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Examining the use of blended learning in maritime education and training

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EXAMINING THE USE OF BLENDED LEARNING IN MARITIME EDUCATION AND TRAINING

By

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Declaration

I certify that all the material in this dissertation that is not my own work has been identified and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views and are not necessarily endorsed by the University.

(Signature):

(Date): **21st September 2021**

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Acknowledgments

Abstract

Title of Dissertation: **Examining the Use of Blended Learning in Maritime Education and Training**

Degree: **Master of Science**

Nowadays, Maritime Education and Training (MET) is seen as a significant aspect in improving seafarers' understanding, knowledge, and proficiency under the International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers (STCW). However, this paradigm faces many challenges. To solve the issues, METIs are trying to develop Blended Learning (BL) approach. This dissertation tried to identify the modality of BL by literature review, which describes how BL can cope with the limitations of the current MET paradigm. It also looked at the current status, limitations, and the effectiveness of collaboration among Maritime Education & Training Institutions (METIs) to improve learning programs concerning BL by conducting interviews. Two strategies were used in this research further to disseminate BL: a literature review and semi-structured interviews. Findings from the literature revealed that BL has four characteristics composed of net-centricity, which means students can take lectures whenever and wherever they are, tailored syllabus, accurate assessment, and enhanced interaction. All of these elements can compensate for limitations competence-based training. Effective BL is based on pre-defined legal sources, highly developed technical infrastructure, and well-trained human resources. The interview results indicate that the pandemic of COVID-19 has accelerated institutions explored to adopt BL and this trend. However, modality, except for net-centricity, is not observed from the interview. This might be because they were forced to rely only on e-learning. The analysis of the interview results also revealed that several METIs lack legal, technical, and human resource basis. As a result, a legal basis for BL, such as guidance, should be developed at IMO. Furthermore, some institutions suffer from unstable internet connections in terms of technical infrastructure, so alternative measures, such as satellite communication, should be considered. Moreover, in terms of human resources, only a few institutions provide BL training for instructors. Instead, institutions have sought to improve their BL by providing webinars for instructors, weekly meetings with faculty members, peer learning, and knowledge sharing sessions on how to conduct BL courses online. Finally, findings revealed that collaboration could save money and enable METIs to deliver enhanced and improved training programs by sharing facilities and human resources.

KEYWORDS: Maritime Education and Training, Blended Learning, institutions, legal, technical, human resources, collaborations

Table of Contents

List of Figures

List of Tables

List of Abbreviations

AI   Artificial Intelligence

BL   Blended Learning

HR   Human Resources

ICT   Information and Communication Technologies

ILT   Instructor-Led Training

IMO   International Maritime Organization

IT   Information Technology

LEO   Low Earth Orbit

LMS   Learning Management System

MET   Maritime Education and Training

METIs   Maritime Education and Training Institutions

MOOC   Massive Online Open Course

REC   Research Ethics Committee

STCW   International Convention on Standards of Training, Certification and Watchkeeping for Seafarers

STCW Code   Seafarers' Training, Certification and Watchkeeping Code

WMU   World Maritime University

VR   Virtual Reality

Chapter 1 Introduction

1.1. Background and context

Since maritime transportation is anticipated to grow rapidly, mainly driven by the speedy development of technologies related to ship designs, systems, and equipment, the maritime industry faces many challenges concerning seafarers' education (ECMAR, 2016). Shenoi et al. (2015) expressed this situation as ironies of automation, meaning highly developed technologies require highly trained human operators. Nowadays, it is widely accepted that the twenty-first century is marked by technological modernization. Explicitly, the equipment and systems used on merchant's vessels have become more sophisticated and advanced. For example, the change from paper charts to electronic charts onboard is one of the advancements. This trend will be further accelerated by digitalization in the future (Shenoi et al., 2015; Dalaklis et al., 2020; Ma, 2020). So, seafarers and cadets need to retain their knowledge and skills regularly, and Maritime Education and Training Institutions (METIs) need to provide appropriate education based on this trend (Russo et al., 2014).

To make it possible for seafarers to continue learning and updating their skills, e-learning has the potential to improve Maritime Education and Training (MET). Current applications of e-learning include, for example, how Massive Online Open Courses (MOOCs) provided by the maritime industry are used among a number of top universities to disseminate high-quality lectures on various subjects (Haiyan, 2016). However, such courses can be used only for complementary materials to enhance learners' understanding of specific knowledge, and it cannot be the main teaching tool (Haiyan, 2016). Therefore, relying only on e-learning is not enough. In addition, e-learning usually lacks emotional communication between students and between students and instructors, which lowers the performance of learning (Chen et al., 2017; Pipchenko & Kovtunenko, 2020).

Furthermore, the inadequate modern facilities of METIs are one of the problems in the maritime industry. In this technology-driven age, most institutions fail to provide the

appropriate equipment and teaching materials to keep students up-to-date on the latest knowledge and skills required to drive ships effectively and reliably (UIA, 2020). Most developing countries are currently facing this issue even though many seafarers engaging in international shipping are from developing countries (Galić et al., 2012). This is because it costs huge sums of money to introduce modern facilities and such facilities need highly qualified and experienced instructors. As a result of inadequate facilities and poor human resources, new seafarers often have difficulties coping with modern equipment onboard, which they have never seen in METIs when they go onboard a ship (Bhardwaj, 2013). Therefore, METIs need to upgrade infrastructure and acquire suitable technologies to fit the new lifelong learning approach.

Moreover, it is difficult to assess and evaluate appropriately through examinations and assignments (Haiyan, 2016). In addition, learners cannot study at their own paces (Pipchenko & Kovtunenko, 2020) because instructors teach them based on unified criteria in the traditional teaching method. Therefore, it can be said that conventional competence-based learning cannot meet the needs of all students (Haiyan, 2016). To tackle the above issues, new teaching blends advantages of traditional competence-based learning, e-learning, and on-the-job training, and it is called "Blended Learning (BL)" (Pipchenko & Kovtunenko, 2020).

BL is a modern approach widely implemented in higher education (Hubackova & Semradova, 2016). Traditional classroom teaching is one of its critical parts. However, the second portion is remote learning, including self-study and interaction with instructors through the internet. The BL approach may allow seafarers to learn at a place and time that is convenient for them, even onboard a vessel (Haiyan, 2016). Thanks to the rapid development of Information and Communication Technologies (ICT), more and more people are getting connected. This trend has transformed the world into more 'net-centric, which means people can obtain necessary information whenever and wherever. This notion can also be applied to the shipping industry (Dalaklis et al., 2020), and net-centric MET enables the crew to take lectures whenever and wherever they want.

Although METIs are trying to adopt BL, understanding how to approach and design BL is limited as BL is still in the developing stage; for example, Myanmar, one of the developing countries, needs to develop and understand how to approach BL comprehensively. On the other hand, if students studying at such METIs can take online learning from METIs in developed countries with lucrative capacities, it will help them acquire new technologies quickly. Moreover, the current pandemic of COVID-19 has forced many nations to conduct MET online (ICS & IAMU, 2020) due to domestic and international movement bans for hygiene reasons. Therefore, it can be said that BL, which integrates online learning, has become more and more important. Based on the above background, this dissertation will focus on BL.

1.2. Significance of the study

The improved BL could address the limitations of the current competence-based learning described in Section 1.1. Therefore, it is important to identify the challenges of BL and suggest possible solutions. In this background, this study will focus on the modality of BL, advantages, disadvantages, and best practices concerning BL. Since BL is still under development in most METIs, there is no specific research in this field. Therefore, it is beneficial to identify the modality of BL and how METIs implement it. In addition, it is crucial to assess best practices concerning BL and limitations with which METIs are facing through the real cases and consider the way how METIs can tackle them.

1.3. Research aims and objectives

This research aims to meet the following four objectives:

1.   To identify the modality of the delivery of BL.

2.   To explore various educational approaches of METIs to BL.

3.   To describe the advantages and challenges of BL.

4.   To investigate capacity-building collaborative programs to optimize BL.

1.4. Research questions

Based on the above objectives, the researcher tackled the following questions:

1.   What are the modalities of BL in Maritime Education and Training?

2.   What are the educational approaches of METIs to BL?

3.   What are the challenges that are encountered regarding BL in delivering MET courses?

4.   How do capacity-building collaborative programs between maritime clusters optimize BL?

1.5. Research methodology and methods

This study uses a mixed research approach to answer the research questions. A literature review answered the first research question. The qualitative approach was used for the other questions to collect data through semi-structured interviews from six METIs and meet the objectives. Data gathered by interview were compared with the results of the literature review. The necessary background data are mainly based on six METIs and gather other necessary information from published papers, websites, document collection studies, and previous studies.

1.6. Structure of the dissertation

The research is composed of six chapters, including:

Chapter One introduces the research, including a brief description of the background information, objectives, expected findings, methodology, and structure.

Chapter Two reviews the previous literature about the general nature of the MET system, the definition of BL, education approaches regarding BL, the advantages and disadvantages of BL, the importance of collaboration among METIs to optimize BL.

Chapter Three concentrates on an overview of the research design on the research methodology and defines the data collection process by describing the document analysis and semi-structured interviews regarding the development of the BL system.

Chapter Four analyzes interviews data conducted by six METIs.

Chapter Five discusses each of the research questions and compares the literature review and interview results.

Chapter Six concludes with the expression of some limitations that need to be considered in the dissertation to examine the BL system to overcome existing congestion problems that the government sector and METIs have been facing. In addition, it will also express recommendations for the BL system of the MET industry.

Chapter 2 Literature review

2.1. Introduction

The fundamental purpose of this chapter is to research the BL approach in the MET sector from an academic point of view. This chapter aims to answer research question one (modality of BL), which means how BL can cope with the difficulties of the current competence-based learning. To answer this, the researcher firstly identifies the framework of MET and later focuses on BL. Specifically, this chapter describes the definition of BL and illustrates how BL is necessary under the framework of MET. Furthermore, it represents the advantages and disadvantages of BL. Moreover, this chapter discusses the importance of collaboration among METIs to optimize the BL system. Finally, this chapter will summarize the discussion and identify the modality of BL.

2.2. General Nature of MET system

Seafarers play a vital role in the operation of the maritime industry. Furthermore, maritime organizations set regulations, conventions, guidelines, and standards, and seafarers are the major operators to follow them (Masuku, 2020). Thus, enhancing seafarers' skills in any way possible will strengthen maritime safety and efficiency while also protecting the marine environment. As a result, it is imperative to improve the MET sector for seafarers in line with ever-changing technological development.

The International Maritime Organization (IMO) adopted STCW 78 to improve maritime safety and environmental protection by enhancing seafarers' knowledge and setting up international minimum standards for seafarer proficiency and watchkeeping. The Convention focused on knowledge obtained through instructors. Following that, the STCW 95 and STCW Manila Amendments 2010 were implemented as a new approach to upgrading seafarers' minimum training standards in alignment with technology advancements. The Convention emphasizes 'competency.' It comprises three important elements: knowledge, skills, and experience. Learning is relevant to

the first two things because experience can be obtained through successive repetition of specific work (Pipchenko & Kovtunenko, 2020). Historically, international MET was centered on practical training and maritime expertise in the merchant navy and fleets.

However, competency-based training is no longer enough to implement training programs to upgrade training standards for seafarers to cope with evolving technologies. Therefore, it is also needed to support e-learning, simulator-based training, and on-the-job training, and this integrated approach is called BL. In competency-based learning, instructors provide lectures in front of students under a pre-defined syllabus with additional teaching aids, such as PowerPoint presentations and textbooks. There might be some auxiliary classroom activities, such as question and answer sessions, presentations by students, and group discussions (Huiyan, 2016). Besides, the increasing use of simulator-based learning is a trend of the industry. The STCW Convention allows flag States to use the methods as alternatives to onboard training (Kim et al., 2021). The latest STCW Code amendments highly suggest the emergence of advanced teaching techniques such as distance education and web-based learning to boost seafarers' competence and knowledge (Bauk et al., 2013).

