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Enhancing maritime education through online distance learning in developing environments

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ENHANCING MARITIME EDUCATION THROUGH ONLINE DISTANCE LEARNING IN DEVELOPING ENVIRONMENTS

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): **.....**

Supervised by: **.....**

Supervisor's affiliation**.....**

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The maritime sector is of critical significance to any economy. Around 90% of world trade is carried by the international shipping industry. The maritime industry is of huge importance in terms of natural resources and energy, trade and industry, as well as sciences and leisure activities. Seaborne trade continues to expand, bringing benefits for consumers across the world through competitive freight costs. However, by providing maritime education through online distance learning will keep up the pace of skills and competences in maritime industry in the fourth industrial revolution.

Maritime education needs to be focused upon. It needs to be considered, discussed, studied, analysed, and continuously improved upon. It is for this reason that the author of this dissertation develop passion for maritime education and has seen a need for online distance learning.

I thank Almighty God for His wisdom, counsel and guidance to be able to do research and complete the study. I would like to thank World Maritime University, JL Dube Institute and Transport Education and Training Authority (TETA) for awarding the opportunity and scholarship to pursue this course at an acclaimed academia. Special acknowledgement to Professor Johan Bolmsten, Professor Sanja Bauk and Dr Mvuselelo Ngcoya for their academic guidance and inspirations in the course of my thesis research. Huge thanks to all the participants who have taken the time to do my survey questionnaires.

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ABSTRACT

Keywords: Maritime Education and Training, STCW, Curriculum development, Online distance learning.

The education and training of seafaring officers is regulated by international regulations based on the Standards of Training, Certification and Watch-keeping Convention for Seafarers (STCW). These regulations require continuous education to keep certificates of competence valid. South African legislation in the sphere of higher maritime education and training has to be modernized in terms of recognition, proper interpretation and implementation of the STCW Convention requirements, and faster deployment of virtual learning as a supplement or substitute to the traditional education and training of seafarers. In addition, the STCW Convention needs changes and adoptions itself.

The purpose of this study is to explore lecturers' and students' awareness regarding the benefits and impediments of online distance learning (ODL) at higher maritime educational institutions in South Africa and their readiness to adopt to this form of knowledge transfer. The study focuses on online distance learning in developing environments with South African METs as focal point. Particular attention is paid to the Durban University of Technology (DUT), which plans to put forward online distance education. Furthermore, to extend the cohort of responders other two METs which are in similar state as DUT regarding ODL were included.

In order to highlight the most significant issues regarding the importance of ODL, a quantitative approach, using survey questionnaires, was used to solicit data from students and lecturers. The chosen research methodology techniques empowered respondents to express their genuine opinions on issues that they considered important when making decisions to implement ODL in MET institutions.

The analysis of the received responses was done in MS Excel Modules (specially imbedded functions in MS Excel) and Statistical Package for the Social Sciences (SPSS) through basic statistical descriptors and multiple-linear regression method. Finally, the discussion of the obtained results was provided along with directions for further research work.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
ARQ	Accompanied research questions
COIL	Collaborative online international learning
CPUT	Cape Peninsula University of Technology
CSIR	Centre for Science and Industry Research
DHET	Department of Higher Education and Training
DUT	Durban University of Technology
DVL	Dependant variable
ECDIS	Electronic Chart Display and Information System
EMSA	European Maritime Safety Agency
GMDSS	Global Maritime Distress and safety Systems
IAMU	International Association of Maritime Universities
ILO	International Labour Organisation
IMO	International Maritime Organization
ISM CODE	International Safety Management Code
IT	Information Technology
IVL	Independent variables
KRQ	Key research questions
MET	Maritime Education and Training
NGOs	Non-Government Organization
ODL	Online Distance Learning
SAAFF	South African Association of Freight Forwarders
SAASOA	South African Association of Ship Operators and Agents
SAIMENA	South African Institute of Marine Engineers and Naval Architects
SAIMI	South African International Maritime Institute
SAMK	Santakunta University of Applied Science
SAMSA	South African Maritime Safety Authority
SAMTRA	South African Maritime Training Academy

SATAWU	South African Transport and Allied Union
SMA	Singapore Maritime Academy
SPSS	Statistical package for the Social Sciences
STCW	Standard of training Certification of Watch keepers
TALFU	Trawler and line Fisherman's Workers Unions
TETA	Transport Education and Training Authority
TVET	Technical and Vocational Education and Training
UCT	University of Cape Town
UKZN	University of KwaZulu Natal
UMA	Umfolozi Maritime Academy
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNISA	University of South Africa
UNTU	United National Transport Union
VTS	Vessel Traffic Services
WMU	World Maritime University

CHAPTER 1 INTRODUCTION

1.1 Background

The maritime cluster is one of the key enablers for growing global industry and trade. It requires skilled and competent workforce in administration, business, and industry, including those who operate modern ships and port equipment for cargo transportation and handling. The cluster should respond effectively to growing demands of international trade and ongoing changes in the shipping business and industry, especially in the context of virtual intelligence and advanced technology. Seafarers are the first in line to implement the conventions and regulations developed by maritime entities. Improving seafarers' competences by all means would help enhance safety and efficiency of navigation and marine environment protection.

The International Maritime Organization (IMO) reported that the human element and poor competence are among the main causes of accidents at sea[1]. Competence of seafarers can be described as worthy performance on-board. This places emphasis on the need for effective Maritime Education Training (MET) to overcome the problem of human errors and keep pace with rapid changes in maritime[2]. Ships are only as good as the officers who operate them[3]. For this reason, the need for proficient seafarers seems to be a global concern for maritime effectiveness, especially in the light of shifting shipping trends, increasing ship sizes and speed, increasing cargo capacities as well as demand for marine transport.

