.
- *Possible differences in average admission grades*.

5.2.2. Prerequisites, group 2

The following prerequisites represent some aspects that may have had an effect on group 2′s examination results:

- *Possible engagement benefits due to student-staff partnership*. Such partnerships may represent an effective approach to meeting the aim and aspiration of high educational learning development.
- *Aspects of more comprehensive focus on flipped classroom, self-studies and overall supervision.* As a compensation for loss of laboratory exercises, resulting in decreased time consumption, these aspects had more focus for this group. More specifically, this group had a more comprehensive focus on problem solving and examination preparation.
- *More focus on examination preparation*. Compared to group 1, this group ended up with more joint time on examination preparation, due to the loss of laboratory activities.
- *Possible differences in average admission grades*.

5.3. Deeper, retainable (implicit) knowledge and understanding related to seamanship competence

The results of this study show the final examination results of two different groups, more specific, instant learning outcome based on the different mentioned teaching contexts. A possible loss of deeper (implicit) learning aspects due to the mentioned loss of experiential laboratory-based learning activities, is difficult to assess. The reason for this is that parts of such knowledge often do not appear until they are needed, often after several years in a profession. Learning through experience is therefore important because it makes it possible to retrieve experience-based knowledge and understanding from the subconscious when needed. Subconscious-based decision making leading to action refers to an unconscious or (implicit) knowledge. According to Talvitie and Ihanus (2002), implicit memory refers to non-conscious remembering, which is a prerequisite of gaining (implicit) knowledge. Implicit knowledge could refer to what we know and what we are taking into account when making decisions, but somehow are not aware of what we know (Taber, 2014).

Using Dale`s simple cone of experience as a guide for the efficiency of learning leading to increased retained learning was a conscious choice, although it has been criticized by various research. Masters (2013) comprehensive literature study is one of many studies concluding that there is no evidence of percentage learning retention, despite many researchers citing primary texts. For this study, Dale's experience cone is presented in the simplest and original version as a visual representation of the relationship between learning achievement through theoretical and practice-oriented learning.

Education according to the seamanship competence must be placed in the context of the knowledgeable practitioner, who can reflect, experiment, and improvise regarding the performance of appropriate actions. Molander (1996) believes the knowledgeable practitioner's competence represents the prerequisite for executing the concept, knowledge in action. He also believes that execution in accordance with this knowledge is not based on underlying theory but is derived from the everyday acquisition of experience. This argument is supported by Schon (1991), who believes that professional knowledge belongs with the knowledgeable practitioner.

6. Conclusion

The database that forms the basis of the examination results survey may be limited, and its validity can therefore be discussed. To generalize an outcome like that represented in this survey may require more comprehensive research. Nevertheless, what we see is at least an estimate of how the groups performed in terms of examination results, based on the different learning contexts they had participated in.

As the results from the survey show, the teaching contexts may not have a significant impact on examination results, even approximately a grade difference in favor of group 2, but, as mentioned in the teaching context, engagement is a prerequisite for learning. Therefore, the undergraduates of group 2 must have been engaged in some way by the digital distance teaching context. The grades obtained by group 2 indicate that it is possible to achieve good examination results by adding a proper and comprehensive study plan, adapted in collaboration with a specific undergraduate group.

A challenging aspect regarding seamanship competence is that these examination results may just indicate examination-related instant knowledge exclusively and not, or at least limited, deeper, retainable practice-oriented learning outcome, because of the loss of experiential laboratory-based learning activities.

Key questions regarding the challenging aspects of the examination results are the degree of seamanship competence that has been achieved. To what extent do the examination results represent only examination-related instantaneous knowledge, and to what extent can the results support more comprehensive seamanship-related competence?

Sediyaningsih and Adara (2019) claim that the role of teachers or lecturers is not just to teach but also to maximize education. Through this statement, they distinguish between teaching and education:

Teaching is more about transforming science, while educating is more about providing concrete examples for students that are delivered through context, and this is missing from the online distance education.

According to this statement, the teaching context from before the Covid-19 closure perhaps relates to a more learning context, by providing concrete examples, while the digital distance teaching context from after the Covid-19 closure relates to a more exclusively transforming science (teaching) context.

In conclusion, the relevance and transferability of the perspectives discussed in this article may apply to most operational and practical-orientated educations.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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