IMO also supports the BL approach in the MET sector. For example, as part of mandated STCW training, Section B-I/6 of the STCW Code, "Guidance regarding training and assessment," mentions two alternatives: in-service training and assessment; and distance learning (including e-learning) which creates the fundamental number of performance requirements and is one of the parts of BL. Furthermore, the IMO Model Course 6.09 "Training course for instructors" includes several virtual teaching approaches, including computer-based training, E-learning, distance learning, and MOOC. As a result, METIs are attempting to develop the BL system, a popular trend in the MET sector.

2.3.   Blended Learning

According to Tucker (2020), *"Blended learning is the combination of active, engaged learning online combined with active, engaged learning offline to provide students with more control over the time, place, pace, and path of their learning."*

Bonks and Graham (2005) defined that *"BL is the integration of instruction from two relatively independent types of learning and teaching: conventional face-to-face learning systems and distributed learning programs."*

According to the IMO Model Course 6.09, *"BL is a way of education in which a trainee combines or blends a variety of approaches such as instruction, digital, and online media learning."*

Based on the above information, this study defines BL as a mixture of face-to-face learning, online learning, practical learning, and simulator-based training for the MET sector (Figure 1). These teaching methods are detailed in the following subsection.

Figure 1

Blended Learning Definition for MET
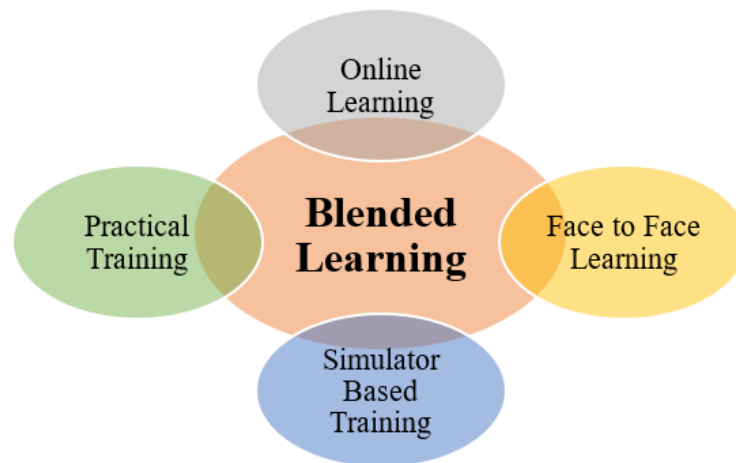
Note. Created by the researcher

2.4. Educational approaches with BL

This subsection will describe each teaching method of BL and how BL is delivered. As mentioned in figure-1, BL has four teaching approaches. The following are the detailed explanations of each approach.

2.4.1. E-Learning

E-learning is categorized into Synchronous Learning and Asynchronous Learning, which can take place both onsite and online.

a. **Synchronous Learning.** Synchronous learning encompasses all modes of learning. Students can learn at the same time with an instructor and can get quick feedback. While all students engage simultaneously, synchronous learning does not occur in person or the same place. Instructors and students simultaneously facilitate the learning process, including in-person classes and online live sessions with the entire class or small communities (Finol, 2020). Students commonly go through the study route together during synchronous learning, supervised by a professor who could assist with assignments and activities.

b. **Asynchronous Learning.** Finol (2020) mentioned that asynchronous learning is a student-centered teaching style typically involved in online courses. Its primary assumption is that learning can happen at various times and places for each learner compared to synchronous learning, which goes on simultaneously and location for groups of students or one student and their instructor. Instructors frequently set up a learning course for students to follow their schedule in asynchronous learning. Asynchronous learning enables students to learn new information and develop skills through their timetable, which could help students who are concerned about falling behind their classmates feel less anxious. An asynchronous learning situation is similar to a typical e-learning

course. For example, an online discussion platform may be asynchronous if a learner reads and writes without engaging in a real-time conversation.

2.4.2. Face-to-Face Learning

Face-to-face instruction is a teacher-centered form of education and an instructional approach in which many students have instructed course programs and learning material in person. When performing standard face-to-face classes, instructors have to acquire specific skills to make conventional education methods efficient (Galić et al., 2020). One of the essential teaching skills is establishing communication with students, allowing students and teachers to engage in real-time. It is the most common method of inquiry learning.

Moreover, students acquire from facilitating engagement with their classmates. Students are responsible for their performance in face-to-face learning at the class's designated meeting date and time. Face-to-face learning ensures a better understanding and retention of subject knowledge and the opportunity for class participants to socialize with each other.

2.4.3. Simulator-based Learning

Simulator-based training is a type of maritime education that uses a simulator. It can be defined as a model of certain events or issues that can provide useful information to decide courses of action. It enables students to practice high-risk tasks under a safe environment created by simulators. In addition, it is more flexible than the other methods because it provides playback of students' tasks, which enables feedback in detail. Furthermore, simulators are theoretically available at any time (time flexibility), and students can practice under different conditions (condition flexibility). Moreover, it enables tailored training for students, and assessors can monitor and evaluate students' performance. Furthermore, simulators may encourage students to practice non-technical abilities, such as communication, leadership, and decision-making (Kim et al., 2021).

2.4.4. Practical Training

Practical training is relevant to skills of competence-based learning. It cultivates literally practical skills such as navigation, the use of equipment including Radar, ECDIS, safety, emergency response (firefighting, survival craft) (Mazzarino & Maggi, 2000).

2.4.5. Delivery of BL

Haiyan (2016) analyzed maritime English courses delivered through BL and concluded that BL is usually composed of individual online lectures, instructors' lectures, and small group projects.

For online courses, METIs shall use digital platforms or Learning Management System (LMS) (MARINA, 2020). Online lectures incorporate quizzes, discussions, debates, and tests to assess students in real-time accurately (Mugabi, 2021).

Instructors' lectures are conducted face-to-face, and instructors and students can be physically present in class and have in-person discussions (Milheim, 2006). These in-person lectures play a role in orienting students and making students motivated.

After online learning, students are assigned into small groups and conduct discussions and decision-making (Haiyan, 2016). Students develop their ability to explore, share ideas, solve problems, and clarify differences when they collaborate with each other (Hammar Chiriac, 2014). The three learning activities enable instructors to monitor students closely and grasp students' learning progress in real-time. Instructors assess students' daily activities in the class, and instructors can evaluate students more accurately than examinations.

By closely monitoring students, instructors can construct tailored syllabus that take into consideration the distinctive characteristics or needs of each student, ensuring that all students acquire competencies (Haiyan, 2016). As BL can usually include simulator-based learning, practical learning, e-learning, face-to-face lectures, and group projects, the integration of both simulator-based learning and practical learning

may provide more tailored syllabus for students and more accurate assessment of students' competence.

2.5. Why is BL essential in MET?

To identify the modality, this section will touch on some challenges of the current limitations of competence-based learning and explain how BL tackles them. The continual advancement of maritime technologies and the perpetual amendment of the convention bring lifelong learning to the forefront of the MET sector. For example, professional seafarers must continue to receive additional knowledge and information updates from GMDSS, ECDIS, and other latest technological training to upgrade the contents of new conventions, amendments, and laws to perform the competent job.

As mentioned in Figure 1, the BL approach for the MET industry can be blended with face-to-face learning, online learning, practical training, and simulator-based training, as the learning and teaching system may vary depending on the specific course. Each educational method has its advantages and disadvantages, so by mixing these methods appropriately, it is possible to minimize challenges of MET. For example, it is difficult for seafarers to gain the latest knowledge on equipment only through practical training. Instead, they can obtain the latest knowledge through e-learning (Alop, 2019). Similarly, it is difficult for students to acquire practical skills, such as fire prevention and firefighting, through face-to-face classroom, but a combination of classroom instruction and practical firefighting and fire prevention practices, exercises, and techniques is effective. Furthermore, simulator-based training enables students to practice high-risk tasks under a safe environment created by the simulator, and students can practice under different conditions (Kim et al., 2021).

Moreover, since maritime simulators are the new means to build competence, online simulation training can be an alternative teaching method. Through online simulation, maritime students could become acquainted with the most up-to-date, cutting-edge technologies. As a result, METIs can share their simulation experiences online, and online simulator training is one solution for METIs to replace their outdated onboard

equipment. Kim et al. (2021) predicted that simulation for METIs would be delivered on cloud (cloud-based simulator), which would secure net-centricity and reduce costs to operate it. In the near future, simulators based on Virtual Reality (VR), which is one of the pillars of Industry 4.0, is expected to be used for MET (Mallam et al., 2019; Pipchenko & Kovtunenko, 2020), and students may be able to use high-quality simulator-based training wherever and whenever they are. Therefore, BL is fundamental in the MET field as these teaching methods are incorporated in one of BL's techniques.

2.6. Advantages and Disadvantages of BL

Every learning method, including the BL system, has its own set of strengths and weaknesses. These are some of the advantages and disadvantages of integrating an effective blended approach.

2.6.1. Advantages of BL

The following advantages of the BL technique in the MET industry:

i.   It can create the ability to learn at a suitable location and time for seafarers mainly through e-learning. In general, e-learning allows seafarers to learn at their schedule at a convenient time and location, even onboard a vessel (Huiyan, 2016).

ii.   It can assist with studying at an individual's speed. This is critical since the seafarer's degree of learning, and knowledge pace differs. A seafarer's self-learning period would be sufficient to cover all of the necessary content in any scenario (Huiyan, 2016).

iii.   Since BL is composed of four methods, instructors can closely assess individual students, enabling individualized, tailored teaching syllabus and accurate assessment (Huiyan, 2016).

iv.   It can lessen the effort of the instructors because the lecture for online courses is recorded in advance. As a result, a training center's operational costs per

student can be reduced because the same faculty members can instruct more students (The Pros and Cons, 2021).

v. It can assist seafarers in gaining a better awareness of how MET courses work in practice. For example, the BL system could be extremely beneficial to seafarers in firefighting training. It can provide classroom learning, practical training, and simulator-based experience to understand the course better.

2.6.2. Disadvantages of BL

BL may have technical drawbacks because it is heavily reliant on technology tools or techniques. The following are some of the disadvantages of the BL approach.

i. For students trying to acquire course content, digital literacy can be a substantial barrier, considering the essential access to high technical assistance (Alexander, 2010).

ii. Cooperative learning can also be problematic in a BL environment due to challenges with supervision in an online context (Wicks et al., 2015).

iii. It is very reliant on the technology tools or resources used to offer the BL process. For these tools to significantly impact the learning experience, they must be dependable, simple to use, and updated (Garrison & Kanuka, 2004).

2.7. Basic Requirements of BL

Legal, technological, and human resource requirements must be considered when constructing a BL system, as described below.

2.7.1. Legal perspective

The legal system plays a significant role because the quality of training standards needs to be constantly monitored and needs effective rules and regulations to check them. However, as the standards for establishing academic and vocational qualifications vary from country to country, mutual recognition of professional education does not always

14

guarantee a consistent level of education for all seafarers (Luttenberg & Rukavina, 2013).

Inventive conceptions of marine education, a shift from traditional learning system to BL approach, professional updating is needed for METIs with the changing of the LMS. In addition, the METIs need to integrate their course material effectively and efficiently in compliance with the STCW Convention and the components of the IMO Model Courses (Luttenberg & Rukavina, 2013) to enhance the training staff's, equipment, and facilities' standards.

Furthermore, promoting competency training, reducing seat time-based constraints, and giving institutions more regulatory discretion should all be part of state policy efforts to encourage BL (Frost et al., 2015). To meet seafarers' training standards with the advancement of the teaching system, maritime administrators need to develop strategies, policies, and quality assurance courses for BL under STCW standards and IMO model courses, and METIs need to be able to implement them. Therefore, the legal system plays an important role in the development of the BL system.

