



COAST

Centre of Excellence in Maritime
Simulator Training and Assessment

Annual Report 2023





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COAST Mission and Vision Statement



VISION: To be leading provider of simulator training and assessment methods for maritime education

MISSION: To promote student-centred learning through simulator-based education

The maritime industry in Norway is the second largest industry by trade just after oil and gas. It plays a pivotal role in the economy thereby seeking utmost significance from all stakeholders to ensure its sustainable growth. Continuous innovation in education programs, research and development are the foremost necessity in increasing competence and value creation in the industry. The Centre of Excellence in Maritime Simulator Training and Assessment (COAST) aims to support the competency development of future

maritime professionals by integrating state-of-the-art solutions to Maritime Education & Training (MET). The long-term vision of COAST is to become an internationally recognized hub as the leader for education and research for Maritime Education and Training (MET). In order to accomplish this goal, the outputs of the first 5-year phase will be disseminated and communicated to maritime training facilities in Norway and across the world. COAST has four focus areas:

1 Synergistic simulation curriculum

3 Student engagement

2 Innovation in simulator training and assessment methods

4 Organizational development

The centre seeks to implement a series of strategies aimed at developing a culture of innovation that supports simulator-based training and assessment practices. The students, along with instructors, researchers, alumni, academic and industrial partners will be involved in developing a "Community of learners" to manoeuvre state-of-the-art knowledge, create interventions and implement novel simulation practices for training and assessment in the maritime domain.

The Centre of Excellence in in Maritime Simulator Training and Assessment (COAST) was formally established on 1st of June 2020. The COAST consortium comprises four institutions providing higher educational in maritime sector in Norway: The University of South-Eastern Norway (USN), Norwegian University of Science and Technology (NTNU), Western Norway Universities of Applied Sciences (HVL), and The University of Tromsø (UiT), USN being the host institution for COAST.

Highlights from 2023

This report delineates the results achieved in 2023 with a detailed breakdown of each of the four mentioned focus areas. We present below an executive summary of selected COAST activities from 2023.

In 2023, COAST achieved significant achievements that have helped advance our mission and vision. We have been able to achieve progress on our plans envisioned for the year. We celebrate the commendable progress of our doctoral candidates, with six out of eight PhDs presenting their progress to a set of external examiners and triumphantly clearing their mid-term evaluations, thereby edging closer to their ultimate scholarly qualifications. The remaining pair are poised for their evaluations in spring 2024, and are in preparation to follow their peers with similar results.

Our collective scholarly output consists of over 20 research publications delving into a diverse range of educational innovations—from the dynamics of learning environments to the enhancement of student

involvement and the integration of varying pedagogical perspectives. This academic year has seen us foster a satisfactory collaborative synergy across four institutions, selecting simulation tools tailored to the skill requirements, and innovating in the realms of virtual reality and cloud-based simulations. Our dedication to improving performance assessment methods has remained firm and this has also been reflected in the progress achieved.

Despite the news related to the phasing out of the Centre of Excellence (SFUs) scheme casting a shadow on our collective spirit, our resolve has only been strengthened to deliver results. We recognise within this challenge the germination of new opportunities for the future.

Activities and Results



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FOCUS AREA 1: Synergistic Simulation Curriculum

Goals

The primary goal is to create a more effective maritime education system by analysing different educational approaches. This includes developing guidelines for curriculum improvement and promoting cooperation among maritime institutions.

FA1 is dedicated to developing and implementing a synergistic simulation curriculum. It aims to integrate diverse practice from various maritime institutions, enhancing the overall training experience for students.

Objectives

- Identify commonalities and differences among maritime institutions through workshops, observations, interviews, and document analysis.
- Develop a guidance document on curriculum synergies.
- Disseminate results at an international level and to similar professions utilizing simulator training



The curriculum

There is a general understanding of the concept of a curriculum as a basic lesson plan. A richer and more multifaceted view can contribute to an effective and comprehensive learning experience.

- “The curriculum” is the master plan for selecting content and organizing the teaching-learning process, including instructional strategies, teaching methods, learning resources, lesson plans, evaluation and assessment, staff development, and reconstruction of the human experience inside and outside the school.
- “Curriculum synergies” refer to intentionally aligning or integrating different factors within a curriculum to create a more cohesive and effective educational experience. It involves identifying the connections, relationships, and overlap between various subjects, skills, and learning outcomes (Karahalil, in review).

Work in 2023

A program curriculum comparison of nautical study plans focused on semester-wise curriculum differences between maritime institutions. The analysis revealed significant disparities in their curricula. The possible impact of these dissimilarities will be further studied. For example:

- In the navigation courses, which include simulator practices, the European Credit Transfer and Accumulation System (ECTS) varies among institutions.
- Courses and simulator practices commence in differing semesters
- The number of courses differs between institutions.
- Simulator practice hours range from 200 to 336 hours.
- The impact of the newly introduced four-year practical navigation program at HVL on students could result in different learning outcomes.