Studies[4]indicate that some 38 500 skilled officers were needed in the maritime industry by the end of 2018. The IMO endorsed *Maritime Education and Training* as the theme for World Maritime Day in 2015[5]. The same source reported that maritime education should

[1] IMO (2014). Maritime Education and Training. World Maritime Day, IMO: London.
[2] Li (2017). Implications of Distance Learning Competence-based, maritime education and training.
[3] Alop (2004). Educatio and training or training contra education. In safety at sea through quality assurance in MET institutions. IMLA Conference . St Petersburg: Admiral Makarov State Maritime Academy.
[4] Drewry (2014). Manning 2014, Annual report. London: Nigel Gardiner.
[5] IMO (2014). Maritime Education and Training selected as World Maritime Day Theme for 2015.

be focused on, considered, discussed, analysed, and continuously improved. Moreover, during the 112th session of the IMO Council meeting (16-19 June 2014), the IMO Secretary General, Mr Koji Sekimizu pointed out that "effective standards of training remain the bedrock of a safe and secure shipping industry, which needs to preserve the quality, practical skills and competence of qualified human resources"[6].

Mr Koji Sekimizu went on to emphasise that "The International Convention and Code[7] on Standards of Training, Certification and Watch keeping for Seafarers (STCW), 1978, as amended has set the international benchmark for the training and education of seafarers. While compliance with its standards is essential for serving on board ships, the skills and competence of seafarers, and indeed, the human elements ashore, can only be adequately underpinned, updated and maintained through effective maritime education and training"[8].

In addition, during a Maritime Education and Training conference organised by SAIMI[9] in Cape Town, a global shortage of 150 000 seafarers by 2025 was predicted. It was also highlighted that the exponential pace of technological development will yield serious skills development challenges and opportunities for the South African economy (SAIMI, 2017). During the same conference, Professor Malek said that technology would play a vital role with the rise of e-learning, distance based learning and simulator training (SAIMI, 2017). Similarly, Dr Doumbia – Henry (WMU president) emphasised that maritime countries should examine the new technologies and tailor maritime education to meet these needs for a sustainable future. Finally, Nick Chubb of the UK-based Marine Society College

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http://www.imo.org/en/MediaCentre/PressBriefings/Pages/21-council112wmdtheme.aspx#.XhnqcX9KiM9
(last access: 11th January 2020)

[6] Ibid.

[7] Note: Convention is made when it is recognized by the flag state, the members of the IMO or the contracting governments that there is a need of provisions or standardization regarding some concern i.e. safety, marine pollution, certification, survey etc. Convention is a broad term and the code falls under conventions as the specific regulations are laid down in the codes with regards to different chapters of the convention. (Source: Gyaan M. (2019), *What is the difference between Convention and Code?*, Retrieved from: http://marinegyaan.com/what-is-the-difference-between-convention-and-code/; last access: 10th January 2020)

[8] 5, Ibid.

[9] South African International Maritime Institute

concluded the conference by noting that the speed of this advancement means that lifelong learning is the minimum standard.

South African legislation in the sphere of higher education has to be modernised in terms of recognition, proper interpretation and implementation of the STCW Convention requirements to fast-track the deployment of virtual learning as a supplement or substitute to the traditional education and training of seafarers. It is important not to lose sight of the fact that the STCW Convention itself calls for a proper education as the foundation of successful training and acquisition of competences. This observation is confirmed by the STCW Manila Amendments, Chapter II, Section B-II / 1, Paragraph 14 which says that the "Scope of knowledge is implicit in the concept of competence. This includes relevant knowledge, theory, principles and cognitive skills which, to varying degrees, underpin all levels of competence. It also encompasses proficiency in what to do, how and when to do it, and why it should be done. Properly applied, this will help to ensure that a candidate can: work competently in different ships and across a range of circumstances; anticipate, prepare for and deal with contingencies; and adapt to new and changing requirements." Additionally, the newest STCW Code amendments strongly recommend the introduction of modern training methodologies including distance learning and web-based learning to upgrade seafarers' knowledge[10].

Various sources have indicated the scarcity of maritime education and training relative to the needs of Operation Phakisa[11] and the local/global maritime economy (SAMSA, 2011; CSIR, 2017; Dyer, 2017). Insufficient training berths, employment opportunities and locally flagged vessels put even greater pressures on existing institutions with limited resources to train more student numbers, especially seafarers (Bonin and Woods 2002; Bonin et al. 2004). In South Africa, no cabotage incentives exist unlike in many other nations (Dyer, 2017). Recognising the increasing digitisation trend of global shipping,

[10] Bauk S., Kopp M., Avramović Z., "A Case Study on Introducing E-learning into Seafarers' Education", *JITA - Journal of Information Technology and Applications*, Vol. 3, No. 1, June 2013, pp. 34-43.

[11] Operation Phakisa is a results-driven approach, involving setting clear plans and targets, on-going monitoring of progress and making these results public.

computer skills ought to be integrated into first year courses in addition to the twelve months of sea service.

Although South Africa has e-learning and ODL policies, it lacks guidelines and legislative frameworks specifically developed for maritime education and training. For example, the South African Merchant Shipping Regulations merely complies with STCW requirements for accredited certificates of proficiency without specifying if online, simulator and web based learninng are acceptable and recognised means of instruction (Department of Transport, 2014).

1.2 Purpose of the study

Since South Africa is a developing country, it can easily transition to become a developed country by raising citizens' education, knowledge and skills. Twenty-five years ago, the majority of the population in South Africa did not have access to higher education. Today, the situation has changed significantly although there is still room for improvement. People need sound lifelong education and skills to keep up with a modern, technology driven and complex society. Life-long learning can be realised through formal and informal learning channels. As a huge virtual library, the internet can help in this regard. However, people should have a certain level of knowledge and education in order to utilise the opportunities provided by the internet effectively. A good way of using the Internet smartly for educational purposes is through online distance learning (ODL).

The purpose of this study is to explore lecturers' and students' awareness of the benefits and impediments to online distant learning at higher maritime educational institutions in South Africa and their readiness to adopt this form of knowledge transfer.

The research was conducted among lecturers and students/ex-students-seafarers at selected higher Maritime Education and Training (MET) institutions in South Africa, namely, Durban University of Technology (DUT), Cape Peninsula University of Technology (CPUT) and Umfolozi Maritime Academy (UMA). The selection of these institutions was motivated by the fact that there are no online distance learning programmes at higher maritime education and training (MET) institutions in South Africa. Secondly, these are the institutions which offer a seafaring education in South Africa. Maritime students have

to upgrade their knowledge and skills continuously to be competent in the world maritime labour market. Since they have to work as seafarers, upgrade their knowledge and refresh their certificates at the same time, ODL might be a good solution.