2.7.2. Technological perspective

Nowadays, ICT offers a variety of options for advancing learning and teaching systems. BL is one of these methods that necessitate the use of a modern technology system. The online education system, including web-based training, i.e., using wireless connections and electronic gadgets such as laptops and computers, is one of the tools of BL approaches that require an advanced technology path to deliver (Vesisenaho et al., 2010). In this way, we can use ICT in various learning contexts with flexibility. Educational institutions' learning tools and facilities have evolved due to current technology advancements, posing new challenges for instructors and students. Educational institutions are slowly adopting new technology and modifying their methods, emphasizing the importance of well-functioning pedagogical and technological approaches (Scardamalia, 2001).

The following are some of the issues regarding technology that institutions are currently facing:

i.   Lack of resources

Most faculty, staff, and students emphasized the lack of appropriate technical resources when discussing the current situation and difficulties confronting METIs about developing education technology that hampered the propagation of academic concepts and their interpretation into the practical field (Bolmsten et al., 2021).

ii.   Instructors' insufficient knowledge of modern technology

There may be a significant obstacle on the part of instructors who are not digital natives, and technological awareness have had challenges in using new technology equipment, which has resulted in the institution being involved in intense and never-ending discussions for students (de Montreuil Carmona & Irgang Dos Santos, 2020).

iii.   Students' insufficient knowledge of modern technology

According to statistics from the African University, instructors are hesitant to use BL because they lack appropriate technical skills and have restricted access to technology (Tshabala et al., 2014). Furthermore, according to Wach et al. (2011), a relevant challenge highlighted above was the difficulties of blending in a specific institution. As a result, students' educational technology becomes a requirement of the blended course. Therefore, some students may face difficulty using technologies during the learning process.

2.7.3. Human Resources (HR) perspective

HR management in academia refers to strategies and techniques for incorporating and sustaining the faculty members and staff in the institution to fulfill its mission and achieve its objectives (Omebe, 2014). It is critical to meet the satisfaction of instructors and academic staff to achieve institutions' educational aims and objectives. Staff interactions, staff maintenance, staff training, staff procurement, and work

16

performance reward are performance indicators in the education system that aim to satisfy instructors and academic staff (Hoque & Kamaluddin, 2015)

Globalization and technological developments have made educational learning more variable and unpredictable in recent years. BL has become a more critical approach due to these impacts. In this sense, educational professionals must recognize the intended structure of approaches and the emerging character of techniques (Torraco & Swanson, 1995), which may provide the newest opportunity, particularly in fast-changing educational contexts like the BL approach. However, according to Mantyla (2000), instructors may be reluctant to shift to new educational systems, which might obstruct the BL approach.

2.8. Why are collaborative initiatives important in the MET industry?

Although technological change and successive revision of IMO instruments require METIs to improve their training (Corbett et al., 2010; UNCTAD, 2019), due to a lack of equipment and training resources, many METIs in developing countries have failed to follow the changes (Sampson, 2004; United Nations, 2020). Specifically, the MET sector has a significant upfront cost due to the infrastructure required, including instructional materials, training simulators, workshops, and training ships, which causes budgetary burdens on METIs and maritime administrations. In addition, relatively long funding is required because the current training program is frequently obsolete and difficult to keep up with technological advancements in the field (Mallam et al., 2019).

Collaboration can offer tangible prospects to efficiencies, resource sharing, and pooling (Kanter, 2014). Collaborations with other maritime institutions, allowing METIs to build a community of practice, and addressing difficulties through a BL approach are feasible solutions to these challenges.

It is critical for METIs and maritime administrations to collaborate with each other to improve quality and credibility (European Commission, 2016) and solve the challenges mentioned above. METIs can develop collaboration programs, including

student training, special lectures, the exchange of information and resources, and staff/instructor training. For example, making partnerships with other maritime institutions to share technologies and facilities is one of the ways of collaborating that can disseminate and communicate updated information about modern technology (Belay, 2014) and share modern onboard equipment. Another instance is to send trainees to other METIs to identify alternative onboard facilities. As a result, maritime students and seafarers will better understand modern onboard equipment, and METIs can share cutting-edge technologies.

In research from European Commission (2016), the collaboration between METIs can bring the following benefits:

❖ Collaboration and partnerships can significantly improve the performance of instructors/staff, apprenticeship programs, and creativity, providing that skill shortages are addressed effectively.

❖ Linking METIs can increase knowledge sharing, economies of scale, and accessibility to financing options.

❖ Collaboration with leading METIs can enhance networking and encourage globalization activities, such as expanding the hub function and establishing centers of excellence.

❖ Enhanced collaboration through education and training partnerships can better position it in a broader context (i.e., global networking).

❖ Networking between various actors, including local authorities, can lead to enhanced development and modernization of the education and training program, enabling the workforce to respond to the changes in the maritime industry.

As a result, collaborative initiatives in maritime and maritime education and training appear critical for the MET sector.

2.9.   Summary: Modality of BL

To answer research question-1, this dissertation first tried to identify the problems the current competence-based learning faces and later suggest how BL can resolve that (modality). Competence-based learning is based on knowledge, understanding, and experience, regulated by the STCW Convention. Although it was developed to tackle the challenge of the old convention, which too much emphasized knowledge, the current educational system also faces several challenges. Firstly, it is based on in-person lectures, so seafarers cannot take courses when navigating (Haiyan, 2016). Although e-learning has been developed to tackle the issue, learning performance may decrease due to lack of emotional communication among students and between students and lecturers in e-learning (Chen et al., 2017; Pipchenko & Kovtunenko, 2020). Secondly, students have to learn more and more emerging technologies quickly (Jo et al., 2020). Thirdly, many cutting-edge technologies, such as bridge simulators, have been introduced to raise training effectiveness, but such systems are too expensive, especially for developing countries (UIA, 2020). Fourthly, competency is usually assessed through examinations and assignments, but it is not practical to rely on such methods to examine competency accurately. Finally, traditional competence-based learning cannot meet the needs of all students. For example, learners cannot study at their own pace (Haiyan, 2016).

To tackle the above issues, a new teaching method that mixes the advantages of traditional face-to-face learning, online, practical, and simulator-based training has been developed. It is called "Blended Learning (BL)." The traditional learning method is composed of lecture and practical parts, and lectures may be delivered by e-learning in BL, depending on the course. However, BL does not rely only on e-learning to minimize the destructive effect of e-learning due to the lack of communication. Even practical parts may be provided online by using appropriate software such as online simulators or VR. Specifically, through online simulation, maritime students could become acquainted with the most up-to-date, cutting-edge technologies. As a result, METIs can share their simulation experiences online, and online simulator training is one solution for METIs to replace their outdated onboard equipment.

Furthermore, simulators provide students with a safer environment with their paces, high flexibility, and high assessment accuracy (Kim et al., 2021). This secures net-centricity of MET, which enables seafarers to learn whenever and wherever they are and resolve the North-South economic disparity if METIs in developed countries support METIs in developing countries through online learning.

Moreover, BL is usually composed of three parts (individual online lecture, teachers' lecture, and small group project), enabling instructors to closely monitor and grasp students' learning progress in real-time. Group project secures interactions among students, contributing students to understanding diversity. Instructors assess students' daily activities in the class, and instructors can evaluate students more accurately than examinations. Instructors develop tailored syllabus for each student, and all students can obtain competence under the tailored syllabus, which contributes to meeting all students' needs (Haiyan, 2016). All these benefits of BL can reduce the limitations of the traditional learning method. The following figure 2 summarizes the above discussion:

Figure 2

Modality to BL: Current Problems of MET and How BL Cope with Them

Students can take lectures whenever and wherever they need (**net-centricity**)

Appropriate use of the face-to-face method and group projects can enhance interaction (**enhanced interaction**)

E-learning enables quick acquisition (**net-centricity**) The four methods enables teachers to grasp progress of studying, and instructors can deliver class according to each student's level, which enhance understanding of students (**tailor-made syllabus**)

Online simulator may enable such states to implement simulator-based training (**net- centric** MET)

BL includes four methods, so teachers can assess in each stages (**accurate assessment**)

Problems of competence-based learning

1. Seafarers cannot take lectures from ships

2. E-learning may resolve the above problem, but it lacks interaction

3. Students have to learn more and more new technologies quickly

4. It might be difficult for some States to introduce expensive educational equipment such as bridge simulators

5. Competence is difficult to assess in the case of paper examination or online test

Note. Created by the researcher

For research question-1, this dissertation identified the modality of BL composed of the four elements: net-centricity, enhanced interactions, tailor-made syllabus, and accurate assessment of competence. The Net-centricity of BL driven by e-learning can resolve the problem that seafarers cannot learn when navigating. In the case of BL, seafarers' study theoretical things through e-learning. They learn through practical training, simulator training, and face-to-face training ashore. However, due to the rapid development of ICT, some of the contents of simulator training and face-to-face training may be delivered by the Internet through online simulator training and online synchronized learning. BL includes activities that enhance interaction, such as group projects, so BL can complement the limitation of e-learning that emotional communication between students and between students and instructors is undermined. Through various teaching activities, including in-person lectures, e-learning, and group projects, instructors can monitor and grasp students' progress, contributing to

the tailor-made syllabus and accurate assessment of student's competence. This modality is ensured by legal basis, appropriate technical resources, and well-trained instructors.

For better delivery of BL, learners and instructors should be familiar with digital equipment (digital literacy) (Alexander, 2010). In addition, cooperative learning may not be secured due to a lack of supervision in an online context (Wicbks et al., 2015). Therefore, guidelines in relation to BL should be developed, taking into account the above issues. Furthermore, lack of reliability of equipment for BL, such as unstable internet connection, may dampen learners' performance (Garrison & Kanuka, 2004). In addition to technical limitations, maritime administrations need to develop strategies, policies, and quality assurance courses for BL under STCW standards and IMO model courses to meet seafarers' training standards with the advancement of the teaching system, and METIs need to be able to implement them. Furthermore, effective training for lecturers in relation to BL should be delivered (Human resource-related modality).

Chapter 3 Research methodology and methods

3.1. Introduction

This chapter will elaborate on the methodology and methods to answer the research questions 2 to 4. The empirical research relies on a multiple-case study using semi-structured interviews as the primary data collection method. The researcher considers using multiple-case studies as they are often deemed more reliable than a single case study for building theory and policy (Yin, 2018).

The researcher referenced the multiple-case study flow chart designed by Yin (2009, p 57) to organize the multiple-case study process. Figure 3 outlines how the flow chart has been designed for this multiple-case study.

Figure 3

Multiple case study Flow Chart based on Yin (2013)
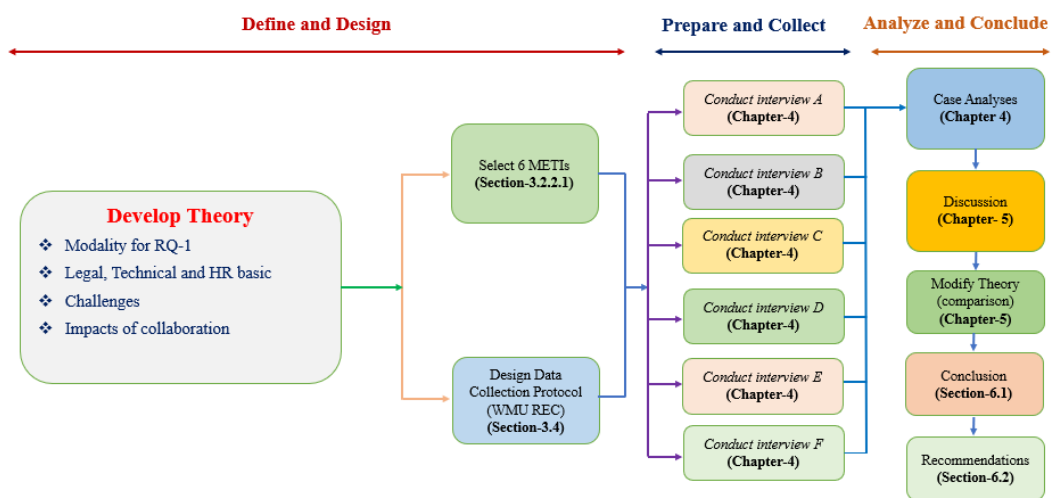
Note. Created by the researcher

Based on the guidance from Yin (2009), the initial phase in constructing the investigation is theory development, case selection, and the description of specific protocols are critical steps in the data collection design process. Therefore, the researcher initially developed the theory to address research Q-1 and serve as a

foundation for the multiple-case study, and addressed the remaining research questions. The researcher answered research Q-1 as summarized in section-2.9 based on the literature review. For Q-2 to 4, the researcher decided to use a qualitative approach because the theory answered by Q-1 is still under development. Therefore, it is necessary to conduct empirical research to develop further understanding of the phenomena under study. Additionally, the researcher followed the regulations and procedures established by the Research Ethics Committee (REC) of World Maritime University (WMU) in section-3.4. Secondly, the researcher chose six METIs in section-3.2.2.1).