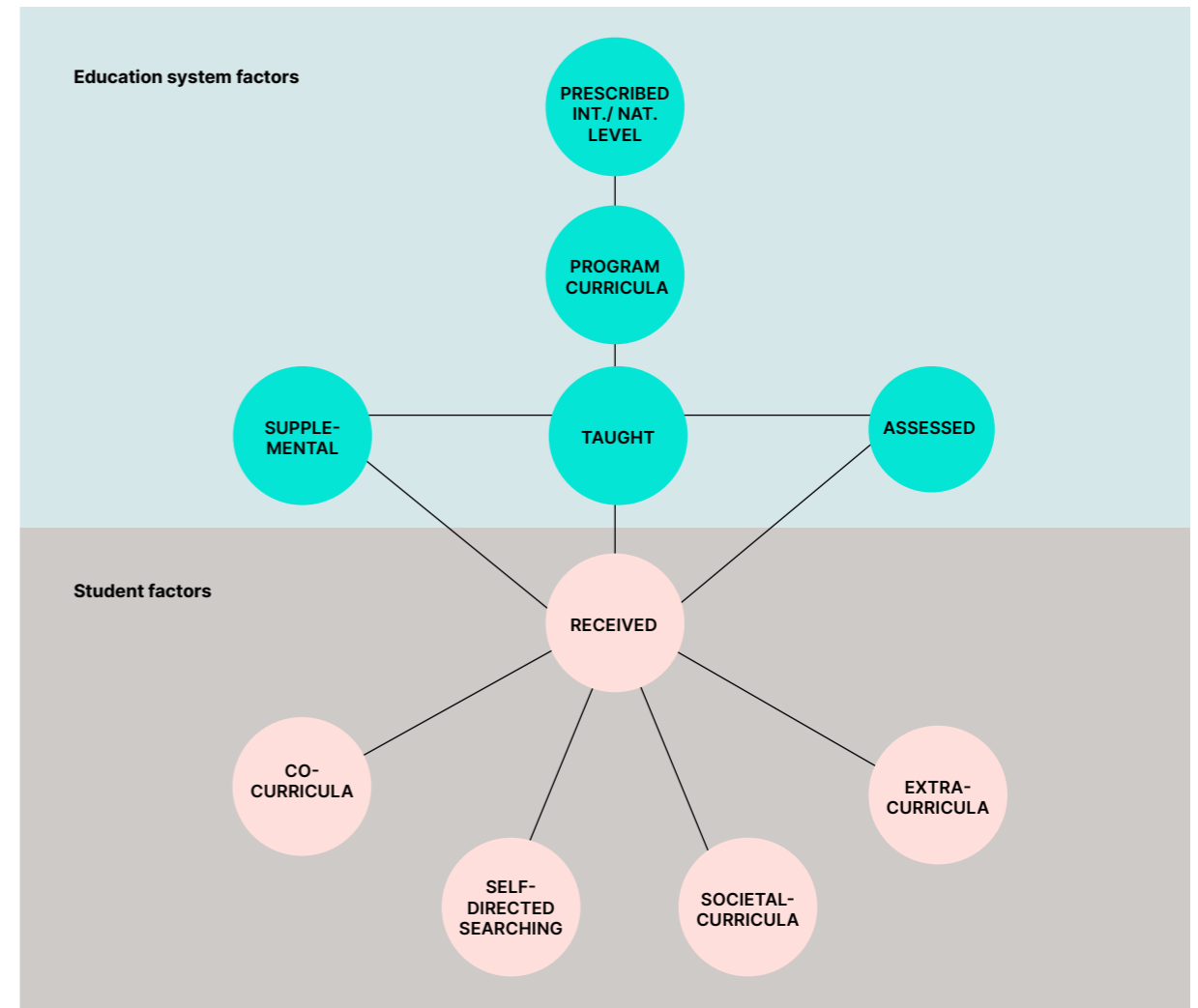


Figure 1: Curricula Factors Concept Map

The conceptual map of curriculum factors was developed further, to give a comprehensive overview and to illustrate relationships between different components. The concept map is divided into two parts and presented in Fig 1. The top part focuses on factors outside of student control (education system factors), while the lower part emphasizes factors in the student’s control. In addition, the lines demonstrate the relationship between these concepts. This concept map is intended to be a flexible, cross-domain model that can be used for more than just MET simulation education. This adaptability is a key strength of our approach, allowing insights and best practices to be shared across different educational domains.

In line with the COAST goals of 2023, specifically applying research to training, FA 1 is branching out into studies on the possibilities of quantifying parts of the training assessment, in collaboration with the other focus areas. One aim of this is to ensure that

subjectivity and objectivity in assessment are balanced appropriately. The Post Doc is performing work on “Measuring, Documenting, Quantifying, and Evaluating the Effect of Simulator Training”, supported by an MSc student. In addition, simulator staff members have initiated an evaluation of the usefulness of the integrated assessment tool in the simulators.

Another application of ongoing research on the agenda is the continuation of the NightSim Activities, vital for practical training and student engagement. Work continues in making the scenarios align with, and expand on, the existing curriculum, what we have denoted co-curricular activities (Karahalil, in review). At the moment, FA1 has a library of 15 scenarios (full mission simulators) complete with instructor guidelines so that they can be self-managed by the students. In addition, 3 scenarios have been prepared for the navigation lab (laptop simulators).



“The student think factory is positive for networking

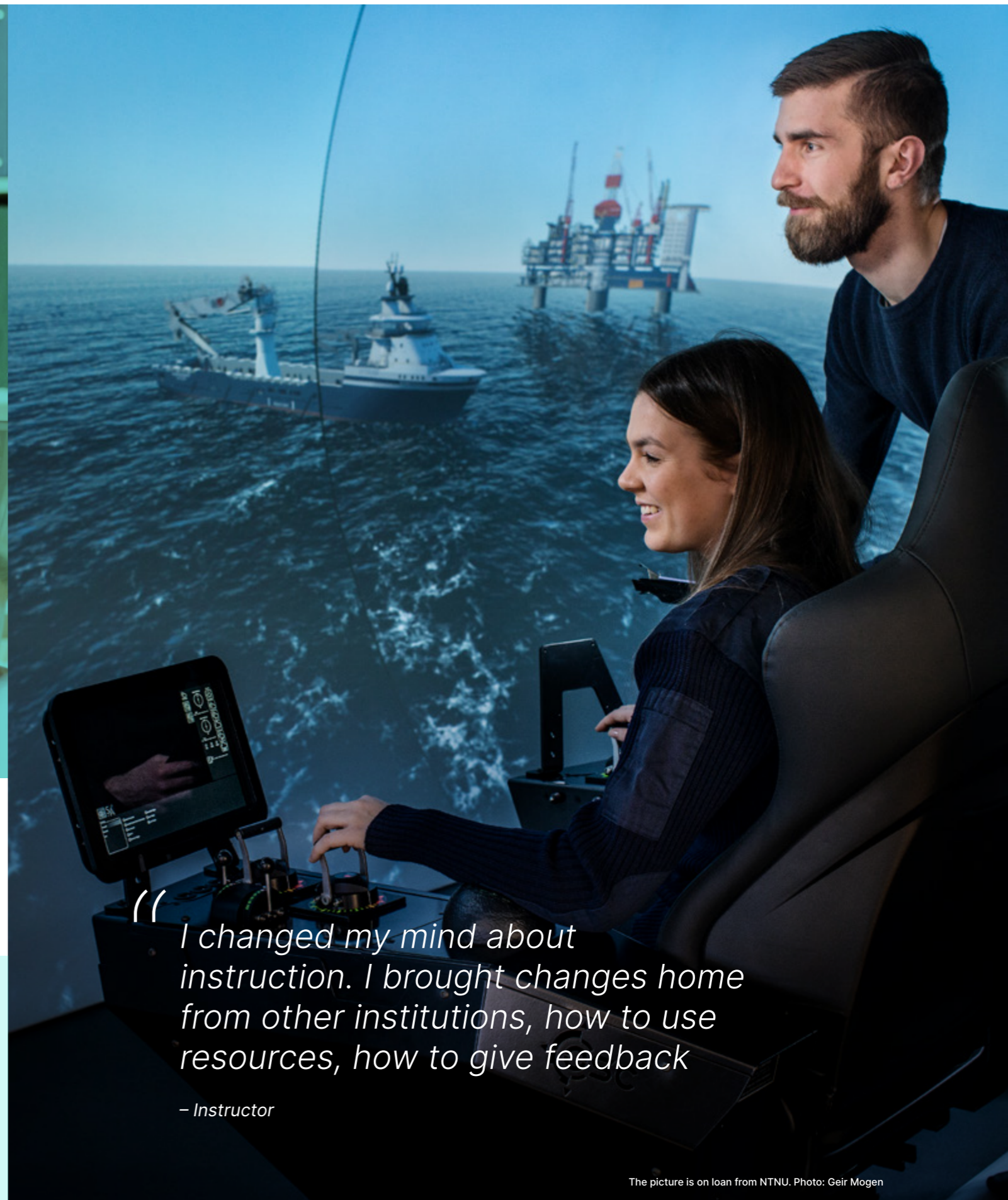
– Nautical science student



Pricilla Du Preez/Unsplash

Key findings include the identification of gaps in the consistency of maritime simulator training across the consortium, as well as on a more general level:

- Norwegian maritime simulator training is not identical across institutions.
- The content of a curriculum can be more varied and comprehensive than commonly assumed.
- Student learning modes are notably varied.
- The curricula concept map identifies key concepts and can be used to enhance the MET curricula.
- Instructors use formative assessment without explicitly knowing that they are. Making this explicit may improve best practice in nautical education (Karahalil et.al., 2023).