The findings of this study will hopefully assist South African METs to model and evaluate the feasibility of pioneering ODL programmes using innovative educational methods and technology. Once successfully implemented, the ODL programme could serve as a model for METs in different developing environments.

1.3 Problem statement

Today people need online long-distance education because they live and work in constantly changing and complex environments. One of the most flexible ways of transferring and acquiring new knowledge is through the Internet. ODL courses reduce costs and make education affordable, particularly for marginalized groups such as those in removed rural areas, people with disabilities, the elderly, etc. (Bauk, 2019). Maritime post- and under-graduate students and seafarers can also benefit from online distance learning, since they spend most of their time at sea and cannot attend face-to-face lectures and trainings.

The Standards of Training, Certification and Watchkeeping (STCW) Code amendments[12] strongly recommend introduction of modern training methodologies including distance learning and web-based learning in seafarers' education.

Research is about resolving a problem. It should be noted that in South Africa there are few institutions that offer education through ODL and e-Learning. The need for overcoming this problem has become even more urgent in the context of the Covid-19 pandemic. The current global crisis has forced learning institutions to consider e-learning extremely quickly and this study becomes more relevant in addressing the issue of ODL. Furthermore, there are many seafarers/ex-students who need continuous refreshment of their knowledge and skills. Since the maritime environment is dynamic and complex, it

[12] IMO (2019). International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, Retrieved from: http://www.imo.org/en/OurWork/HumanElement/TrainingCertification/Pages/STCW-Convention.aspx
(last access: 10th January 2020)

requires high level seafarer skills and knowledge. Seafarers need skills to understand, resolve and reflect on complex problems in their working environment. To be able to do this, they must constantly learn, hence Higher Maritime Education and Training institutions should provide such opportunities. In this context, ODL and e-Learning are unavoidable means of conveying knowledge and skills.

As an initial step towards achieving these goals, this study explores a cohort of lecturers and students at a higher maritime educational institution in South Africa[13]. The study explores whether these lecturers and students are well informed about the common advantages and disadvantages of this innovative way of knowledge enrichment and transfer. It also investigates their readiness to adopt online distance teaching and learning methods.

Answering this key research question is a milestone in the process of introducing, adopting and routinizing virtual engagement at maritime higher education institutions in South Africa and other developing countries that function in similar economic, socio-cultural and political conditions.

The development of ODL courses can foster further development of collaborative online international learning (COIL) or virtual engagements that already exist at some high education institutions in South Africa. These programs are currently treated as supplementary forms of regular face-to-face education, but they are not recognized as *formal* or *official* educational programmes. The students need both the education and the appropriate recognition of that education. Therefore, this research should provide justification for the establishment of recognized ODL study programmes in South Africa and consequently in developing countries worldwide.

1.4 Methodology

This study applies a hypothetico-deductive method, which includes identifying a broad problem area, defining the problem statement, research questions, hypothesis, measures,

[13] Research has been conducted at Maritime Studies Department (Faculty of Applied Sciences, Durban University of Technology, South Africa).

data collection, analysis, and the interpretation of results. The study also adopts an inductive approach[14].

This investigation deploys both qualitative and quantitative analysis. The qualitative analysis is done through extensive and critical reading of secondary literature sources on the topics of interest such as textbooks, journals, theses, conference proceedings, unpublished manuscripts, reports, Internet sources, etc. On the other hand, the quantitative approach is realised through a questionnaire. The questionnaire was conceived upon the key research question:

> *How would you assess the real need for implementing online distance learning (ODL) in maritime high education in South Africa?*

This question constituted the main focus of the study conducted among lectures and students at tertiary maritime education institutions in South Africa. The accompanying questions were identified through extensive and critical review of relevant literature sources, as follows:

- *ODL and MET competence based learning*
- *ODL benefits for students and lectures*
- *Knowledge about ODL and virtual engagement in general*
- *Capacities and attitudes for ODL adoption*
- *Rising MET accessibility and affordability*
- *Costs concerns.*

The first construct in the model *ODL and MET competence based learning* was analysed through the research question on the impact of ODL in increasing maritime knowledge and competence. In addition, the question on ODL as a path to the global MET e-classroom was also posed.

[14] Sakaran U., Bougie R., Research Methods for Business – A Skill-Building Approach, 7th Edition, Wiley, UK, 2016.

The second construct *ODL benefits for students and lectures* dealt with increasing digital skills, fostering curiosity, easier learning, innovativeness of ODL, its flexibility and effectiveness in comparison to face-to-face (F2F) learning and the benefits of blended learning.

The third construct *Knowledge about ODL and virtual engagement in general* considered respondents' knowledge about ODL taxonomies and their familiarity with virtual engagement and tele-collaboration.

The fourth construct *Capacities and attitudes for ODL adoption* investigated infrastructural capacities such as computers labs, computers, internet access and lecturers' and students' attitudes towards ODL, time management and self-discipline issues.

The fifth construct *Rising MET accessibility and affordability* considered ODL benefits for the students from rural areas, marginalised groups and particularly seafarers who would like to continue their education and training.

The sixth construct *Costs concerns* interrogated some expenditure exemptions when it comes to ODL and blended learning in comparison to face-to-face (F2F) learning.

The key research question was treated as a dependent variable in the model, while associated research questions were used as independent variables. Based on these dependant and independent variables hypotheses were developed. Hypotheses can be defined as tentative, yet testable statements, which predict what one expects to find in a set of empirical data[15]. They can be described as logically conjectured relationships between two or more variables expressed in the form of testable statements. By testing these relations through appropriate statistical analysis, it becomes possible to obtain reliable information on what kind of relationships exist among the variables operating in the model. The hypotheses developed based on extensive and critical literature review as well as identified dependant and independent variables are as follows:

- Actual use of ODL in higher education in South Africa is at a modest level of development.

[15] 12, Ibid.