After that stage, the researcher conducted interviews and analyzed the results (the detailed process in the following sections 3.2 and 3.3). The interviews details will be expressed in Chapter-4. Then, the researcher discussed each research question by comparing interview results with the literature review, which will be stated in Chapter-5. Finally, the researcher concluded and suggested recommendations for stakeholders in Chapter-6.

3.2. Data collection methods

In this study, analyzing literature review and semi-structured interviews were conducted for the collection of data.

3.2.1. Analyzing literature review

The researcher analyzed the literature review to answer the research Q1 and support the qualitative semi-structured interview data. It is a method for critically evaluating literature review of existing knowledge to answer a specific research question (Gough et al., 2017).

3.2.2. Semi-structured Interview

A semi-structured interview (see Appendix A) was constructed for Q-2 to Q-4 because the researcher wants to better understand the BL system concerning the METIs' educational approaches and needs. An interview method is a preferable option for

addressing the research questions because it allows interviewees to express their opinions in their thoughts and also provides verifiable, comparative qualitative data (Cohen & Crabtree, 2006).

The semi-structured interview was separated into four portions (see Appendix A). Based on the information collected in Chapter 2, the researcher constructed open-ended questions. Nineteen interview questions were created, and follow-up questions were asked depending on the respondents' answers. These questions allowed the researcher to draw additional information from the respondents' responses and explore more profound significance. To conduct interviews, the researcher chose experts from METIs and described the reason for selecting METIs as participants in the following section-3.3.2.1. The participants responded to the questions based on their instructions, current circumstances, and experiences.

The interviews were performed online because of the time interval, the respondents' location distance, and the researcher's travel restrictions. Before each interview, eligible participants were contacted through email. The interviews were arranged after obtaining verification of their engagement, as well as proposed days and times. All of the interviews were done using Zoom and Microsoft Teams, an online meeting tool, and each one lasted around an hour.

3.2.2.1. Selection of participants and characteristics

As indicated in Table-1, the participants in this study belong to six (6) different countries: Estonia, Lithuania, the Philippines, Poland, Singapore, and the United Kingdom. All participants work at the METIs as instructors, curriculum managers, and project managers. The researcher expresses detailed information in section-4.2.

The researcher chose participants from METIs as METIs play a critical role in training high-quality seafarers to ensure vessel safety, environmental protection, and trade flow. Therefore, they are significantly involved in the emergence of competent seafarers. Moreover, they are also working in various ways in the design and implementation of BL.

Table 1

Participant Characteristics

Codes for Participants	Country
A	Estonia
B	Lithuania
C	Philippines
D1	Poland
D2	Poland
D3	Poland
E	Singapore
F	United Kingdom

3.3. Data analysis methods

Data analysis refers to the process of analyzing qualitative data to generate additional knowledge or insight. The literature review conducted under research question 1 identified the modality, advantages, and disadvantages of BL. For the semi-structured interviews (Q-2 to 4), the answers from the interviews were coded using Nvivo software and Microsoft Excel. The researcher looked at all of the interview transcripts to develop research questions and synthesize recurring concepts. The documents were coded according to the frequency of occurrence and then divided into separate code groups. The decision to use this data analysis method was focused on the need to acquire a more in-depth understanding of the research questions by methodically categorizing the perspectives of research participants, which were then supported by knowledge.

3.4. Research Ethics

In terms of human involvement in collecting data, the research employed the regulations and procedures set forth by the WMU REC. Before they were allowed to participate in the interview sessions, all participants were given a written form

requesting their consent (See Appendix B) and a document asserting REC's approval, which they signed. This form included fundamental research information and a commitment that the data collected would be used exclusively for educational purposes and strictly for this research. All data were handled with the utmost discretion and privately stored on a personal laptop with strong password security and a highly secure Google drive linked to a WMU email address. As soon as the master's degree is completed, the data will be deleted.

3.5. Summary

This chapter described the data collection and analysis processes and the ethics protocol of WMU. The following chapters will examine the findings from the interviews (Chapter 4), the discussions from the literature review and interview results (Chapter 5), and recommendations and conclusion of the research (Chapter-6).

Chapter 4 Analysis of Research Findings

4.1.   Introduction

The researcher analyzed Q1 in section 2.9. To answer Q-2 to Q-4, the researcher conducted semi-structured qualitative interviews with six METIs in six countries to discover their perspectives and difficulties in developing a BL system. The research included eight participants, each of whom was characterized in Chapter-3, Table 1. The findings from the interviewees' comments are presented in this chapter to analyze the following research questions.

Q2.   What are the educational approaches to BL?

Q3.   What are the challenges that are encountered regarding BL in delivering MET courses?

Q4.   How do capacity-building collaborative programs between maritime clusters optimize blended learning?

4.2.   Demographics of Participants

The following pie chart displays the regions of participants as they are classified by global continent.

Figure 4

Maritime Region of Participants
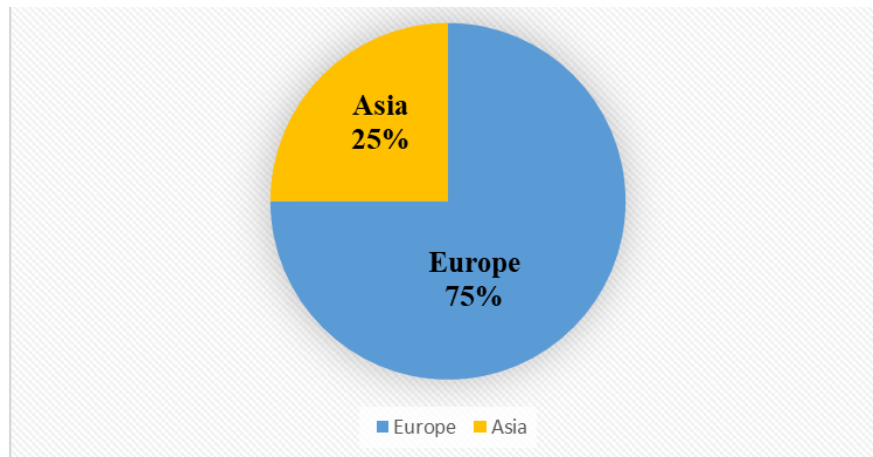
4.2.1. Designation of Participants

The designation of participants in their various METIs is depicted in the pie chart below.

Figure 5

Designation of Participants
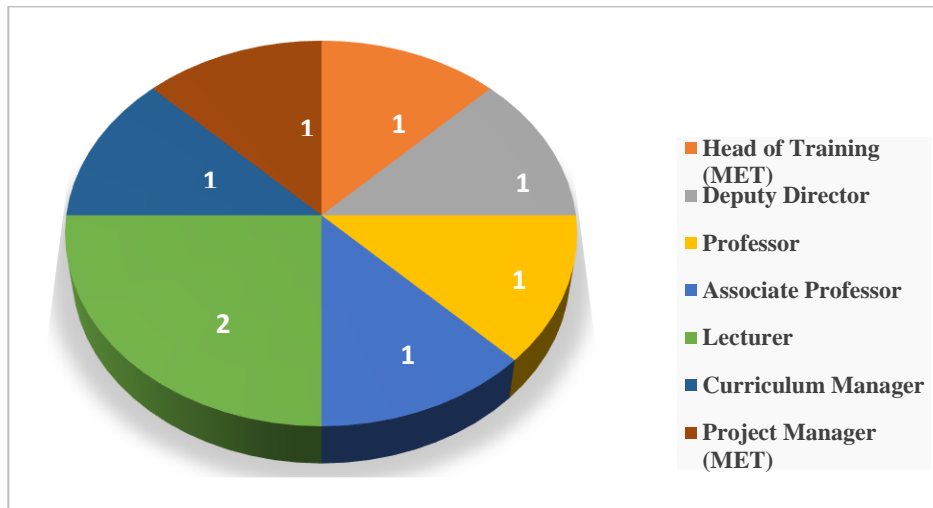
4.2.2. Working Experiences of Participants

The researcher separated the respondents' professional experience into traditional learning experiences and BL experiences in the pie charts below.

Figure 6

Respondents working experiences (Traditional Learning)
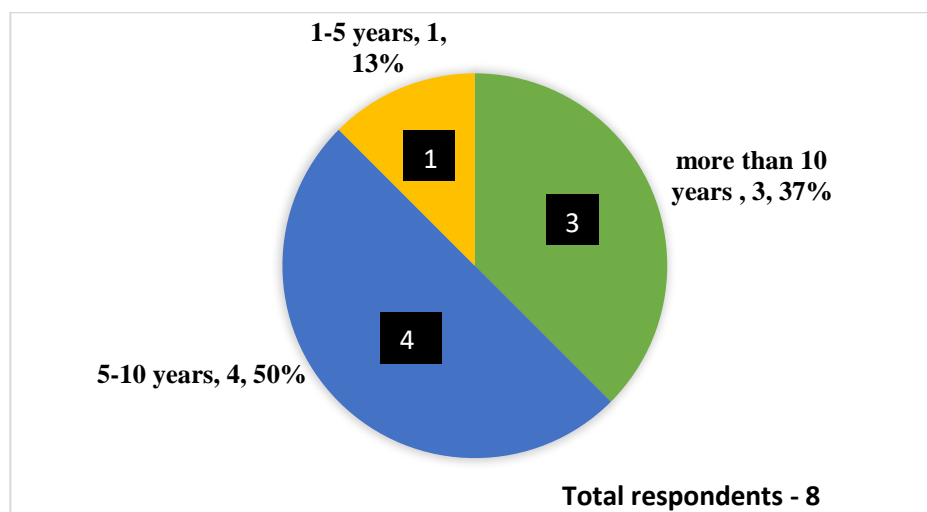
Figure 7

Respondents working experiences (BL)
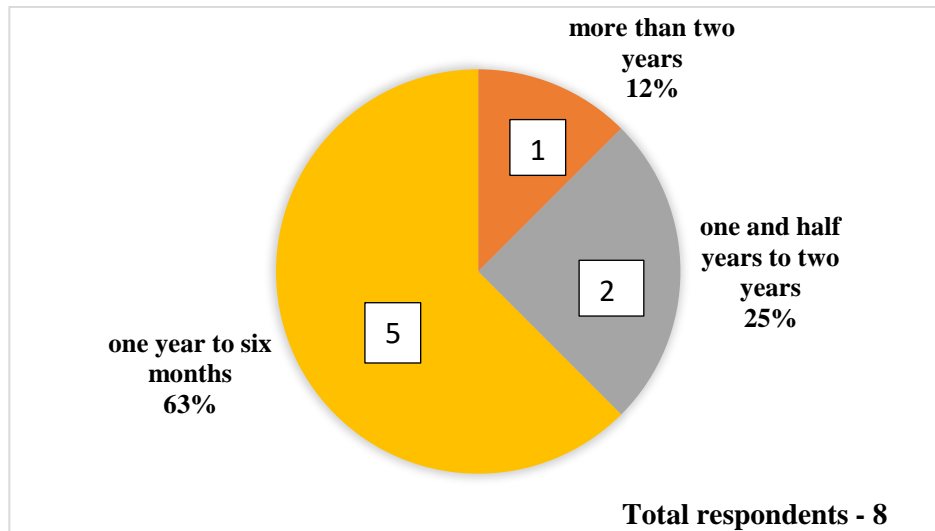
4.3. Semi-structured interview findings and analysis

4.3.1. Q-2: What are the educational approaches to BL?

To investigate Q2, the researcher constructed five open-ended questions and investigated how BL could be approached in METIs. Then, the researcher coded the respondents' answers according to the respective questions and developed relevant charts to assess findings. All quotations are italicized and represent the actual responses.