“I changed my mind about instruction. I brought changes home from other institutions, how to use resources, how to give feedback

– Instructor

The picture is on loan from NTNU. Photo: Geir Mogen

PhD Work

- 30 ECTS were obtained from PhD courses
- 1 journal article and 1 conference paper were published.
- 2 bachelor's and 1 master's thesis projects were supervised.
- The PhD midterm evaluation was conducted in September 2023.
- IAMU Young Researcher Project Funding was secured for the PhD project.
- The "NightSim" project is continuing to be performed to provide nautical science students with additional simulator practices (see Table 1).

Meetings, Conferences, etc.

- The online "Simulator practices in different domains" workshop was organised in 2022.
- Some outcomes were presented and discussed at the USN Joint Simulator Workshop held in 2022.
- A workshop was conducted with participation from HVL healthcare and maritime simulator instructors, and aviation experts.
- The subsequent studies were presented at the online workshop organised by HK-dir SFU in 2022.
- Participated in the International Association of Maritime Universities (IAMU) Conference in October 2023.



“The PhD students have seen that it is possible to research your own practice

– PhD student

The picture is on loan from NTNU. Photo: Geir Mogen

Sessions for simulator training for 2023 autumn semester

Training in 2023	Bridge	Lab	2nd Class	1st Class
September 6th	x		5	16
September 13th		x		24
September 20th		x		24
September 27th	x	x	21	24
October 10th	x		21	
October 25th		x		20
October 31st	x		20	
November 1st		x		22
November 9th	x		28	
Total sessions: 9	Total: 5	Total: 5	Total: 95	Total: 130

Table 1: Evening simulator sessions

Plans for 2024

As part of continued curriculum research in 2024, further document analysis will be performed on the maritime simulator program curricula within the consortium to identify standard practices for simulator training. This will include a detailed document analysis of curricula prescribed by the IMO and NMA.

The Post Doc researcher will continue working on "Measuring, Documenting, Quantifying, and Evaluating the Effect of Simulator Training". The MSc student is supporting this work by studying instructors and student views on objective assessment.

A dedicated simulator staff member will work on evaluating the integrated assessment tool in the simulators. The PhD student will undertake an IMO internship, conducting interviews with members of the Sub-Com-

mittee on Human Element, Training and Watchkeeping to discuss the STCW revision process. Additionally, interviews with instructors are planned to obtain a more in-depth understanding of effective maritime training methods. Focus group interviews with consortium students are also scheduled.

The work on training assessment and the NightSim Activities will continue as will supervision of Bachelor's and Master's projects.

Participation and presentations at the SFU-24 online seminar and the IAMU Conference 2024 are planned.

If time allows the concept map will be developed further by describing the rate of evolution of the different factors over time.



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Table 2: Status of activities in FA1

Description of activities		2020		2021		2022		2023		2024		2025	
		H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2
A4	Conduct a systematic literature review of simulator practices in maritime, aviation, health and education												
A4.1	Hiring PhD candidates at HVL		Delays	Delays	Completed								
	Hiring Post Doc							Ongoing	Completed				
A4.2	Internal meeting to draft plans of the systematic review			Delays	Completed								
A4.3	Workshop			Delays	Completed								
A4.4	Conduct review. First draft of analysis of literature review			Delays	Completed								
A4.5	Workshop to share preliminary analysis			Delays	Completed	Delays	Completed						
A5	Report on good simulator-practices from maritime, aviation, health, space, teacher education et al.												
A5.1	PhD will conduct the first draft of report				Delays	Delays	Completed						
A5.2	Discussions with representatives in the Consortium				Delays	Completed							
A5.3	Revision and final draft						Completed						
A5.4	Publish report						Delays	Completed					
A6	Conduct a document analysis of Maritime simulator training curriculum in Navigation across Consortium												
A6.1	Conduct interview guide for students and staff				Delays		Completed						
A6.2	Internal meetings to draft questions and plan procedure				Delays		Completed						
A6.3	Discussions with consortium representatives				Delays		Ongoing	Ongoing					
A6.4	Interview students and staff				Completed	Completed	Delays	Ongoing					
A6.5	Analyse data and write preliminary results				Ongoing	Completed	Delays	Delays	Ongoing				
A7	Report from document analysis on consortium curricula												
A7.1	Conduct a first draft				Delays	Delays	Delays	Ongoing					
A7.2	Discussions with representatives in the Consortium							Ongoing					
A7.3	Revision and final draft					Delays	Delays	Delays	Ongoing				
A7.4	Publish report							Delays	Ongoing				
A8	Develop guidance document regarding curriculum synergies in future maritime simulator-based training (BA), including learning from good practice, based on A5 and A7.							Delays	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing

Ongoing
 Delays
 Planned
 Completed



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FOCUS AREA 2: Innovation in Simulator Training and Assessment Methods

Goals

The goal of FA2 is to evaluate the current state-of-the-art training and assessment practices in Maritime Education and Training (MET) and develop novel simulator training and assessment methods by taking technological advances into consideration.

Objectives

- Evaluate current state of the art in relation to the use of variety of simulator types utilized in maritime domain
- Investigate new research-based teaching and assessment methods utilizing maritime simulators
- Analyse the role of social interaction and practices in simulation exercises

Simulator student assistant course (SSA)

In the spring of 2023, 21 students entered the elective SSA course at the bachelor program at USN. The course aims to the development of the student's didactic competence related to simulations, but also skills in the use of simulator technology. An important part of the course is linked to practical exercises where the students' pedagogical reflection related to their own role as the simulator assistant (SSA) is problematised.

The main themes in the course are:

- Technology (programs/instrumentation)
- Ethical dilemma relevant for student assistants
- Planning for teaching and learning through simulation or use of a simulator
- Teaching methods, principles, tools and techniques
- Communication and interaction in learning work
- Student-led evaluation
- Evaluation of teaching

It consists of three interdependent generic elements, covering ethics, simulator-based technology (content dependent) and practical simulator assistant training (didactics).

To make use of students' experiences and know-how as resources for training and engaging in the maritime field, the students can, formalise some of the undocumented competencies, enabling easier transitions to the work domain. This includes the STCW requirement of educational training, formalized by IMO course 6.09. Further, formalising such competence enriches the students' engagement and collaboration in simulator-based learning activities within and across universities of the consortium. The coursework was organised with mandatory attendance on Friday evenings, providing students with knowledge of ethical concerns, simulator-based technology and didactics. During the semester, the SSAs have participated as trainee simulator-instructors and are responsible for extracurricular training in the big-view and full-mission simulators on Wednesdays. These informal and voluntary simulator training evening's function both for building a social environment and as a simulator-training with peers and more trained second and third year simulator assistants.

Summing up the experiences from USN, the students in the Student-think-factory suggested that the subject ought to be taught at all universities in the consortium.



Briefing at first day at the Simulator Student Assistant course at campus Vestfold, USN

¹ Undheim, Per Eirik.

1) Faglig presentasjon om praksiseksamen 2) Leading Workshop: Artificial Intelligence opportunities for the future MET. A short collaborative workshop between MET researchers and lecturers. 3) Faglig oppsummering om framtidens bruk av AI i maritim utdanning i Norge.. Maritim Utdanningskonferanse; 2022-10-18 - 2022-10-20 USN

This is planned for 2024. One lesson learned is that the SSA-course should be taught in the students' third semester, and that the subject might be relevant to all student assistants, regardless of topic. During 2023 the use of simulator assistants has become widespread in the maritime education domain, including the mandatory training in communication subjects related to the use of GMDSS and Cargo handling.