- Introducing and adopting ODL more extensively will bring innovations into both teaching and learning, and it is a step towards creating *digital* campuses.
- ODL is more flexible than traditional learning, since instructional materials are available at any time, from any device, which is connected to the Internet and has a browser.
- ODL can provide access to high education to students who for some reason cannot attend face-to-face classes e.g., seafarers who have to sail and upgrade their knowledge simultaneously, students with disabilities, students from distant rural areas, other underrepresented students, etc.
- ODL can reduce the costs of space, energy, infrastructure and commuting.
- Some students do not have their own devices to work on, and/or permanent and reliable access to the Internet.
- There is insufficient number of computer labs at South African campuses that can provide students and teachers with computers and uninterrupted Internet access.
- Some teachers and students do not have appropriate Information Technology (IT) knowledge and skills and they need additional training.
- Through ODL students can learn faster, but teachers have to put additional effort to prepare their classes, and this extra work is usually not paid for.
- After some time, instructional materials may become obsolete. Therefore, return of investment into creating electronic instructional materials is vague.

The above listed hypotheses have been tested through questionnaires sent via e-mail to selected South African higher MET lecturers, students, and ex-students, i.e., seafarers. They filled in the questionnaires voluntarily and sent them back to the researcher. The hypotheses and questionnaires were conceived on the basis of an extensive, critical literature review in the field, discussions with colleagues and the researcher's own experiences. The preliminary version of the questionnaires was sent to an expert in the field with the intention of improving clarity and eliminating ambiguity of the questions.

Two types of questionnaires were used: one for the lecturers and the other for the students/ex-students-seafarers. The questionnaires which were delivered to the selected lecturers sought to investigate lecturer's attitudes towards adopting ODL and developing and using electronic instructional materials. Lecturers were also asked if should ODL bring teaching/learning improvements and at what pace; should it contribute towards developing student's critical thinking skills and intercultural competencies (under the assumption that foreigners enrol into the programme). They were also asked if ODL reduced overall educational costs.

On the other hand, the questionnaires for students/ex-students-seafarers sought to find out if they were familiar with computers. Did their working environment (on campus or on-board a ship) provide them with uninterrupted and reliable Internet access? Do they have the necessary equipment (computers, tablets, smart phones, etc.)? Are they capable of learning independently?

Both lecturers' and students'/ex-students'/seafarers' responses were later carefully analysed, statistically processed and discussed. Through the questionnaires, the respondents rated each of the questions on a scale from 1-5 (according to the Likert's scale), where 1 denotes a standpoint closest to a *negative* response, while 5 corresponds to a standpoint closest to a *positive* response. The analyses of the received responses were done in Excel Modules (specially imbedded functions in Excel) and Statistical Package for the Social Sciences (SPSS) through the multiple-linear regression method. Finally, the discussion of the obtained results was done along with directions for further research work.

1.5 Overview of the study – Development of Chapters

The thesis shall consist of six chapters, as follows:

Chapter one provides the outline of the study, describes the rationale and significance of the research, formulates the hypotheses and explains the methodology of the study.

Chapter two presents a review of relevant literature. It explores models and concepts of ODL that have already been implemented in different countries, including their advantages and disadvantages.

Chapter three discusses ODL challenges for developing countries in the digital age, including the challenges that South Africa faces in general education, maritime education and training and maritime policies

Chapter four delineates the research methodologies applied in the study

Chapter five provides quantitative analysis of empirical data collected from the respondents (lecturers, students, ex-students, i.e., seafarers[16]) through basic statistics and multiple-linear regression analysis in Excel Modules and Statistical Package for the Social Sciences (SPSS). This chapter also undertakes a qualitative and quantitative analysis.

Chapter six provides a conclusion and identifies areas for future research work in the field.

[16] 11, Ibid.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction and Definitions

This chapter's overall objective is to review literature in the field of ODL. It aims to provide a theoretical framework, contextual background and understanding of core issues, and discuss characteristics and factors related to enhancing maritime education through online distance learning in developing environments. This literature review follows an issues-based, systematic thematic analysis, providing definitions, characteristics, related sources and case studies for various e-Learning, competency and maritime education/training types. It aims to systematically summarise and identify existing core concepts and research gaps and provide a theoretical justification for this study's unique conceptual contribution and subsequent methodological approach.

2.2 (Online) Distance Learning

Distance education is not new and has been in existence for more than a hundred years (Bauk, 2014). In South Africa, the Department of Higher Education and Training views distance education as an integral part of the post-school education system since most universities have reached their limit of on-campus students with their existing infrastructure (Department of Higher Education and Training, 2012).

Reduced funding and growing student populations have resulted in increased demands for distance education. Technology has also been a key driver in creating the need for accessible online distance education for students. Today, Cloud helps students develop high order thinking skills, allows them to integrate formal and informal learning, fosters experimentation, curiosity and creativity (Bauk, 2019).

Information Technology (IT) based education currently includes a number of core distinctions between various forms of distance learning including e-Learning, online or Internet based learning, Web based, Cloud based and blended learning. (Tsai and Machado, 2004). Web or Internet based learning utilises a Web browser and network connections. Computer based learning does not require an Internet connection.

Globally, online distance education has grown exponentially in recent years and has become an important part of higher education. This mode of delivery of education reaches a wider student audience, better addresses student needs, saves money, and more importantly uses the principles of modern learning pedagogy (Tucker, 2004). The rapid growth in online distance education is a result of the advancement in technology and the improved access and availability of electronic technology (Galusha, 1998). The method of delivery of distance education has evolved over the decades from correspondence study, open universities, teleconferencing, networks and multimedia delivery (Passerini, 2000) to a high degree interactivity between lecturers and students (Sherry, 1995). The high degree of interactivity is a result of the advancement in telecommunication technology; which has redefined the distance education environment (Dabbagh, 2004). Improved telecommunication technology has profoundly changed the character of distance education by providing the capability for direct and immediate interaction among lecturers, students and knowledge (CHEA, 1998).

Today, seafarers would be able to access online education anytime anywhere due to the improved on board accessibility to the Internet. This will allow learning to be pursued anytime via information retrieval from an online distance education classroom (Karadeniz, 2009; Chang, 2001). If structured properly, the distance education student can now have almost the same instructional contact and interaction as the student on campus through the provision of synchronous communication (Galusha, 1998).