4.3.1.1. Types of educational approaches of BL

The researcher grouped the educational approaches of BL into the following three categories:

- ❖ Combination of face-to-face learning (including Practical Training) and online learning (synchronous)
- ❖ Combination of face-to-face learning (including Practical Training) and online learning (asynchronous) and
- ❖ Both

The researcher conducted interviews with respondents based on this classification.

According to respondents' answers, four METIs integrated face-to-face and online learning (synchronous). Some of the respondents explained why they chose a hybrid of face-to-face and online learning (synchronous).

"We provide training online and also in contact in classes. And our instructors provide the theoretical lectures online and practical all the basic safety training, including firefighting training, survival crafts were provided in contact, face-to-face classes." (B)

"We have fully remote programs that students complete everything remotely, but we call it a virtual learning environment. Sometimes the tutor will be in the classroom or at home, dependent on the circumstances. And we also have situation where we have students, some students in the classroom, and some students remotely at the same time. But also, we have delivered from the classroom for some practical training." (F)

The findings reveal that two METIs used a combination of face-to-face learning and synchronous and asynchronous learning systems. In this case, they upload their training courses to an open-source learning platform like Moodle, an online learning platform, and integrate distance learning. For practical training, they delivered the courses in face-to-face sessions, and for theoretical sessions, they conducted lecturers online.

"We are using both, combination of face-to-face learning with synchronous and asynchronous. So, all the lectures were done online, and only the practical lessons were the laboratory simulators for use, then the students were allowed to come to the Academy. We use the Moodle platform. It is possible for the teachers to pre-record the lecture as we have our classroom or video room in the university that they can use. And there is a possibility for the students to come into the classroom. But at the same time, some of the students can watch the same lecture from wherever they are. For practical training, we have our simulators." (A)

"Currently, it is mostly online, synchronous, instructor-led via a virtual platform. So, we use Microsoft Teams. We do have the E-learning modules. For instance, you

normally get the video tel, the seagull, so we've now signed up to the ocean learning platform, which is a combination of both, and with the e-learning material as well."
(E)

4.3.1.2.   The current trend

The maritime industry has slowly explored adopting BL to tackle the limits of competence-based learning in METIs, and it is considered that the pandemic of COVID-19 accelerates this trend. The empirical data in this study collected through the interviews confirm this trend.

The findings point out that four METIs only delivered their class in the traditional learning system before the pandemic, and they did not develop the BL system at that time. They introduced the BL system due to the pandemic's impacts.
"Until March 2020, I conducted all classes in a traditional way, i.e., in a lecture or laboratory room in the presence of students." (D1)
"And so previously, it would have been instructed classroom training, obviously, instructor-led simulator training, that is mostly the type of training that we used to conduct." (E)

"The primary reason we shifted the online learning environment in my institution is to come to contain the spread of the virus." (C)

"Because of the COVID-19 pandemic, my institution transformed into a Blended Learning system."(D1)

"Since the pandemic, we were sort of forced to actually change more to the blended learning approach." (E)

The interviews reveal that the two METIs had adopted BL before the outbreak. One METI used BL to conduct lectures for master students, and another one used the fully remote program, which is part of BL. They did not widely use the BL system in their institution at that time. But, because of the pandemic, they have to use the BL system. Therefore, it can be concluded that the pandemic accelerated the trend to adopt BL.

"We actually had it already previously because for the students who are, for example, masters students, and working may be from ships, or they have another job so they can still be present in the lectures without coming to the academy and sit in the classroom." (A)

"We had fully delivered blended learning programs before COVID. So they have been around for quite some years, some number of years. But they were fully remote learning; it was not just a part of online learning or blended learning. It is a fully remote program where the student would complete absolutely everything online. Due to COVID, obviously, we have started to deliver and embed more of remote learning widely" (F)

4.3.1.3.   Learning platform of BL

The following findings highlight why and how METIs had exploited various learning platforms in their institutions. They mostly used cloud-based learning platforms, such as Google Classroom, Microsoft teams, and Moodle, to conduct online lectures.

"We use Google Apps, Google meets, Google Classroom, Google forums, and others. We use Google platform because our internet system and the E-service time schedules are built on this platform." (B)

"So we have a Moodle platform that serves as a repository of materials for tests and references. We call that the LMS-The Learning Management System." (C)

"We use Microsoft teams' platform as it was easy for us to prepare our topics, like a background, and some positions and some ideas." (D2)

There is no METI that has developed its own platform. This might be because using a cloud-based platform is easier to deploy and a cheaper alternative than purchasing a server and developing its system.

4.3.1.4.   Advantages and Disadvantages of Online Learning Approach

In this section, the researcher focused on the advantages and disadvantages of online learning as the METIs in the study are currently conducting online learning as a primary educational measure during the pandemic. Therefore, the researcher analyzed the pros and cons of the online learning system incorporated in the BL approach.

a. Advantages

Figure-8 shows an overview of the qualitative analyses of the perceived benefits of online learning. The bar charts are based on the interview answers of participants, with the responses being coded according to how they affect the BL approach of METIs.

Figure 8

Advantages of Online Learning
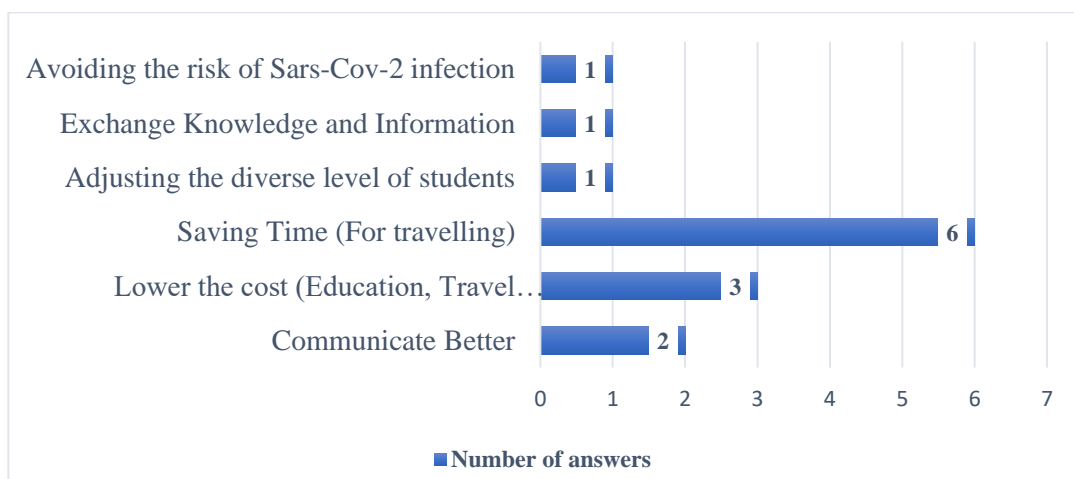
The majority of respondents think that this learning technique saves time and allows them to study at their pace. As a result, they do not need to go to university and save on travel expenses. One institution suggested that even synchronous learning students can watch the lecture again if recorded, contributing to a better understanding of students.

"I think it gives the students more freedom to do their own work and everything and still be able to take part in the lectures. And I think it's really good for the mariners, seafarers that work, maybe they are not even in the country for the lectures, they can

be studied. They can do this, and when the lecture is recorded, and they can rewatch it, do that in another time." (A)

"The advantages that we have through the distance learning system, for example, if you are so far from Academy or if you are abroad, because of this learning system, you can study their lessons from your place." (B)

"Also if you are learning in E-learning system, you can work in home and also you can study in home and can attend the classes." (D2)

One METI mentioned that this learning system is beneficial for seafarers as they can learn during their private time.

"For seafarers, especially if they stay away from home long period of time, so if they can do the training in the comfort of their home in their own time, it also makes sense for seafarers". (E)

Here are some other advantages of online learning. Some respondents mentioned that it could lower their costs of education and traveling. They also felt that they could communicate and get responses promptly.

So, I think the main advantage of e-learning and blended learning is that we can lower the costs of education, especially the internet, for free. So, we do not need to spend money for our traveling to university. We can contact very briefly and very quickly with each other." (D2)

"So, the first one is the students who don't want to attend face-to-face because it's a short course, they can optimize travel less CO2 emissions, and they can save some money." (F)

One respondent suggested that the BL has the flexibility to adjust the learning levels of different students.

"It gives you opportunity to diversify among the students. So there are some students that are really quick learners, and they can grab a lot, and they can use the time, and they can go and research a bit further. And you can really push them to their highest sort of level. And because it's all sort of blended, and those who need more time, you

can optimise the time, give them a bit more sort of remote learning, then catch up with them." (F)

b. Disadvantages

Aside from the benefits, findings indicated that there are also drawbacks to online learning. The responses of the participants during the interview sessions are listed in the bar chart below.

Figure 9

Disadvantages of Online Learning
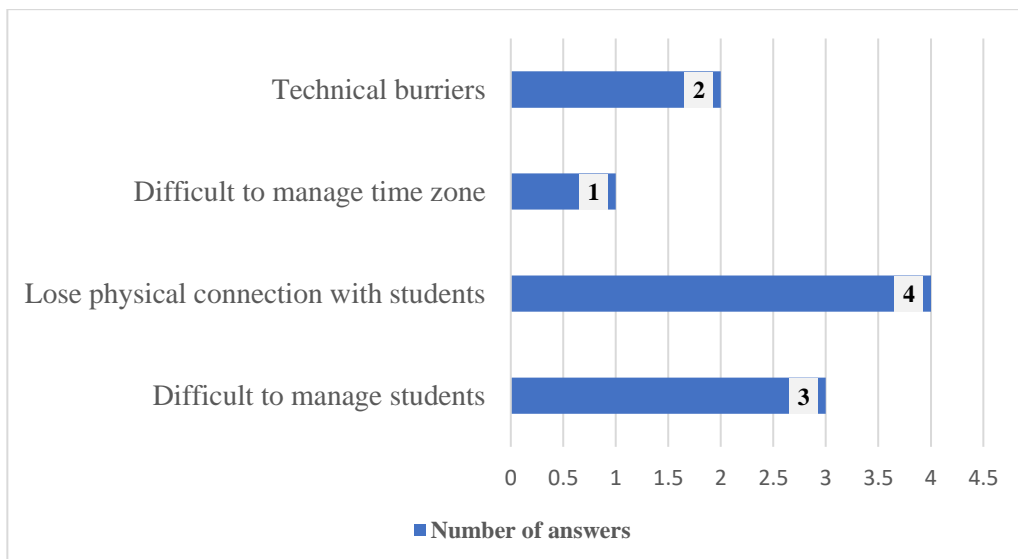
Some respondents considered that this teaching method makes losing physical connection, and they assumed it was harder to maintain students' attention.

"Some students can be a bit older; they don't want to engage in online lectures, so they just listen." (A)

"During the traditional lectures, students were more active. They asked me questions. They shared their opinions and discussed. In the online class, it's difficult to manage their attention" (D1)

Therefore, institution D3 (introduction of the break-out session into e-learning) might resolve the limitation that e-learning cannot secure interaction among students and between students and instructors.

"I can create the inside of programming groups. For example, if we're good at one meeting, I can create different rooms and send different students to that room, and they can work together in small groups, not in the 15 or 14 students at the same time. They've been some exercise together." (D3)

One of the interviewees mentioned that adjusting the time zone was challenging.