Participation in the tug-boat tournament and the student think factory

After a qualifying tournament on campus, USN sent a team to Ålesund to attend the national finals in the Tug-boat tournament. The event was a success both regarding content and socially. The students interacted with other participants from the COAST institutions and shared their own experiences in the event.

Simulation and technology development of ship-loading

In the course Cargo Handling at our nautical program, a new advanced training simulator has been implemented (Undheim 2022¹). Together with improved activities, aims and assessment, this enhances the work realism giving our students an even better understanding, and it enables training and load studies for onboard positions and terminal work. Assisted by modern technology, realism is recreated with regard to technical interfaces for loading and unloading.



VR/AR research and Cloud-simulations

There has been work providing a framework for integrating innovative simulator-based training (e.g., with Virtual Reality (VR)) into the maritime education context (Tusher et al. 2024). In addition, detailed analysis of video recorded authentic simulator-based training, displaying that instructors and students participate in playful activities. While previous literature on simulator-based professional training highlights the serious nature of simulations in high-risk domains, such as maritime navigation, findings demonstrate a deviant case of playfulness and competition in simulator training and debriefing (Starup et al, forthcoming). The COAST research underlines the importance of collaboration practices – a perspective to the socio-cultural perspectives on learning (Gyldensten et. al. 2023). Expanded knowledge on a hybrid multi-criteria decision-making approach (Tusher et al. 2023) can be instrumental for maritime instructors and students in gaining in-depth knowledge about the underlying criteria and interrela-

tionships influencing the selection of various simulator types. Students also learn how VR compares to other simulator types and under which criteria (e.g., technical, instructional, and organizational) a particular simulator is optimal. The results clarify the factors influencing maritime students' attitudes towards VR as a training solution. Additionally, the study will elucidate how several mediating elements, such as perceived health risks, regulatory uncertainty, and learning styles, affect the overall acceptance of VR technology for training maritime students.

However, due to underlying of the importance of someone's needs to be held accountable, the research on fully autonomous ships is currently gaining less momentum, shifting towards concepts of remote operator control. During 2023 several meetings with industrial partners such as MORILD and Fynd have been held, coming up with potentials of further improvements on fidelity and gamification.

Meetings, Conferences, etc.

- Participated in the SimPro 23 conference at Gothenburg, Sweden in April 2023
- Participated in the SimLearn 23 Conference at Åsgardstrand, Norway in September 2023
- Participated in the International Conference on Marine Navigation and Safety of Sea Transportation (TransNav 2023) at Gydnia, Poland in June 2023
- Participated in the International Association of Maritime Economists (IAME) conference at Long Beach, California, USA in September 2023

Plans for 2024

- Technology mapping across consortium (hard- & software, technology integration, future needs)
- Scientific anthology on simulator-based training and challenges in maritime vocations
- Conduct one course for simulator student assistants (SSA)
- 3 scientific papers
- 6 conference presentations
- Make a COAST festival in the form of a student festival



The picture is on loan from USN.



Pixabay

Table 3: Status of activities in FA2

Description of activities	2020		2021		2022		2023		2024		2025	
	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2
A9 Conduct a research design												
A9.1 Internal workshops		Delays	Delays	Completed	Completed	Completed	Completed	Completed	Completed	Completed		
A9.2 Cross consortium workshops		Delays	Delays	Completed	Completed	Completed	Completed	Completed	Completed	Completed		
A9.3 Conduct a first draft of the research design		Completed	Completed	Completed	Completed							
A10 Implementation of the research design				Completed	Completed	Completed	Completed	Completed	Completed	Completed		
A10.1 Develop ethical guidelines		Completed	Completed	Completed	Completed							
A10.2 *Make data-storing and user agreements across the consortium		Completed	Completed	Completed	Completed							
A10.3 *Make standard agreement letters for all data-collection		Completed	Completed	Completed	Completed							
A11 **Mapping what is excellent simulator-practices across consortium		Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed		
A12 Develop and synthesize research-based practices to create innovative training and assessment methods in maritime simulators across the consortium		Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed		
A13 Data collection												
A13.1 **Formulate initial questionnaire for quantitative data collection across consortium			Delays	Delays	Delays	Delays	Completed	Completed	Completed	Completed		
A13.2 Formulate qualitative data collection plan (e.g., student and instructor interview, focus group discussions)			Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed		
A13.3 **Pilot test and adjust the quantitative and qualitative data collection procedures			Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed		
A14 Data analysis for understanding the best practices of simulator-based training and assessment practices			Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed		
A15 Disseminations			Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed		

■ Ongoing
 ■ Delays
 ■ Planned
 ■ Completed

*Not viable – following each PHD project.

**This steps will eventually follow the analysis of qualitative data



The picture is on loan from NTNU. Photo: Geir Mogen



The Bialons/Unsplash



Brooke Cagle/Unsplash

FOCUS AREA 3: Student Engagement



Goals

Assessing the effectiveness of current student engagement practices in simulator training and evaluation throughout the consortium, examining the structure of student union and alumni groups, recommending successful strategies, and creating frameworks to encourage widespread student collaboration across our institutions. Assessing the effectiveness of current student engagement practices in simulator training and evaluation throughout the consortium, examining the structure of student union and alumni groups, recommending successful strategies, and creating frameworks to encourage widespread student collaboration across our institutions.

Objectives

- Evaluating effective engagement strategies, propose best practices and developing participation models for collective student engagement
- Developing and standardizing Student Simulator Assistant (SSA) course for all member institute
- Developing COAST alumni network and supporting the student union

Activities

Revised and new collective models and organisation of student engagement / involvement, student unions and alumni networks

The year commenced with fervent preparations for the Tugboat Challenge tournament, an enthralling event that united students from USN, HVL, UIT, and NTNU. The tournament culminated in the grand finale held at NTNU Ålesund in April, where teams demonstrated their exceptional skills and profound knowledge in a fiercely competitive environment.

Recognizing the significance of fostering a collaborative learning environment, COAST actively supported weekly coffee breaks for nautical students through the “12 o’clock coffee” initiative. The significance of a collaborative learning environment, initiatives such as the “12 o’clock coffee” and partnerships with the student union to organize “Fagdager” (professional days) are testament to the successful structure of student union, enhancing the overall student experience through shared knowledge and camaraderie.

The “12 o’clock coffee” every Thursday in Ålesund, provided a welcoming space for students to engage in informal discussions, share innovative ideas, and forge meaningful connections. Extending its unwavering support, Coast collaborated with the student union “Sekstanten” to facilitate the organization of “Fagdager” (professional days)

The Coast-Sekstanten cooperated with BF Bilfergen, a veteran car ferry from 1916 and the annual Julebord (Christmas party) event.

These initiatives were meticulously designed to enrich students’ educational journeys, encouraging social interaction, and cultivate a keen sense of community within the maritime field.

Development and implementations of SSA (simulator student assistant) curriculum, course plan and training exercises.