As the subsequent literature review supports, a diversity of e-Learning tools, methods and technologies have become increasingly popular in secondary and higher education over the most recent two decades. In the past few years, South Africa and other nations have increasingly considered the implications of digital disruption and the 4th Industrial Revolution, which the maritime education and training sectors are not exempt from. This move towards Internet based learning has significant potential risks and opportunities for the future of workforces, economies, training institutions, businesses, individuals and communities. Learning Management Systems (LMSs) such as Blackboard and Moodle may help to facilitate the transition towards this future (Sari and Setiawan, 2018).

2.3 Competence Based Training

Global maritime education remains primarily vocational and practically orientated, driven by market demand and stakeholder requirements, rather than theoretically orientated. One popular trend is the emphasis on competence-based training both in general and in specific seafarer education aligned to satisfying various international IMO and ILO/other conventions, codes and recommended guidelines. This training's prime purpose is to ensure the transfer of sufficient skills and proficiencies to satisfy the accredited certificates of competency needed for various seafarer ranks under the STCW section B-I/6 and other conventions/local laws as detailed in subsequent sections (Jiang and Li 2017). This specifically extends to distance and eLearning as legitimate mechanisms to ensure this. Competence based training is primarily results and performance orientated, where seafarers determine mastery of a subject at their own rate based on pre-set performance criteria, recognising pre-acquired knowledge and seafaring experience as legitimate indicators of competence. Its value for maritime education and training is to provide refresher and distance learning education courses that do not necessarily impair a seagoing career, as shore-based education would. However, the source concedes that certain competences can only be demonstrated by physical rather than online or distance learning. Competency based assessments need to replicate real life as much as practically possible to be of highest value and ensure quality assurance. Certain legal frameworks and educational policies also require updating to recognise the validity and confer legitimacy upon competence-based training delivered by distance and online/eLearning specifically relating to maritime education and training.

2.3.1 Maritime Education and Training

There are several projects, conceived and developed in different environments, which enhance maritime education and training attempts based on computer based methods and tools. Some of these projects are highlighted below.

Among the most prominent is project Seafarer's Global Use of Long–distance Learning (SEAGULL) which is a European Union initiative developed between 1998 and 2000 to focus on distance learning technologies in maritime education and training including a

cost-effective analysis via surveys and workshops (MSC-Marin, 2004). It incorporated CD's, Internet, computers, servers, a website and e-Learning Management System as a prototype. To succeed, the project findings emphasised effort and attitude or psychological willingness of educators, learners and institutions. Access to facilities, changing assessment modes, equipping vessels, securing active cooperation from shipping lines and technical expertise were necessary. The project tested learning aboard the MS Voorneborg via this system with specific software and pilot course for an experimental three months. Participants mentioned satisfaction with interactive feedback and time saving but experienced connectivity and data challenges along with time pressure commitments needed for studying. The need to ensure sufficient participant IT literacy and motivation was perceived as necessary.

In Ghana, a project focusing on women at the Maritime Authority empowerment (Akyeampong, 2019) was also initiated. It distinguished between computer, Internet and simulation based training and individual face to face teaching/coaching/mentoring but indicated logistical challenges that exist in attempting to provide sufficient physical campuses, lecturers and other facilities in the absence of eLearning tools and applications. In Myanmar a similar study focused on maritime community communication and learning by employing information technology via the formation of a specific maritime cluster and cloud centred learning (Aung, 2009). This helped to overcome a perceived shortage of qualified and experienced seafarers.

Various forms of e-Learning and distance education also proved to have potential advantages in helping seafarers adapt to their transfer into post-seagoing careers onto shore-based activities such as ports, shipping line offices and maritime authorities/agencies or tertiary institutions. One Kenyan case study recognises the challenges of ensuring effective maritime education and training including funding, resources, governance and the teaching methods (Mohammad, 2019).

2.3.2 Seafaring Education

Historically, global seafaring education both in the merchant marine and navies was based on practical apprenticeships and seafaring experience. Maritime education training via simulations can reduce the physical resources and actual sea time necessary to secure STCW and other certificates of competency. Simulators enhance the accuracy of assessing the proficiency of a seafarer more than a direct oral or written examination. The Myanmar case study embraced simulators as a means of addressing a shortage of lecturers, examiners and training vessels (Maung, 2019). Simulators are more capable of testing human memory, whilst not exposing lives and vessels to costly elementary human error by trainees/cadets. It emphasises the capacity to test language comprehension skills, confidence, leadership, emergency scenario responses, risk management, navigation and communications. It proposed a compulsory simulator training scheme that could enhance the quality of domestic maritime education and training, enabling more global competitiveness, market demand and job opportunities for local seafaring graduates. It also reduced exam writing waiting times.

Simulator training, along with specialised software is further recognised along with e-learning and web-based learning as vital components to assist in navigation, seamanship in polar waters and ECDIS systems. However, simulators are expensive, require being physically present to train/operate and detailed training to prepare for. Real time responses are less susceptible to cheating but are more prone to making simple, swift mistakes that cannot be so easily rectified. The study identified the value of simulators as internationally recognised for 5 days (40 hours) as equal to 10 seagoing days, 10 days of simulator instruction equates to 30 seagoing days and 15 days or 120 hours equals 60 ocean days. A survey with 34 respondents identified the majority perspective that full mission, limited task and single task simulators are sufficient to address the current STCW Convention requirements. Virtual and augmented reality have been also identified to pick up other individual and generic requirements.

Alternatively, another source focused on how multi-user virtual environments can facilitate maritime education and training (Pham, 2012). It envisioned the capacity for learning via

games and simulations, social collaboration and virtual delivery method over other forms of knowledge and experience. It contends that Virtual World and related technology applications can be implemented into actual educational environments, methods and practises. It remains accessible to others after the lecturers or students have individually departed and it is not constrained by the requirement for physical presence. This is echoed by the online maritime teacher training and curriculum at Constanta Maritime University Romania (Stan, 2019). This web oriented system carters for global students and lecturers not just those directly at the campus. It actually enhances student's self-esteem as they do not face peer pressure and discrimination or social ostracism. Access to electronic copies of books and articles from the university library, counteracts the shortages students typically face when seeking set texts or recommended readings from the campus library. Constanta Maritime University followed the example of Kongsberg Maritime in Norway which improved cadet training via maritime simulator software.