"When you talk about professors in a different country in a different timezone, synchronous learning sounds really practical." (C)

4.3.2. Q-3: What challenges are encountered regarding BL in delivering MET courses and their possible solutions?

In Q3, the researcher examined the challenges. The challenges are grouped into three areas: legal, technical, and human resource constraints, and the findings are reported in detail for each of the three categories.

4.3.2.1.   Legal and Ethical Challenges

According to the findings, neither of the countries of the METIs interviewed did have specific rules, regulations, and guidelines for BL, especially for remote learning, issued by the relevant authorities. According to their responses, this was a new learning approach, and the government did not yet have BL guidelines for METIs, so they only followed the guidelines for normal situations.

"An administration, they haven't really produced clear policy, in terms of online learning for higher institution. So we are still following the guidelines set out for the regular process." (C)

"Truly, we don't have any guidelines regarding blended learning." (D2)

"There are no rules for blended learning. disciplining wasn't so popular until the pandemic came to our university." (D3)

Because the competent authorities do not have clear rules and regulations in relation to the BL, the instructors followed the procedure for online learning that their institution had announced.

"We comply with the university rules." (A)

"We haven't specified specific rules official approved by law or some ministries orders. So, my university released the procedure." (B)

However, for practical and theoretical training, institutions prepared according to the STCW guidelines.

"We prepare very well to adjust with the STCW training courses. We create platform for online courses. We make cooperation with our Maritime Administration for practical and theoretical training. We provide online and practical framing what is written in the model courses and our programs approved by Maritime Administration." (B)

It is indicative that although institutions A and F already introduced BL before the pandemic, they have not developed a clear legal basis yet because of the absence of international guidance for BL.

According to the research findings, METIs are experiencing difficulties adhering to the BL development because the relevant maritime authorities have not yet released explicit laws and regulations on BL.

"The difficulty here lies in the fact that there were no guidelines so far, for we were left on our own. And then, on our own initiative, we just picked out things that we know we can implement on the education side." (C)

In addition, one respondent claimed that assessment was a challenge for the institution since they had difficulty making calculations because they could not really determine whether the students were doing the exam on their own or with external assistance.

"Online assessment also is very difficult because the integrity of the assessment can be compromised in an online environment if you do not manage it properly. So among other things, you know, conducting online assessment can be very stressful for the students taking the exam as well as for the instructors managing the exam. (C)

"I think probably the biggest challenge was the assessments and to manage and make sure that the assessments are reliable and valid when they are remote. Some of the assessments, which are really mathematical and math-based subjects. It's really heavily based calculation. And in that regard, how can you ensure that the students are completing them independently?" (F)

Unlike these METIs, institution A did not mention such a difficulty. This might be because the school conducted various methods to monitor students within e-learning lectures, such as frequent quizzes realized by specific cloud applications, including Kahoot and BuzzFeed Quizzes, which enabled A to monitor students' progress closely even in e-learning. And also, their institution releases online learning code practice guidelines, which are convenient for assessment.

"Our university has online learning code practice guidelines, these are general suggestions that participants have to keep their microphone closed when they're not speaking and all these things like for the students, and for lecturers, also there are this good practice includes assessment and exams." (A)

The findings demonstrated that adherence to the guidelines provided by the competent authorities for practical training, which had been a temporary challenge during the pandemic, was also a struggle for METIs.

"All our theoretical lectures of STCW training were audit by responsible personnel from Maritime Administration. So difficulties with the training is we need to prove when we need to provide practical training in classes, for example, not less than 10 square meters for one person. So it means we need to keep two meters or one and a half meters, not less than one meter between peoples and we calculate with the instructor, how many people we can admit that and so on." (B)

4.3.2.2. Technical and human resource-related Challenges

Since the technical and human resource sectors are interconnected, the researcher incorporated the two challenges. According to studies, METIs encountered the most technical difficulties while attempting to integrate BL. Furthermore, it has been discovered that the lack of specific training for instructors regarding BL is a barrier to METIs.

Some institutions have old instructors who are inexperienced with new teaching facilities, which presents a barrier for METIs. Instructors unfamiliar with modern technical tools could find it challenging to use BL because of a lack of specific BL training. In addition, the failure of some technical applications to function correctly might be a challenge for classroom management.

"The main challenge we have is a lot of lectures that are former Mariners, captains, or chief engineers. And they're quite old already. And they don't have these IT skills." *(A)*

"We don't have specific training for blended learning. Sometimes, it's challenging for us. For example, that wasn't challenging for me because I'm quite young but for old professors have some problems. They don't know how to start a meeting, or how to send something, and so on." *(D3)*

Findings revealed that instructors experienced challenges in arranging teaching tools and materials for the relevant BL courses.

"What you do in the classroom and what you're doing face to face is not 100% acceptable for remote delivery. So the main challenge was probably for the lecturers to ensure that their materials are fit for purpose and that their materials are suitable for blended learning delivery." *(F)*

When evaluating students' online performance, integrating two different learning platforms has proven to be a concern.

"The challenge with my institution now is that there is very minimal synergy between Google classroom and LMS, moodle, they're not connected. So about the grading

system, that's a different platform in itself. So when we go to class, we go to google classroom, when we want to read books, we go to LMS, when we want to take the assessment, we go to the LMS, and then when we want to check the grades, we go to a different platform." (C)

It has also been discovered that instructors who conduct online courses and students have difficulties due to a lack of a stable internet connection.

"Sometimes classes are ongoing, and then suddenly, the student will get cut off, or the instructor will get cut off." (C)

"Our seafarers are across the globe. So some have the benefit of a country with really good internet. And some live in rural areas. Moreover, some of the instructors now working from home also don't have good internet." (E)

Although institution C answered in the Q-2 that the institution introduced the specific server to stabilize the internet connection, the problem still seems to still exist. The other METIs did not refer to this problem. This might be because institution C is in a developing country, and communication infrastructure is not well compared to other institutions in Europe. For example, Singapore, where the school E is located, provides a high-speed internet connection ("Internet Speeds," 2020), but outage or low-speed internet connection in other countries might be a problem when seafarers take lectures there.

The inadequacy of technological equipment for students is also a hindrance to the success of an online course.

"Another problem is insufficient devices for the students. Most of them have laptops. Most of them also have iPads. But there are certain cadets that do not have devices at all. So that's also a problem." (C)

"The first challenge was the infrastructures like computers for teachers and students. Some students have quite old computers. So we had to prepare infrastructures for students." (D2)

Findings indicated that the lack of suitable technical equipment for students posed a challenge for students and instructors. Sometimes, instructors had to give some of their time to solve that problem.

"In the university, we've got the same computers everywhere, and there are good computers. But at home, students with different computers, for example, some of them were really good, and some of them were really poor." (D3)

One institution mentioned that all instructors have their laptops, and their classrooms have special equipment to conduct lectures themselves. So, the instructors can conduct lectures with these devices.

"All of our lecturers have their own laptops. And now we have some classrooms that are equipped with cameras, and probably most of them have the streaming and recording possibilities also installed. So they can either do it in their own cabinet using just their laptop or use classrooms that are equipped with recording devices." (A)

Findings indicate that to tackle the problem of technical resource shortages, some institutions provided the necessary technical equipment for instructors who needed them, and it could be convenient for instructors to conduct courses.

"We try to equip our lecturers, we collect all the administration laptops and share with the lecturers that they have a possibility to work at home. If they don't like or don't have computers, they were allowed to come to Academy and can work at the university because all our classes are equipped with the multimedia system." (B)

"We provided laptops internet for those who didn't have so not necessarily for everybody if they had in the past." (E)

Moreover, one institution provided iPad not only for instructors also for students. It is great to support as students can learn their lectures and do not need to concern about learning facilities.

"In fact, my institution went out of its way to provide every cadet with its own iPad. My boss recently purchased extra iPads for use in classrooms and assessments." (C)

Some institutions believe that sharing knowledge among teachers solves some challenges with delivering BL lectures. In contrast, others realized that instructors have their own knowledge and learning styles, making it easier to conduct BL.

"Most of the lecturers have their own knowledge. So, it is easy for them learning to understand Moodle platform and to conduct online lectures. So we don't have specific training for blended learning." (A)

"We just arranged short courses very briefly courses and how to use them. Each lecturer has their own teaching style; that's why we don't need specific training." (D2)

Some universities offer instructor training programs. Although these programs are not explicitly designed for BL, they comply with IMO and STCW criteria.

"We have training programs for instructors and lecturers, but it's not formalized. But for blended learning, we haven't." (B)

"In terms of the training, our instructors probably would have done the IMO the trainer course. In terms of blended learning, and we haven't actually had training." (E)

Findings demonstrated that one institution offered instructors the opportunity to receive online training and became more aware of how BL could be used in the lecture.

"Our management provided us with webinars, on how to use Google classroom and the Google suite webinars, we're where we are in a series of webinars that focuses on online, blended learning." (C)

Although there was no formal training for BL, faculty members held weekly meetings to share knowledge of the difficulties encountered during conducting courses.

"We don't have specific training for blended learning. All started with simply how to use Microsoft Teams and how to use Canvas as a new platform. And there was a huge amount of training. So that training was centrally organized, sometimes like one hour a week to introduce various functionalities, various features. And we also did peer learning and best practice sharing." (F)

4.3.3. Q-4: How do capacity-building collaborative programs between maritime clusters optimize BL?

Q4 investigates, based on the experiences of METIs, how they could collaborate to develop capacity-building programs with one another and how they can benefit from these collaborations.

4.3.3.1. Capacity-building collaborative programs between maritime clusters

The exchange of academic staff and students is one of the forms of collaboration that have been identified as being particularly beneficial to educational institutions.

"We participate in a few different programs. First of all, is exchange of academic staff and students. We provide distance learning lectures for students from some countries, while lecturers from other universities also delivered their lectures. We also provide lectures for our students." (B)

Certain METIs decided to form strategic partnerships with other maritime institutions to implement BL projects. By doing so, they benefited themselves and partner institutions and gained recognition from other organizations.

"We have strength for strategic partnership projects with many institutions. For example, in one project, we have Greece, Portugal, Romania, France, Slovenia, Latvia, Bulgaria, Ukraine, Croatia, they participated in our projects. The main purpose of this project is to do a platform of blended learning for cooperative institutions. And for example, that is practical maritime English, we collected the lecturers for us from other institutions, and they were doing learning material for maritime English." (B)

"We acknowledged the importance of collaboration. That's why we value the partnerships that we've created as much as we benefit from our counterparts. We also share what we learned and what we've discovered with our local partners here. We

were able to share our best practices, what we've learned, and the other maritime institutions are able to benefit from that as well." (C)

Through collaboration programs, not only can knowledge be exchanged, but also facilities and resources can be shared among partners.

"Another important aspect of collaboration is that sharing resources. The pandemic has really solidified the challenges in resources, but having that collaborative spirit, we are able to share resources between institutions or countries that do not have much which are able to benefit from the resources of others." (C)

"We do have a bit of exchange among the schools in terms of facilities and resources. We have some institutions that inquire if we have some courses that we can deliver because they may not facilitate those courses for their students. So, we collaborate for delivering lectures." (F)

4.3.3.2. Benefits of collaboration

When METIs in the MET sector work collaboratively, there are numerous benefits to be gained. Findings discovered that one of the benefits of collaborative programs is the opportunity to share knowledge and experiences.

"Sharing our knowledge with another university having their experiences with online learning and blended learning, by sharing our best practices, that we have and that they have and whether they are suitable for maritime students. For example, we can make training programs for our lecturers, having them know, what is the correct way or the best way, and then we can move on to students." (A)

"If we make collaboration programs with other universities, we can exchange our knowledge and also experiences, for example, if we can collaborate with International Maritime associations of maritime academics, we can have some conferences and projects. Another benefit is that we can also arrange some new techniques, which we learn from other universities." (D2)

It is possible that collaboration could enable more METIs to link with one another in the future, which could result in more collaborative initiatives.