The year witnessed the remarkable success of three new student participants who successfully completed the “Simulator Student Assistant” (SSA) course #2. Their commitment to acquiring specialized knowledge and skills in the maritime domain was truly commendable. Furthermore, two students who had previously finished SSA course #1 during 2022 joined this one, generously sharing their invaluable experiences and insights with their peers. The role of SSA has been proven invaluable in honing critical thinking, problem-solving, and effective communication skills. These skills are transferable and can be applied to various other disciplines, such as healthcare and engineering, after being tailored to suit the specific needs of those fields. For example, in healthcare, SSA could be utilized to perform as laboratory assistant, instruct and facilitate students in analyzing patient data and aid students develop skills to improve patient care. In engineering, SSA could be used to assess complex problems and develop efficient and sustainable solutions. The adaptability of SSA makes it a valuable method in a wide range of educational and professional settings, providing individuals with the ability to excel in their chosen field by applying the skills and principles learned through SSA.



Andrei Ionov/Unsplash

How is the pilot course for the simulator student assistants (SSAs) planned, operationalized, and reviewed?

The Think Factory Workshop held in Ålesund in September with NTNU coast students emerged as a resounding success. This platform provided a stimulating environment for students to engage in collaborative problem-solving and explore groundbreaking ideas. Subsequently, COAST PhD Anastasia Skarpeti led a planning session in November for the workshop in week 14-2024, further solidifying the commitment to fostering intellectual discourse and creativity within the maritime sector. The SSA course compendium developed and piloted by NTNU Ålesund is distributed to the three institutions for them to adopt and modify to local requirements.

How do simulator student assistants (SSAs) participate in the engagement of maritime students through 24/7 simulation-based activities?

The COAST and maritime students at the Norwegian University of Science and Technology (NTNU) enjoy around-the-clock access to a wealth of resources including a 7-bridges simulator center, navigational labs, and collaborative spaces. This provision significantly underpins a scholarly approach to practical and theoretical learning within the maritime domain. COAST students, in particular, are integral to the vibrancy of these facilities, actively engaging in maintenance, operational support, and the proactive development of training programs and support research initiatives. Their contributions not only amplify their educational journey but also reinforce the high caliber, industry relevant output for which NTNU is renowned.



Photo: Trude Haugseth Moe

One NMA Pilot stated *“The Simulator training for nautical students at NTNU is undeniably essential and invaluable in preparing them for the challenges of real-world maritime operations. As a senior pilot in the Norwegian Maritime administration, I have witnessed firsthand since I became involved with the students in Ålesund in 2005, the significant impact of simulator training on the competency and confidence of aspiring seafarers. The realistic scenarios and immersive experiences provided by simulators enable students to develop crucial decision-making skills, enhance their situational awareness, and practice emergency procedures in a safe and controlled environment. This not only ensures the safety of future maritime operations but also instills a sense of professionalism and responsibility in the next generation of seafarers. The ability to simulate various weather conditions, navigational challenges, and vessel operations is instrumental in shaping well-rounded and competent maritime professionals. Therefore, it is imperative that simulator training remains an integral part of nautical education, equipping students with the necessary skills and knowledge to navigate the complexities of the maritime industry.”*

Present excellence/innovative practices to other professions, nationally and internationally

FA3 played a pivotal role in co-hosting the prestigious “Maritime Lecturers Conference” (MUK 23) in Ålesund, spanning from the 17th to the 19th of October.

The conference saw a gathering of 180 educators from various maritime educational institutions, including upper secondary schools, higher vocational colleges, and maritime universities

The three-day event was widely recognized as a significant success, with COAST and NTNU and Fagskolen I Møre og Romsdal hosting the event gaining prominence through the display of roll-up banners and a notable lecture delivered by Professor Salman Nazir. There was huge interest from industrial representatives in the work done under the umbrella of COAST.



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The key lessons or valuable inputs from the perspective of COAST were:

1. The active engagement of Norwegian maritime industry representatives with the endeavors undertaken by COAST indicates a significant appreciation for the synergistic relationships between maritime educational bodies and the maritime industry. This can lead to practical learning opportunities for students and ensure that educational curricula are aligned with industry needs.

2. COAST is a collaborative center of excellence. The success of the conference and the prominence gained by COAST and NTNU through their displays and lectures indicate that innovative teaching methods and educational practices are crucial. Professor Salman Nazir's notable lecture highlighted the need for systematic new approaches to maritime education, emphasizing the need for continuous improvement in teaching methods to keep pace with industry changes.

3. The conference underscored the importance of providing educators with the tools and knowledge necessary to train the next generation of maritime professionals effectively.

The highlight of the year's collaborative endeavors were undoubtedly the Think Factory Workshop held in Tromsø from December 13-15 2023.

This workshop served as the Student Think Factory grand culmination, bringing together participants from NTNU, UiT and HVL. This event epitomized the essence FA3 goal by assessing the efficacy of student engagement practices within the framework of simulator training and evaluation.

It facilitated cross-disciplinary discussions and the vibrant exchange of knowledge among students, researchers, project leader and coordinator. The workshop demonstrated a commitment to enhancing practical knowledge alongside traditional simulation-based pedagogies in addition to UiT lecturers and a highly interesting, guided tour on the recently delivered research vessel "Prinsesse Ingrid Alexandra" which offers students a first-hand experience with the forefront of maritime research technology, from advanced sonar systems to remotely operated vehicles (ROVs), inspiring a new generation of maritime students. Another highlight was the illuminating presentation on the research vessel "Beret Paulsdatter." This session, led by COAST PhD candidate Johan Fredrik Røds,



Figure 3: The research vessel "Prinsesse Ingrid Alexandra" on Byfjorden in Bergen
Photo: Christine Fagerbakke/HI



PhD candidate, Johan-Fredrik Røds (UiT)

offered profound insights into the vessel's integral role at the University of Tromsø (UiT) as a complementary resource to conventional simulator training. The "Beret Paulsdatter" serves as a dynamic platform for hands-on learning, enabling students to apply theoretical knowledge gained in simulation exercises to real-world maritime operations. The vessel's inclusion in the academic curriculum exemplifies a progressive approach to maritime education, merging traditional methods with

experiential learning to produce well-rounded seafaring professionals. In essence, the Student Think Factory gathering at UiT was more than just a meet-up; it was a breeding ground for innovation and collaboration in the maritime student simulator domain. Students left not only with new connections but also with renewed enthusiasm for their field, a testament to the power of hands-on experience and the spirit of cooperation that defines COAST's approach to maritime education.



Figure 2: Meeting in Student ThinkFactory at UiT, December 2023. **Photo:** Trude Haugseth Moe.