2.3.3 IMO Conventions

Currently, legal ambiguity exists internationally as to whether maritime education and training can be effectively substituted by online, distance and e-Learning based educational alternatives.

In Myanmar, one study explored the capacity of technology to produce and deliver not only qualifications that would satisfy STCW and seafarer training requirements but also more advanced training courses (Win, 2018). It emphasised how both are capable with sufficient attention of ensuring quality of standards and regular monitoring as required by STCW Regulation I/8. International Maritime Organisation Conventions focus more on establishing standards and requirements rather than the specific means of delivery. The 1936 International Labour Organisation's Officer's Competency Certificates Convention indicates "*No person shall be engaged to perform or shall perform on board any vessel to which this Convention applies the duties of master or skipper, navigating officer in charge of a watch, chief engineer or engineering officer in charge of a watch unless he holds a certificate of competency to perform such duties; issued or approved by the public authority of the territory where the vessel is registered"(ILO).* Yet the individual standards are not specified and many of them could be substituted or partially provided by courses.

The 1978 STCW Convention merely provides basic requirements and minimum standards for various grades of seafarer/officer ranks. This means prescribing formal accredited service or institutional instruction rather than historic seafaring apprenticeship practical experience that served for over 5000 years. Simulators were added as a means of training in 1995 whilst the 2010 Manila amendments completely ignored increasing digitisation and other e-Learning trends to focus only on ECDIS and liquefied natural gas carriers. The ISM code focuses only on compulsory security, safety and risk management training, to reduce the probability of human error; but is often practically based and needs physical visits.

A study on bridge simulators via bridge resource management training affirmed that for most navigational tasks, students could rehearse navigation via simulation techniques, reducing eventual human error when permitted to eventually undertake sea trials (Zhang 2018). This can assist seafarers to become certified as intended by the Standards of Training, Certification and Watchkeeping for Seafarers (STCW Convention) and STCW Code. The study assessed various skills including situational awareness, decision making, communication and prioritisation. It contends that the STCW Code merely requires "*assessments for seafarers to be structured with written programmes including such methods and media of delivery, procedures and course material as are necessary to achieve the prescribed standard of competence".* Section A states, "*Instructors, supervisors and assessors must be appropriately qualified for the levels of training or assessment of competence of seafarers either on board or ashore".* "*Each Party shall ensure that to ensure quality standards, the education and training objectives and related standards of competence to be achieved are clearly defined and that the levels of knowledge, understanding and skills appropriate to the examinations and assessments required under the Convention are identified".* Existing STCW gaps do not ensure quality maritime education and training, as different individual nations and authorities lack consistency in their standards, curriculum coverage and methods of delivery/intensity.

Nothing specifically encourages or refutes the possibility of substituting physical campus education for blended, distance, online or virtual reality/simulation education for many

maritime education and training requirements in related conventions (International Transport Workers Federation, 2013; International Labour Organisation, 2015) such as the International Maritime Labour Convention 2005 and Work in Fishing Conventions 2007. Minimum requirements specify age, basic English language proficiency, medical certificate and accredited training and qualifications including shipboard familiarisation. Until 1978, seafarers did not need a formal degree, they only needed experience. Provision is made for continuous education given that certificates of competency need to be revalidated after a maximum of every five years. These certificates require basic security, safety, first aid, firefighting, survival training, GMDSS. Radar-Arpa, ECDISM and other competencies.

2.4 Online Distance Learning Taxonomy

2.4.1 Introduction

Although there is no universal definition of electronic learning, this review identifies several common characteristics, methods, theories and approaches for various forms of online and distance learning including eLearning, blended, Internet and web-based, cloud and distance learning.

2.4.2 E-Learning

Although a significant research gap exists in applying these forms of education specifically to the global and South African maritime education and training sectors; this review aims to fill this research gap. A systematic e-Learning evaluation of South African universities established the lack of a unified approach across tertiary and secondary education sector institutions to create and deliver accredited courses and training that are competency based (Bagarukayo and Kalema, 2015). It concedes that demographic challenges exist relating to racial, income inequality, educational, cultural, electricity, Internet and data price barriers in ensuring equitable access to e-Learning. A combination of learning techniques (blended learning) are therefore advocated as a potential solution. Physical challenges include shortage of qualified professional lecturers due to brain *drain*, university *employment equity criteria* that specifically excludes one race even if qualified, student social-political dissension, shortages of physical campus facilities and large class sizes; lack of management support; time pressures and commitment for active lecturers. This provides e-Learning with an opportunity to subsequently resolve these challenges with sufficient

motivational support and resources. Other identified challenges include excessive administrative workloads, instructor attitudes, competing and limited resources and negative perceptions towards the values of e-Learning. Challenges in adapting to the curriculum also exist.

Other e-Learning concepts focus on best practices, advantages, disadvantages and types of technology used (Epignosis, 2015). Although not all examined in this review, they extend to social and collaborative learning, gamification, micro-learning, video-learning, rapid e-learning, personalisation and continuous learning. These provide cost-effective, swifter means of ensuring access to pertinent information that can be updated via regular schedules as necessary. Interactivity is often perceived to be more fun or amusing. E-Learning offers far more opportunities to supplement compulsory or recommended reading materials. However, it does present certain health challenge risks as it is not as intellectually and physically stimulating as physically attending and participating in campus life and staring at a screen for too long, if not interspersed with other activities, can cause health problems. It remains hard to test physical grasps of concepts along with social isolation, which social media and online forums can only partially alleviate. Certain individuals learn more effectively via face to face engagement. To succeed it is necessary to determine student and educator needs or priorities, establish clear access and expectations required and a supportive community (Epignosis, 2015).