"We can get more connection and the future for cooperation because we start from one project, our partner like us, and now we have five projects, that's it's also in all projects, the students participate. And it's privilege for lecturers to provide internationally updated information and for students exclusivity to participate." (B)

"One of the advantages is that we have seen the value of collaboration, that once we have these linkages, once we have this network, we can benefit from this and you can also give back." (C)

Moreover, it has been demonstrated that online collaboration programs offer the advantage of saving time and money.

"We can also make collaboration programs online. The benefit is we can travel in one day in many countries on your computer screen. And also, we can keep our finance. We can save half expenses on travel." (B)

4.4. Summary of the findings

The findings show that the METIs slowly adopts BL, and the pandemic has accelerated the introduction. Many of them prefer the mix of face-to-face and online learning (synchronous). For practical training, they tend to deliver the courses in face-to-face sessions, and for theoretical sessions, they conduct lectures online. The significant advantages of this teaching method are saving time and money. The identified challenges related to BL are the initial cost, time zone difference between lecturers and students, lack of clear legal basis, e.g., guidelines, lack of training for teachers, cheating at online examinations, poor digital literacy, and technical infrastructure such as poor internet connection. Collaboration between institutions in relation to BL may enhance the quality of BL because it enables METIs to share knowledge and experiences with each other.

Chapter 5 Discussion

5.1.   Introduction

The significant findings of the research are described and interpreted in this section in order to provide answers to the research questions.

5.2.   Discussion of research findings

1.   *What are the modalities of BL in Maritime Education and Training?*

This dissertation identified the modality of BL composed of the four elements: net-centricity, enhanced interactions, tailor-made syllabus, and accurate assessment of competence as described in 2.9. This subsection will analyze how METIs can meet the modality of BL.

In relation to net-centricity, all METIs answered that students could take lectures whenever and wherever they are. This fact indicates that net-centricity is attained through e-learning because many METIs were forced to introduce online learning due to the pandemic. Regarding interaction, two institutions (A and D) answered that they have difficulties increasing interactions among students and between students and instructors. Theoretically, this limitation can be resolved by other teaching methods of BL (face-to-face learning, practical training, and group projects). However, the domestic movement ban due to the pandemic prevented the schools from conducting these methods, which forced the institutions to rely only on e-learning and they cannot make fully use of the advantage of BL. One METI (F) answered that the instructors assign extra research for students who show better performance and care for poor-quality students concerning tailor-made syllabus. Unlike other METIs that rely only on e-learning, this institution (F) provides practical learning and simulator learning even in the pandemic, enabling this METI to monitor students closely.

Regarding accurate assessment, there is no observation from the interviews that they can evaluate competence accurately thanks to BL. Instead, two METIs (C and F) indicated that it is difficult to assess students through online examinations. The

situation is more difficult in the case of institution C, which usually relies only on e-learning, than institution F.

To summarise the discussion, net-centricity is observed from the interview, but the other elements were not identified. This might be because the pandemic forced METIs to prevent face-to-face communication among students and between students and instructors. Therefore, they tend to rely only on e-learning and sometimes practical training if needed. Two METIs pointed out the difficulty of interactions, and this is true of the challenge of e-learning. Therefore, it can be concluded that although they were forced to introduce BL, they relied only on e-learning and practical training, which they failed to fully use BL to avoid or minimize facial contacts.

2.   What are the educational approaches to blended learning?

According to the findings, four out of six METIs were hesitant about the notion of turning the entire MET sector online despite its increasing importance. Instead, the traditional learning approach was used by the vast majority of METIs, with two of six institutions embracing the blended learning system.

However, the other four institutions have now shifted to the BL system. The primary reason is the COVID-19 pandemic because, during the pandemic, governments suspended institutions to control the spread of the virus, and practical training was limited to a small number of people.

When institutions deployed BL, four of six institutions preferred synchronous learning because it is almost impossible to deliver practical training like firefighting and survival crafts asynchronously. However, no specific institutions were discovered to use only asynchronous learning only. According to findings, the other two institutions used a combination of both synchronous and asynchronous learning.

Research findings show that institutions have benefited from using BL. For example, students and instructors can work from their place, saving time and money and providing opportunities for students from different regions to be found in one place, especially for seafarers who are unable to join are enrolled in asynchronously distance

learning courses. Furthermore, faster and smoother communication between instructors and students and sharing knowledge and information enhances the learning system more effectively. For example, BL can save time, so quick learner students can use the time available to do more research, and students who need more time can use that time to study.

3. *What are the challenges that are encountered regarding BL in delivering MET courses and their possible solutions?*

    a. **Legal aspect**

The first finding of legal aspects was that most maritime authorities did not adopt specific BL rules, guidelines, and regulations for METIs. Especially, there are no special guidelines for delivering online sessions; the STCW criteria for practical training are the only ones that exist. METIs can only follow standards for competent training as a result. However, one institution indicated that the lack of such specific rules would make it easier for them because it would allow them to work more extensively in their teaching. Therefore, some institutions are fulfilling the legal requirements for BL by creating their own guidelines for BL and getting instructors and students to follow them. The IMO Instruments Implementation (III) Code requires governments to regulate technical matters of ships flying their flag, but the Code implies that this is limited to the situation that a new or revised IMO instrument enters into force.

Since there is no unified international guidance on remote education or training (ICS and IAMU, 2020), legislation concerning BL depends on each country. To tackle this issue, ICS and IAMU recommended the shipping industry and METIs to encourage IMO to develop guidance on remote learning and approval of training programs that can meet the STCW Convention's requirements (ICS and IAMU, 2020). Given the international aspect of the shipping industry, it is ideal to unify the quality of MET internationally, including remote learning. Furthermore, IMO is a forum of States, so flag States are recommended to share their experiences related to the issues and develop such guidelines at IMO.

b. Technical aspect

The key technological prerequisites are tools and equipment to conduct online classes. In this regard, some institutions can provide the equipment necessary for online learning, especially computers, laptops, learning software/platforms, while others attempt to do so. In addition, some institutions mentioned that instructors have their own laptops, which can be convenient for delivering online lectures. However, findings revealed that the equipment used might vary depending on the training courses, so different tools and materials are needed for each class. Based on the above findings, this dissertation believes that METIs should provide all necessary equipment regarding online learning unless lecturers want to use their own equipment. Furthermore, an internet connection has been a crucial necessity for BL, especially in online courses. The solution for this problem is discussed later.

c. HR aspect

Management of HR in education is crucial, according to Omebe (2014), because instructors are the essential tool for achieving learning excellence. Therefore, instructor training is an integral function for students' smooth delivery of lectures. However, there is no specific training available for BL among METIs. Few institutions have stated that instructors do not need special BL training because they have their own knowledge and teaching styles. Some institutions conducted IMO trainer courses and other STCW-required trainer courses, although it is not specific training for BL. In fast-changing learning environments, educationalists must identify the appropriate platform of techniques and the evolving feature of technologies (Torraco & Swanson, 1995).

Discussion for legal, technical, and HR challenges

However, there is still no guidance on how BL should be effectively delivered; some institutions have sought to find the way to increase the quality of BL, such as providing webinars for instructors, weekly meetings with faculty members, peer learning, and knowledge sharing sessions on how to conduct BL courses online. Such methods are considered to be beneficial because different teaching methods may be required for

online learning, and effective ways to train students should be identified by sharing best practices. For example, Rakic et al. (2020) pointed out that students who have good linkage with other students tend to show higher performance in the case of online learning, so instructors might be required to force interactions between students, such as discussion or establishment of forums so that poor quality students can improve their performance. In any case, METIs should enhance the quality of instructors by regular information sharing among instructors to identify the most effective teaching method. At the tactical level, such as using effective online learning tools, it might be effective to use webinars delivered by vendors, as some interviewees suggested.

Although the findings indicated that BL reduces travel expenses for instructors and students, it raises educational costs for METIs because institutions have to provide the necessary tools and equipment for BL. For example, it costs US$ 1,800 per year to obtain one ZOOM account for educational purposes (ZOOM, n.d.). Therefore, unless the opportunity cost due to the effect of saving time surpasses the initial cost, METIs may not select BL anymore after the pandemic is relieved. In the case of the asynchronized method, the METIs may save the initial cost because the institutions are required to broadcast the course contents online after developing the materials. Therefore, they do not have to purchase such an account. However, this method lacks flexibility in which lecturers can adjust the level of training, taking into account the level of students. Therefore, the author believes that appropriate measures to compensate for high initial costs, such as subsidies from governments, should be developed to disseminate BL.

Furthermore, when embracing synchronous learning, it was discovered that adjusting time zones for different students and instructors from various places was problematic. Given the fact that the working hours of seafarers are usually irregular, it might be inappropriate to deliver synchronized lectures in fixed time. In this case, an asynchronized method is considered to be more feasible. However, the effectiveness of the asynchronized method should be equivalent to that of synchronized learning. Therefore, it is necessary to develop an appropriate asynchronized strategy that can compensate for the disadvantages of the method, so further research should be

conducted in this field. Moreover, some instructors have lost students' attention, resulting in minimal physical interaction between students and instructors. In this case, regular follow-ups, such as an online meeting, for each student to grasp students' interests are considered to be effective.

In online learning, it might be challenging to conduct online evaluations because the integrity of the assessment can be compromised in an online environment if institutions cannot manage it properly (C). Furthermore, online examinations make it challenging for instructors to evaluate students' answers because it is hard to ascertain if they are working independently or receiving external assistance. Jalali and Noorbehbahani (2017) developed an automatic cheating detection system that uses webcam images to tackle such a problem. The authors claimed that the system's accuracy was 100%. However, it is opaque whether this method can cope with the issue of mathematical calculation, which one of the interviewees pointed out. In any case, further study should be conducted in this field to detect cheating and keep equity of exams. Furthermore, providing practical training in line with the local government's social distancing rules has become a temporary obstacle for METIs during the Covid-19 pandemic, as METIs have to create a comprehensive schedule and seating plans to determine how many students can be accommodated in the classroom.

It has been challenging to organize online courses due to the lack of digital skills. Some institutions have senior instructors, including former mariners, captains, or chief engineers, and some are too old to be familiar with modern technological tools and software. However, some institutions arrange weekly meetings with faculty members by sharing their knowledge. Nevertheless, it was still a problem for institutions. Arranging specific tools and materials for each BL course is also a challenge for some instructors. If their materials are not appropriate for the subject, it can create problems during lecture time.

Furthermore, institutions that use two learning platforms find it challenging to conduct assessments between the grading system and the google classroom. To tackle the problem, it is necessary to increase digital literacy of both students and lecturers.

Digital literacy is the capacity to effectively utilize Information and Communication Technology (ICT) in identifying, assessing, using, sharing, and generating information found online (Hamutoğlu & Sezen-Gültekin, 2019; Maphosa & Bhebhe, 2019).

Maphosa and Bhebhe (2019) recommended that educational institutions provide training in online education for both learners and instructors. The authors also claimed that it is beneficial for students to belong to specific academic communities to conduct research and share findings using digital systems. By doing so, the authors explained that students could also cultivate digital literacy. Agustini et al. (2020) proposed to increase instructors' digital literacy through training which both educational institutes and industries conduct. Atkins (2018) pointed out that the roles of learning technologists who are actively involved in research and educational activities from the perspective of learning technology will become more important, so METIs and governments should leverage them to support teachers' work in the era of digitalization. In any case, given the fact that the pandemic of COVID-19 has forced METIs to implement online learning immediately, they do not have enough time to train instructors, students, and learning technologists. Therefore, METIs and governments may be required to act based on the above suggestions to disseminate BL further.