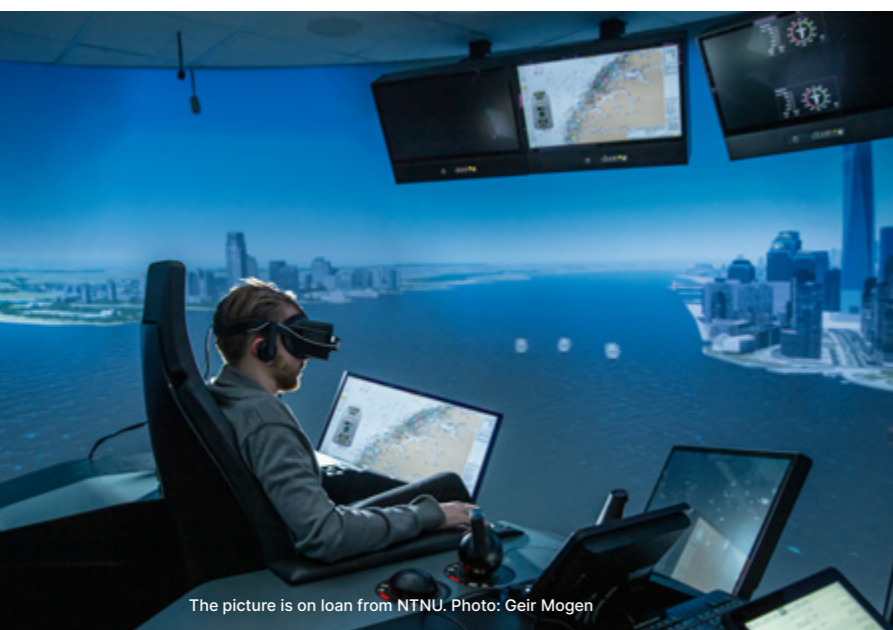
Figure 4: MS «Beret Paulsdatter» **Photo:** Vaagland Båtbyggeri



Plans for 2024

Tugboat challenge: Subsequent to the successfully concluded Tugboat Challenge of 2023, a new cycle of the competition has been initiated across four distinguished institutions. The final stage of this contest is slated to be hosted at HVL on the 10th and 11th of March, where the participating teams will strive to demonstrate their maritime prowess. This annual competition has not only catalyzed a surge of enthusiasm among maritime students but has also established itself as a pivotal element of practical education within our institutions.

“The Tromsø” convening in December 2023 has given rise to a novel initiative, dubbed the “*Tugboat Obstacle Course Series*”. This initiative features one or more standardized obstacle courses that are designed to be navigated by standard tugboat by individual students who aim to achieve the quickest completion time or garner the highest points. Each participating institution will be responsible for the development of their unique obstacle course modules, which will be systematically circulated among all four entities. This innovative endeavor invites individual students to pilot standard tugboats through a series of standardized challenges, promoting individual excellence and skill in maritime navigation.



Building on the impetus of COAST's initiatives, the establishment of a **maritime student alumni** network could be essential for fostering a community of practice among maritime professionals. The network if successful, will provide a platform for knowledge exchange, mentorship, and the strengthening of professional ties across the industry. By leveraging the experiences of graduates, current students will gain invaluable insights into maritime careers and the evolving industry landscape. The alumni network could also serve as a resource for continuing education and professional development, ensuring that maritime professionals remain at the forefront of industry advancements. Additionally, the planned network aspires to facilitate collaborative efforts in research and innovation, contributing to the dynamic nature of maritime education. Structured to encourage mentorship, knowledge sharing, and strengthening of professional relationships, the alumni network is poised to become an integral resource for continued learning and industry innovation. Tapping into the vast experiences of our alumni, students will gain unprecedented access to real-world insights, preparing them for successful careers in the ever-evolving maritime sector. The network's focus on collaborative research and innovation will further energize maritime education and contribute significantly to the broader maritime community.



PhD candidate, Anastasia Skarpeti, NTNU

PhD Work

Anastasia Skarpeti conducts her research exploring Student' engagement (SE) in maritime simulation-based training activities. She successfully completed her Midterm-evaluation in August 2023. She has finalized all mandatory PhD courses, collected video-data from Norwegian maritime educations, and is working on her first article and Kappa. She had approximately five months of stay at University of Gothenburg, Sweden in spring 2023. The aim was to attend two doctoral courses and to collect video-data from a Swedish Maritime University. Finn Tore Holmeset, aims to explore the impact of implementing green technology onboard vessels. In the project he examines how the battery-hybrid power system affects vessel machinists and electricians in an operational context, where the focus is on finding answers to which technical and operational challenges are introduced in conjunction with introduction of this technology. Based on findings in the upcoming research, a basis can be formed to say something about the future need for training and education, and possibly shed light on what needs to be changed in relation to the current standard.



University of Gothenburg (Shutterstock).



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Table 4: Status of activities in FA3

Description of activities		2020		2021		2022		2023		2024		2025	
		H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2
A16	Revised and new collective models and organisation of student engagement/involvement, student unions and alumni networks												
A16.1	Hiring PhD candidates												
A16.2	Workshop on student engagement												
A16.3	Workshop on SSA												
A17	Development and implementations of SSA (simulator student assistant) curriculum, course plan and training exercises.												
A17.1	Draft and Finalise SSA curriculum												
A17.2	Run pilot SSA course												
A17.3	Implementation of SSA course across COAST												
A17.4	Student engagement activities: Tugboat Tournament												
A18	Present excellence/innovative practices to other professions, nationally and internationally												

Ongoing
 Delays
 Planned
 Completed



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Maria Prøis Rønneberg



Figure 5: PhD thesis: Xue, H. (2023). "Methods for enhanced learning using wearable technologies. A study of the maritime sector." UiT The Arctic University of Norway. **Photo:** Front page from PhD thesis and backgroundimage from Shutterstock.

FOCUS AREA 4: Organizational Development



Goals

The primary goal is to create a more effective maritime education system by analysing different educational approaches. This includes developing guidelines for curriculum improvement and promoting cooperation among maritime institutions.

This COAST focus area will result in revised and collective models for systemic educational transformations, partnerships for supporting simulator-based training and assessment, and models for professional development of instructors and trainers.

Objectives

- Evaluate, revise and suggest new models of organizing simulator-based training and assessment through workshops, observations, interviews, and document analysis.
- Provide systems, structures, and flexible organizations to become more innovative and leading providers of simulator training and assessment for maritime education.
- Develop working seminars with industrial partners, maritime organizations, alumni, the leadership of the institutions, instructors, students and researchers to develop a common baseline, suggest changes, plan for educational and institutional transformations and implement relevant changes across members of the consortium.
- Disseminate results at an international level and to similar professions utilising simulator training.

Work in 2023

Data was collected at the four COAST partner institutions UiT, NTNU, HVL and USN. This study has mapped how the whole process of simulator training (brief, execution and debrief) is organised and conducted. Both similarities and differences have been observed. The study includes both field observations and interviews with the simulator instructors.

Helene Xue defended her thesis on the degree of Philosophiae Doctor in October 2023. Xue studies the use and role of wearable sensors and technologies in maritime training. The thesis contributes to the advancement in simulator use and new technology in maritime education and training simulators. It finds that incorporating biosignals can allow the instructors to gauge student stress and possibly adapt learning to fit the training program with individual students' needs. By knowing the students' stress level, instructors can assist students in managing their stress and adjust the challenge point so that the training stays within the Zone of Proximal Development (ZPD).

From the simulated to the real environment

Simulator training aims to enhance the knowledge, skills and attitudes of candidates for officer of the watch. The transfer from a simulator to onboard navigation may challenge the students. Real navigation does not typically present itself as nicely as in simulators. For students without any previous seagoing experience,

what takes place in a bridge simulator may provide little meaning, and scenarios may be challenging to make sense of. In 2023, FA 4 conducted two voyages with the research vessel *Beret Paulsdatter*, where the students sailed as duty navigators in the waters previously sailed in the simulator. The purpose of the exercise is to let the students see the transferable skills from simulator to real-life navigation and vice versa. It is found that students invest more time and effort in the simulator exercises following the voyage with a real ship. It seems that the overall quality of the simulator training increases.