Another approach to e-Learning considered certain key factors essential in assisting it to be a successful educational transition. It emphasised human factors by ensuring that staff were sufficiently qualified, motivated and passionate. Ensuring that sufficient technical skills; technical support, the right attitude and collaboration were available was perceived as crucial. Lecturers are also supposed to have empathy for those students who experience challenges when adjusting to online, distance and blended education at least initially. In a surveys that included 394 students, 45 teachers and 22 experts, Fitzpatrick (2012) emphasised the need for sound marketing, quality materials, decent infrastructure, reliable service, standards, guidelines and motivation for eLearning to be victorious and popular. The study also emphasised the need for prompt feedback, ease of use and simple language.

The KSF (Key Success Factor) model (Figure 2) therefore incorporates technology, evaluation, design, human and support factors.

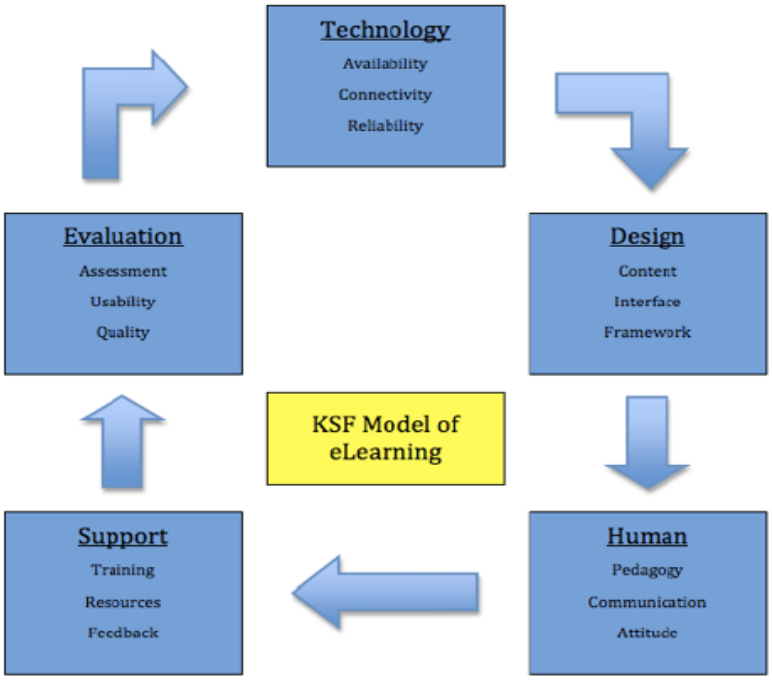

Figure 2. 1 Model of eLearning (FitzPatrick, 2012)

E-Learning methodologies typically involve the conducting of a stakeholder needs analysis (FAO, 2012). This focuses on the teams/educators, learners, activities, technology, curriculum and educational outcomes to resolve challenges of culture, disability or social shyness. It also works for those who do not listen effectively or behave responsibly and respectfully in the formal lecture environment. Online data can assist with monitoring and evaluation of students, lecturers and educational progress or attainment. As stated above, educators can focus both on synchronous and asynchronous learning in their approaches. Examples of the former include live webcasting, whiteboard, Trello, Skype, Zoom interactive e-lessons and conferences. Examples of the latter include emails, blogs, discussion forums, podcasts, simulations, games and others. When selecting e-Learning or blended learning, the extent of previous experience and knowledge of students; their IT

literacy; technology and software capacity, the nature of the course and institution will influence the actual method selected and its performance. (Fitzpatrick, 2012)

The perceptions and beliefs of students and lecturers along with their willingness to embrace technology and a divergent approach to education remain paramount to consider when converting to e-Learning. Campuses offer easier access to printing. One study focusing on Bolivian teachers' reactions at UMSA in La Paz reinforced the underlying hope in its promise and potential benefits, mostly overriding fears or scepticism (Holmstrom and Pitkanen, 2012). The prime concerns remain about the extra time, attention and physical effort this would impose upon lecturers and tutors. They have to invest more effort in being responsive and in new forms of relationships. Lecturers mention the need to update educational materials of which only physical rather than electronic copies exist. This would mean having to scan the physical copies. Another voiced concern was a lack of technical knowledge among many participants. Many teachers just upload material from lectures not investing in any additional materials beyond that which they would normally recite. Teachers are worried about being technologically ignorant. Poverty often leads to lack of familiarity with computer and web-based learning. An alternative source concedes though that e-Learning can still resolve the issues of rural educational gaps for communities once the problems of cost-effective learning solutions and the other challenges are resolved (Hussain et al, 2013).

2.4.2 Computer Based Learning

Comparatively few sources focus specifically on computer-based learning as distinctive from other eLearning types. Most studies merely relate to the use of a physical computer as distinctive from Internet or web-based learning which requires connections to wireless networks. Even physical or face to face education typically relies on these devices to facilitate learning as opposed to old fashioned methods of typewriting, handwriting and printed materials only. This is affirmed by various studies that focus on preferences of those being educated and those conducting the education (Cubukcu, 2008). Computer based learning is friendly and it facilitates active learning and provides access to updated and limitless learning. Many of these benefits extend to web or Internet and blended based

learning. Computer based learning should not be necessarily online, internet or web based. It might be based on *off-line* learning tools e.g., particular computer based educational games, and different types of tutorials (files, audio, and /or video recordings).

2.4.3 Blended Learning

Blended learning is increasingly perceived as the most optimal and enriching student experience as compared to face to face physical and campus centred learning (Lalima and Dangwai ,2018). It requires similar characteristics to ensure its potential success. When traditional learning methods fail to modernise, they fail to address emerging educational and vocation-based requirements along with the needs and abilities of students. Blended overcomes traditional challenges in accessing printed material and campuses. Blended learning can extend to e-Libraries, virtual (global) classrooms[17], live streaming, discussion blogs and forums, webcams, videos, audios, demonstrations, games, group activities and virtual laboratories and is flexible to various needs. It may include social media such as Facebook, Twitter and Instagram. Yet it retains the access to campus, social life and direct teaching access that pure e-Learning cannot provide e. Design guidelines have been frequently recommended for this pedagogical approach (Eastman 2018). Examples include the rotational, self-blended or self-learning model, flex and enhanced virtual models.