There are several issues that both students and instructors face. The first issue is an unstable internet connection. When it comes to delivering online courses, this is a challenge for both instructors and students, and it can lead to a lack of focus on education. Furthermore, poor internet connection can lead to bad performance of learners because it has negative impacts on students' motivation (Krishnapatria, 2020). Therefore, internet connections should be supported within the learning process (Windiarti et al., 2019). However, it requires the development of communication infrastructure to provide stable internet connection, and it may not be feasible in developing countries. Therefore, Coran and Salih (2018) proposed to develop an e-learning system based on satellite communication. The merit of satellite communication is that it does not require terrestrial infrastructure except for antenna, but it is relatively expensive to use satellite communication. Currently, Low Earth

Orbit (LEO) satellite constellation is considered to be a cheap, high-speed, and high-capacity telecommunication option in the future (Shenoi et al., 2015). Space infrastructure to provide LEO satellite constellation has been developed recently (Mann, 2021), so it is recommended for METIs to consider creating an e-learning platform by using LEO satellite constellation to tackle the problem of internet connection. Another issue is a limitation of appropriate technological resources, such as laptops, computers, and tablets. Even if they have technical equipment, some are no longer up to date with new software. Again, this is a concern for both students and institutions. Some METIs can support these for both students and instructors, but those unable to provide adequate technical resources have become a challenge.

To tackle the above issues, the following actions are required:

Recommendations

The researcher recommends

- Governments
    - to subsidies METIs to cope with the high initial costs of online educational tools.
    - to share their best practices at international forums such as IMO and IAMU to develop international guidelines in the future.
- METIs
    - to improve the quality of instructors by regular information sharing among instructors to identify the most effective teaching method
    - to allow lecturers to attend webinars delivered by vendors to improve their digital skills.
    - to provide necessary training infrastructure, including laptops, for instructors and learners (Agustini, 2020)

o to provide training in relation to online education for both learners and instructors.

o to conduct regular follow-ups for students to grasp their attention and deliver effective content in line with students' interests.

o to hire and cultivate learning technologists so that they can effectively support teachers in delivering online learning

o to provide necessary training infrastructure, including laptops, for instructors and learners (Agustini, 2020) [reiterated]

o to consider developing e-learning platform by using LEO satellite constellation to tackle the problem of internet connection.

● Research institutes

o to conduct research and development on an appropriate asynchronized learning method equivalent to a synchronized method in terms of quality and effectiveness.

o to develop effective methods to detect and eliminate cheating during online examinations

4. *How do capacity-building collaborative programs between maritime clusters optimize blended learning?*

Collaboration with educational institutions is necessary to boost quality and credibility (European Commission, 2016). To overcome the obstacles outlined in Q-3, METIs should communicate with one another. One interviewee mentioned that collaboration programs with other universities by sharing knowledge and experiences can benefit METIs because instructors can share their knowledge and best practices with students. For example, the institution can collaborate on training programs for their lecturers, learn the correct way or the best way from these programs, and then move on to students. They can then give their feedback on how they like how they see the valuable factors of this BL course and move forward from that (A). Furthermore, collaboration

can foster a positive culture within the industry. Once institutions develop a culture of collaboration, whether, for online learning or another endeavor entirely, they can promote a positive culture that permeates their country and organization, most notably their knowledge, resources, and culture (C).

Collaboration programs enable METIs to share expertise and engage in conferences and projects, resulting in acquiring new techniques. Through collaborations, financial benefactors for new projects can also be discovered, which is mutually advantageous. In addition, METIs could be more interconnected through collaboration programs and create better cooperation networks in the future. Certain institutions recognize the value of collaboration. As a result, they have chosen to initiate collaborative programs. To mutually benefit, they collaborated with other METIs on strategic partnership projects and developed knowledge and experience exchange programs.

Furthermore, as some METIs acknowledged the importance of communication, they established various collaboration programs. As a result, they exchanged facilities and resources and assigned instructors to offer training courses at other institutions and were invited from other institutions. As a result, they can acquire modern facilities and updated knowledge for their respective field.

Multi-lateral international cooperation in the field of BL is also crucial in the future. Given that there is no international guidance on BL (ICS & IAMU, 2020), especially online learning, the maritime industry will be forced to develop such guidelines to standardize quality, technical specification, and effective teaching methods about BL. The above already existing cooperation program can be a basis for international guidelines. Therefore, it is recommended for the communities concerning BL to share their experience at IMO or IAMU to develop international guidelines in the future. If such guidance is adopted, it can be an excellent legal basis for governments and METIs to implement BL.

Recommendations   57

The researcher recommends

- METIs

  o to actively cooperate with METIs in another country to share
    experiences in relation to BL with each other

- cooperative entities or governments

  o to share their best practices at international forums such as IMO and
    IAMU to develop international guidelines in the future.

Chapter 6 Conclusion and Recommendations

6.1.   Conclusion

The current competence-based learning, emphasizing knowledge, understanding, and experience, has faced many difficulties. First of all, it is based on in-person lectures, so seafarers cannot take lectures when navigating. Although e-learning has been developed to tackle the issue, learning performance may be decreased due to lack of emotional communication. Secondly, it is expected that there will be a number of cutting-edge technologies arising due to Industry 4.0, so it is not effective for seafarers to use such technologies only through the traditional training based on in-person lectures. Likewise, practical training alone is not sufficient to cope with the successive upgrades of technologies. Thirdly, many cutting-edge technologies, such as bridge simulators, have been introduced to raise training effectiveness, but such systems are too expensive, especially for developing countries. Fourthly, competency is difficult to assess through examinations and assignments. Finally, traditional competence-based learning cannot meet the needs of all students. For example, learners cannot study at their own pace.

To cope with these issues, the Blended Learning method (BL), which is the effective combination of a traditional learning approach emphasizing in-person lecture and online learning, is considered to have the potential to be dominant in the future. In the case of BL, theoretical classes are delivered through e-learning, which secures net-centricity. Since BL involves various teaching methods, including face-to-face classes, group projects, and practical training, interactions among students and between students and teachers are also secured. Instructors can monitor and assess students accurately through various activities, enabling tailor-made syllabus and accurate assessment of competence. Thus, the literature review identified the modality of BL composed of the four elements: net-centricity, enhanced interactions, tailor-made syllabus, and accurate assessment of competence, which can contribute to minimizing limitations of the current competence-based learning. However, the modality except for net-centricity is not well identified through the interviews. This may be because

the pandemic forced the schools to prevent face-to-face communication among students and between students and teachers, which made them rely only on e-learning and sometimes practical training if needed. Therefore, it can be concluded that they failed to use BL to avoid or minimize facial contact fully.

The identified challenges related to BL are the initial cost, time zone difference between lecturers and students, lack of clear guidelines, lack of training for teachers, cheating at online examinations, poor digital literacy, and technical infrastructure such as poor internet connection. To tackle the issues, governments, METIs, and research institutes are required to take action in 6.2. In addition, cooperation between METIs can also contribute to resolving the issues. Through intimate collaboration, institutions can exchange their expertise and best practices, which improves their BL methods. In addition, several institutions can share facilities and human resources, which saves money and enables them to deliver enhanced and improved training programs that one institution could not have attained before collaboration.

6.2.   Limitations of research

The inability to interview a substantial percentage of METIs may be the first limitation of this research. The researcher supposed that this could be related to European holiday leave. Due to vacations, some METIs could not respond to the researcher's email request for an interview. Secondly, the literature analysis may not have included all scientific work on BL, as this technique is still in its development, and the majority of METIs are currently attempting to develop this system.

The primary deficiency is conducting interviews with METIs regarding BL because most METIs are delivering BL due to the COVID-19 pandemic's influence. Moreover, they are focusing on e-learning rather than BL, and it is difficult for the researcher to obtain the data needed to interview BL.

6.3. Suggestions for future research

Since the COVID-19 pandemic has compelled METIs to introduce BL immediately, they do not have enough time to train instructors, students, and learning technologists, especially e-learning. Thus, future studies may include developing an asynchronous learning approach in quality and effectiveness compared to a synchronized method. Additionally, research institutions may create effective strategies for detecting and eradicating cheating on online assessments.

6.4. Recommendations

To further improve BL, this dissertation recommends the following actions:

- Governments

  o to subsidies METIs need to cope with the high initial costs of online educational tools.

  o to share their best practices at international forums such as IMO and IAMU, to develop international guidelines in the future.

- METIs

  o to improve the quality of instructors by regular information sharing among instructors to identify the most effective teaching method.

  o to allow lecturers to attend webinars delivered by online education providers to improve their digital skills.

  o to provide necessary training infrastructure, including laptops, for instructors and learners (Agustini, 2020)

  o to provide training in relation to online education for both learners and instructors.

  o to conduct regular follow-ups for students to grasp their attention and deliver effective content which is in line with students' interests.

  o to hire and cultivate learning technologists to effectively support teachers in delivering online learning

- o to consider developing an e-learning platform by using LEO satellite constellation to tackle the problem of internet connection.
- o to actively cooperate with METIs in another country to share experiences in relation to BL with each other
- Research Institutes
  - o to conduct research and develop an appropriate asynchronized learning method equivalent to a synchronized method in terms of quality and effectiveness.
  - o to develop effective methods to detect and eliminate cheating during online examinations
- Cooperative entities or Governments
  - o to share their best practices at international forums such as IMO and IAMU to develop international guidelines in the future.

According to the above recommendations, the researcher believes that the major issues will be resolved in the future. Students can cultivate their competence and skills in more effective and flexible manners through BL.

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Appendices

Appendix A. Semi-Structured Interview Questions

Personal information Questions

1. Name

2. Occupation

3. Number of years involved in lecturing/teaching activities

4. Number of years involved in online lecturing/teaching

I. Educational Approach

1. What kind of online teaching/lecturing have you conducted before conducting the blended learning system? Why did you transform to the blended learning system?

2. What kinds of educational approaches are your institution currently using? For example, Combination of Face-to-Face learning with Synchronous **or** Combination of Face-to-Face learning with Asynchronous **or** Both

3. Why did you use those kinds of approaches? What are the advantages and disadvantages of these learning approaches?

4. What kinds of challenges did you face when you started using these approaches? For example, Technical Challenges

II. Modality of BL

Technological Requirements

1. When you start using the blended learning system, what technological specifications did you necessitate?

2. What process did your institution undertake to achieve those requirements?

Legal Requirements (Policies, Standards and guidelines)

1. What are your country's policies, standards and guidelines regarding the blended learning system?

2. How did your institution prepare to fulfil these requirements?

3. What kind of challenges/difficulties did you face, and how did you solve them?

Human Resources Requirements

1. How many courses did you deliver on the blended learning system? Could you explain in detail?

2. Depending on the specific courses, what kinds of tools and materials did you use? Could you describe the challenges/difficulties when you use those tools and materials?

3. How do you train instructors to deliver blended learning in your institution?

4. What kind of challenges/difficulties did you face, and how did you solve them?

III. Educational Collaboration

1. Does your institution participate in collaboration programs with other Maritime Education and Training Institutions (METIs)? For example, student training programs, conducting special lectures regarding blended learning, sharing materials and resources, organizing staff/instructors training

2. How did you collaborate, and what kinds of benefits did you get from these programs?

3. Do you have future collaboration programs with other METIs regarding the blended learning approach? Could you elaborate more details in this regard?

All of the questions will be a little bit changed depending on the respondents' designation, and follow-up questions will be asked depending on their answers.

Appendix B. Consent Form

WMU WORLD MARITIME UNIVERSITY

Dear Participant,

Thank you for taking the time to answer the attached questionnaire. I will be very grateful if you will take a few minutes to complete it.

The topic of the Dissertation is the **Development of blended learning technology based on educational approaches, needs and frameworks.**

The purpose of this questionnaire is to collect data for a Master of Science Dissertation at the World Maritime University (WMU) about how Blended Learning System is implementing in your organisation.

Data derived from this questionnaire is only for the purpose of the dissertation and I hereby assure complete confidentiality. Your name will be anonymised in the final report. Further, those anonymised data will be stored until my master degree graduation after that the electronic files will be deleted, and hard copies will be shredded.

There are no right or wrong answers. I am interested in your opinion. Any additional comments you have which will be exceptionally welcome. I consider you an important part of this survey. Your participation –purely voluntary – is critical to the success of the survey and is very much appreciated. If you want to withdraw your participation in this questionnaire, you can withdraw at any time.

If you have any questions, you are welcome to send your questions to me for a prompt reply to the below email.

Thank you very much for your cooperation and participation in this survey.