Figure 6: MS «Beret Paulsdatter» **Photo:** Geir Ole Søreng



Photo: UiT



Tyler Lastovich/Unsplash



Accelerated learning

Voyage planning is essential to ship navigation, as the STCW convention highlights. To train the candidates, UiT has explored an accelerated voyage planning concept to enhance the student's knowledge and skills in voyage planning. Navigation can be divided into two main steps: planning and execution. When conducting navigation at sea, there is often a time gap between the voyage planning and the voyage execution, limiting/hindering the learning between the two processes. The same hindrance might occur during simulator training. By reorganizing the learning process, the students may accelerate their performance in voyage planning. As part of mapping alternative ways of organising simulator training, the students at UiT have gone straight from voyage planning into the simulator to evaluate specific selected courses without executing the voyage. The students get rapid feedback on their choices for the voyage plan and can immediately evaluate their choices and the impact of their choices.

FA 4 also studied the effect of rapid training methods on ship handling, navigation and decision-making. It was found that students obtaining conventional training over a longer period could solve unfamiliar and critical situations, applying their knowledge and skills. Students exposed to rapid training were able to train tasks effectively. More studies are needed before a rapid training method can be applied. However, a mix of training methods between conventional, longitudinal training and rapid, specific training can likely enhance the overall learning efficiency.

The aviation industry

During 2023, a short study on how airline pilot training is organised and conducted. Before 2006, training to become an airline pilot was general in that all went through the same training for the commercial pilot license (CPL) independent of the type of aircraft to be flown.

Simulator training in the aviation industry:

- Have explicit pre-requisite knowledge prior to simulator training.
- Have concrete, standardised objectives for each lesson.
- Readily available training objectives and supporting literature.
- Have systematic progress.
- Stage checks are part of the quality assurance for training.

With the introduction of the multi-pilot license (MPL), there was a shift to an emphasis on competency-based training, focusing on crew resource management and multi-crew cooperation. The MPL program requires fewer actual flight hours than CPL training, with more training in simulators. As part of the MPL program, industry collaboration involves airlines to ensure that training is aligned with industry standards and operational requirements.



PhD, Helene Xue, UiT

PhD Work

Helene Xue graduated on 4 Oct. 2023 with the PhD thesis "Methods for enhanced learning using wearable technologies. A study of the maritime sector". UiT The Arctic University of Norway.

Data collection on organisation of maritime simulator training among the four COAST member institutions.

The PhD midterm evaluation was conducted in December 2023.

FA 4 signed the third PhD contract at UiT to participate in COAST, starting 1 Feb. 2024.

Meetings, Conferences, etc.

- Participated in the Applied Human Factors and Ergonomics (AHFE) 2023 and received the AHFE 2023 Best Paper Award – Human Factors in Transportation (MAR).
- Participated in the OMAE conference 2023
- Kongsberg Simulation User Conference
- Visit Singapore Polytechnic and Singapore Maritime Academy.



Hu Chen/Unsplash



Plans for 2024

Organize an industry seminar on safe navigation and simulator training in May 2024.

The Multi-Pilot License concept from the aviation industry inspires this seminar. By bringing members from the maritime industry into the seminar, the objective is to have the industry's input on operational and best practices incorporated into simulator training. Much experience is gathered year around in the industry, and there are limited possibilities for the simulator training organisations to be updated on both challenges, improved practices and needs in the industry.

Organize instructor seminar and institutional development in June 2024

There is currently limited sharing of best practices between institutions providing simulator training. The seminar will have instructors from both the maritime and aviation industry. This seminar will address aspects of simulator instructions such as training sequence, instructor role and methods for formative assessment, partnership for improvement. Shared protocol development for evidence-based training

Case study of the simulator training in the aviation industry.

An in-depth study of the aviation industry's competence-based training and assessment (CBTA) and evidence-based training for simulator use. Two organisations will be studied, UiT – University of Tromsø School of Aviation and TFHS – MPL training. In addition, an ab-into program will be studied in an airline, attempting to identify the organisation's methods to improve industry best practices.



Table 5: Status of activities in FA4

Description of activities		2020		2021		2022		2023		2024		2025	
		H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2
A20	Develop models of organisational structures of Maritime institutions												
A20.1	Internal workshop at faculty level												
A20.2	Workshop on organizational development												
A20.3	Map organizational structures of maritime institutions in Norway and abroad												
A21	Professional development of simulator instructors and trainers												
A21.1	Meeting with Result. UiT department for development of education quality												
A.21.2	Workshop with COAST simulator instructors												
A20.3	Workshop with instructors from aviation and healthcare												
A21	Evaluate, revise and suggest research-based models of organizing simulator-based training and assessment based on Focus Area 1-3.												
A22	Establish collaboration with external organizations												
A22.1	Collaboration with the maritime industry												
A22.2	Collaboration with government organizations												
A22.3	Collaboration with aviation industry												





COAST Plans and priorities for 2024

In light of the state’s decision, the possibility of continuing the SFU (Sustainable Futures Unit) centers has been terminated. Given this situation, it is imperative that we adopt a strategic approach to ensure that we maximize outcomes during the remaining operational period. After a careful evaluation, the center will prioritize the following three areas:



1

Planning for the Post-COAST Era

Develop a transition plan in which we identify and secure pathways for ongoing projects.

2

Implement Best Practices from COAST to Educational Programs

Integrate the insights and research findings from COAST into existing maritime curricula within the larger partnership of COAST.

3

Dissemination Activities

Share our research findings across professions utilizing simulators locally, nationally, and internationally to encourage the adoption of COAST’s solutions across different fields of study and industries.

Melina Lorenz/Unsplash



References

Gyldensten, W., Wiig, A. C., & Sellberg, C. (2023). Maritime students' use and perspectives of cloud-based desktop simulators: CSCL and implications for educational design. *TransNav: International Journal on Marine Navigation and Safety of Sea Transportation*, 17 (2), 315-321. DOI: 10.12716/1001.17.02.07

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Tusher, H.M., Mallam, S. & Nazir, S. (2024) . A Systematic Review of Virtual Reality Features for Skill Training. *Technology, Knowledge & Learning*. <https://doi.org/10.1007/s10758-023-09713-2>

Undheim, P.E. (2022, October). Artificial Intelligence opportunities for the future MET. Maritime Education Conference, Tromsø, Norway, October 18-20, 2022.

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Appendix

Appendix-1: List of key member staff of centre in 2023

Name	Role in COAST	Institution
Salman Nazir	Scientific Leader	USN
Inger Johanne Lurås	Centre Coordinator	USN
Camilla Wiig	Pedagogic Advisor	USN
Margareta Lützhöft	Leader of Focus Area 1	HVL
Leif Inge Magnussen	Leader of Focus Area 2	USN
Per Haavardtun	Co-leader of Focus Area 2	USN
Tron Resnes	Leader of Focus Area 3	NTNU
Arnt Myrheim-Holm	Leader of Focus Area 3 (from 1 Nov. 2023)	NTNU
Antoni Vike Danielsen	Co-leader of Focus Area 3 (from 1 Nov. 2023)	NTNU
Bjørn-Morten Batalden	Leader of Focus Area 4	UIT
Magne-Petter Sollid	Co-leader of Focus Area 4	UIT
Rami Zghyer	PostDoc	HVL
Meric Karahalil	PhD	HVL
Hasan Mahbub Tusher	PhD	USN
Mari Auby Starup	PhD	USN
William C. Gyldensten	PhD	USN
Finn Tore Holmeset	PhD	NTNU
Anastasia Skarpeti	PhD	NTNU

Hosna Namazi	PhD	UIT
Johan-Fredrik Røds	PhD	UIT
Ole Martin Foss Nybø	Leader of Student ThinkFactory	HVL
Sem Lucas Sebastiaan Hage	Co-leader of Student ThinkFactory	UIT
Aina Lund Sørli	Student ThinkFactory	HVL
Anna Monika Witkowska	Student ThinkFactory	HVL
Lone Berg Ness	Student ThinkFactory	HVL
Johannes Fæste Mikalsen	Student ThinkFactory	UIT
Øyvind Andreassen Sæterstrand	Student ThinkFactory	UIT
Natalie Pedersen Nordstrøm	Student ThinkFactory	UIT
Eline Hetle Alsaker	Student ThinkFactory	USN
Sander Haugen	Student ThinkFactory	USN
Max William Viktor van der Haagen	Student ThinkFactory	USN
Tora Arntzen Slotvik	Student ThinkFactory	NTNU
Oscar Ulrik Danielsen	Student ThinkFactory	NTNU
Johannes Svendsen	Student ThinkFactory	NTNU
Anders Groven Sandøy	Student ThinkFactory	NTNU
Amanda Hallberg	Student ThinkFactory	NTNU
Maria Erstad	Student ThinkFactory	NTNU
Olav Johan Marø	Chief Engineer	HVL
Vigleik Storesund	Teacher	HVL
Arnt Håkon Barmen	Teacher	NTNU
Hallgeir Giske	Teacher	NTNU

Appendix 2: Research Publications in 2023

Title	Author(s)	DOI	Type of publication	Status
Maritime Students' Use and Perspectives of Cloud-Based Desktop Simulators: CSCL and Implications for Educational Design	Gyldensten, W., Wiig, A. C., & Sellberg, C. (2023)	https://doi.org/10.12716/1001.17.02.07	Professionals and Educators	Published
An evaluation of maritime simulators from technical, instructional, and organizational perspectives: a hybrid multi-criteria decision-making approach	Tusher, H. M., Munim, Z. H. & Nazir, S. (2023)	https://doi.org/10.1007/s13437-023-00318-1	Journal article	Published
A Systemic Review of Virtual Reality Features for Skill Training	Tusher, H. M., Mallam, S. & Nazir, S. (2024)	https://doi.org/10.1007/s10758-023-09713-2	Journal article	Published
Playing to learn? A frame analysis of competition and playfulness in maritime simulation	Starup, M., Sellberg, C., & Wiig, A.C.	N/A	Journal article	Forthcoming
Seeking the Best Practices of Assessment in Maritime Simulator Training	Tusher, H.M., Nazir, S., Ghosh, S & Rusli, R (2023)	https://doi.org/10.12716/1001.17.01.10	Journal article	Published
Formative assessment in maritime simulator-based higher education	Karahalil, M., Lützhöft, M., & Scanlan, J. (2023)	https://doi.org/10.1007/s13437-023-00313-6	Journal article	Published
"I'm quite engaged in trying to get the students engaged": Maritime Instructors' perspectives on student engagement with simulation-based activities	Skarpeti, A., Giskeødegård, M.F. & Wiig, A. C.	N/A	Journal article	In Review
Peer-to-peer reflections in maritime simulation: Student engagement in extracurricular training activities	Skarpeti, A., Sellberg, C., & Wiig, A.C.	N/A	Conference paper	Forthcoming
A case study of technological challenges connected to introduction and use of battery-hybrid power system on board novel ships	Holmeset et al.	N/A	Journal article	In Review
Organizational Challenges to a pathway to "Greener" shipping: A Case Study	Holmeset et al.	N/A	Conference paper	Forthcoming
A study on the effects of rapid training method on ship handling, navigation and decision-making skills under stressful situations.	Xue, H., Røds, J.F., Haugseggen, Ø., Christensen, A.J., Batalden, B.-M. & Gudmestad, O.T.	N/A	Journal article	In Review
Assessment of stress levels based on biosignal during the simulator-based maritime navigation training and its impact on sailing performance.	Xue, H., Haugseggen, Ø., Røds, J.-F., Batalden, B.-M. & Prasad, D.K	N/A	Journal article	Forthcoming
Trustworthiness Evaluation Framework for Digital Ship Navigators in Bridge Simulator Environments.	Namazi, H., & Perera, L. P.	N/A	Conference paper	Published
The impact of safety factors on decision-making in maritime navigation.	Xue, H., Røds, J., Batalden, B	http://doi.org/10.54941/ahfe1003950	Conference paper	Published

Appendix 3: Conferences and seminars

Title	Date and place	Related work	Attendance
International Association of Maritime Universities (IAMU) Conference 2023	Helsinki, Finland, October 18-21, 2023	Factors Impacting Curricula in Maritime Simulator-Based Education	100+
International Association of Maritime Economists (IAME) Conference 2023	Long Beach, USA, September 5-8, 2023	An evaluation of maritime simulators from technical, instructional, and organizational perspectives: a hybrid multi-criteria decision-making approach	100+
International Conference on Analyzing and Advancing Simulations for Professional Learning (SimPro2023)	Gothenburg, Sweden, April 26, 2023	Playing to learn? A frame analysis of competition and playfulness in maritime simulation	50+
International Conference on Marine Navigation and Safety of Sea Transportation (TransNav 2023)	Gydnia, Poland, June 21-23, 2023	Seeking the Best Practices of Assessment in Maritime Simulator Training.	100+
SimLearn Conference 2023	Åsgardstrand, Norway, September 13, 2023	Monitoring, noticing, and instructional feedback during maritime desktop simulation	20+
International Conference on Marine Navigation and Safety of Sea Transportation (TransNav 2023)	Gydnia, Poland, June 21-23, 2023	Maritime Students' Use and Perspectives of Cloud-Based Desktop Simulators: CSCL and Implications for Educational Design.	100+
Applied Human Factors and Ergonomics Conference (2023)	San Francisco, USA, July 20-24, 2023	The impact of safety factors on decision-making in maritime navigation.	100+
International Conference on Offshore Mechanics and Arctic Engineering	Melbourne, Australia, June 11-16, 2023	Trustworthiness Evaluation Framework for Digital Ship Navigators in Bridge Simulator Environments.	50+

Appendix 4: Master and Bachelor theses

Student (s) name	Year and place	Title	Level
Tøsse, A. A., Rossland, S., and Tonning, A. F.	2022, HVL	Assessment of the benefits of extended maritime simulator exercises conducted by students.	Bachelors
Rønning, T. N., Haltbakk, L.S., Farstad, H.O.	2023, HVL	Unlocking the Potential: Co-Curricular Simulator Activities in Maritime Higher Education and Student Participation.	Bachelors
Skaar, N.	2023, HVL	Assessing the Impact of Simulator and Real Vessel Training at the Royal Norwegian Naval Academy.	Masters
Korneliussen, M. and Moland, H. A.	2023, UiT	Hvordan har tilbud om frivillig trening på navigasjonssimulator innvirkning på trygghet og læringsprestasjoner for studenter?	Bachelors