The rotational model seeks to invert the traditional student and lecturer learning and presentation or seating model. For example, the flipped classroom variant is for students to concentrate on lectures as homework and use contact sessions to work through assignments or tutorials to absorb comprehension more capably (Eastman 2018). Students become more active and vocal. Other versions include individual, lab, teacher, team or station rotation. The flex model helps students to be flexible in their approach to learning. It allows them to self-elect which electronic and physical resources are most capable of helping them to achieve educational success but requires significant motivation, discipline and effort. The tutor or lecturer makes themselves available on an as-needed basis. The a la carte model is essentially the same as eLearning -where everything is provided and studied electronically

[17] The DUT practices Collaborative Online International Learning (COIL) courses (iKude Erasmus+ project,2020)

(Brooke 2018). The enhanced virtual model consists of scheduled face to face learning sessions but most education follows e-Learning at the student's pace.

A greater diversity of experiences can be encountered including virtual tours of ships, various climates and environmental conditions etc. than can be afforded by the majority of students, tertiary institutions and financiers. Students can access life skills from campus involvement, actual lecturers, field visits and seagoing experiences. With more opportunities and resources provided online, blended learning enables actual lectures to focus on personal tutorials, more enriching case studies, experiences and group discussions to help students potentially grasp concepts more effectively. A blended learning case study was conducted in in Jordan using these approaches to teach English to 34 university students (Oweis, 2018). One group learnt traditionally, the other using blended learning. The second group reported greater motivation, academic performance and memory retention. These benefits are confirmed by other studies (University of Western Sydney 2013; Its Learning Inc 2015; Brooke 2018).

Only limited research has however, specifically investigated the applicability of blended learning specifically towards maritime education and training. One case study affirms its potential suitability with updating of certain IMO Model courses such as 6.09 and massive online open courses offered in person or via distance education (Haiyan 2016). If these courses can ensure social inclusion, retain attention, focus and interest and remain approachable and provide feedback timeously along with overcoming disengaged students; maritime education and training can prevail via e-Learning. More research is therefore needed to subsequently compare student and educator experiences of maritime education and training via e-Learning, online and distance education. Studies need to focus on how they engage with materials online, which materials they select, upload and use or ignore and why and how the process or learning experience can be continuously improved. The advantages and disadvantages along with correlation to performance need to be determined. Lecturers also need to avoid risks of students being inactive during contact sessions, or poor attendance, if they feel that e-Learning on its own remains sufficient. This presents even higher risks for MET as it is mostly practical and skills directed.

2.5.4: Web Based Learning

Web or Internet based learning focuses on electronic learning where resources and learning materials are available via an Internet connection rather than just a physical computer or mixed/blended learning approach. One study argues for its advantages and disadvantages for medical education but questions the extent to which it can provide personalised experiences as it involves significant effort (Lynch and Lynch, 2003; Cook, 2008). The educator acts more as a facilitator of knowledge directing the student towards potential learning resources and resolving certain queries. However, the student additionally decides what, where and how they wish to learn. Web based learning reduces issues of physical distance and provides greater consistency in the standards of education delivered and reduces miscommunication issues. Class sizes do not present a challenge to web based learning, so it is cost-effective. It remains perpetually available and can be easily updated unlike textbooks that have challenges with remaining relevant. Simulators, games and other techniques enable alternative forms of teaching that would be less suitable in a formal, structured lecture environment. Lynch and Lynch (2013) identify recurrent disadvantages of web-based learning including risks of social isolation, cheating; initial web upload, conversion time and cost; poor instructional design and challenges of ensuring that it improves physical contact experience.

Assuming that technological barriers to e-Learning are resolved, enough time exists, and sufficient support is provided, online web and distance-based learning for MET can follow similar successes that have been recorded by similar correspondence courses such as those offered by the University of South Africa (UNISA) and the United Kingdom's Open University (MacKimm, et al, 2003; Wasim et al, 2014)). Web learning can connect diverse forms of learning and it is enriching for both students and lecturers. A Malaysian case study focused on ensuring usability of contact lecturing materials uploaded online (Nordin and Norlidah, 2013). Web based learning needs to be goal orientated so that it can contribute more to student performance than face to face learning. The survey involved 157 lecturers in 15 colleges and universities to confirm its findings. Another study involving 371 students and 11 lecturers focused how web-based learning in high school science enhanced remembering, understanding, applying, analysing and evaluating performance

criteria and greater control of learning (Kay, 2011; Hamzah, 2017)). Many students find it simple to learn when they do not experience challenges with processing information, freezing computers and Internet connectivity. However, the pace of learning needs to permit time to adjust and ensure active, creative, inspired knowledge.

2.4.5 Cloud Based Learning

An Internet or web-based approach via cloud computing similarly echoes improved learning outcomes of technology-mediated learning. One study which was conducted in Bengkulu city, India applied Moodle to teaching senior high schools (Sari and Setiawan, 2018). Moodle is accessible via the Internet although it can store files remotely. It can store e quizzes, assignments, social discussion forums, lecture notes, videos and electronic articles/books without the need for institutional servers. Therefore, Cloud based learning might be treated as a kind of *learning outsourcing*.

2.5 South Africa

As previous studies have shown, Africa and South Africa have been slow to embrace e-Learning for maritime education and training. A systematic study (Dyer, 2017) on the state of local and global maritime education cited few education providers, increasing demand and limited physical evidence for the provision of facilities or interest in employing those seeking to digitally and otherwise modernise the future of African maritime/blue economies. One assessment of the quality of seafarer education in South Africa and Ghana (Maringa, 2015) further affirmed the current deficiency of maritime education and training instruction, the gaps in ensuring that local seafarer knowledge competes globally, the need for greater investment, political/policy support and active networking collaboration. The study identified existing means of instruction, their impact and potential effectiveness and potential problems and constraints. In Maringa's (2015) study, 15 seafarers and lecturers from Ghana and 15 from South Africa participated in the study. South African seafarers were found to be more concerned about the gap between theory and their actual experience of seafaring, shortages of training berths and work experience than the quality of education and technology employed to deliver their studies. 66.7% mentioned lack of quality maritime education and training, failure to attract and retain qualified lecturers, limited financing, poor simulators and lack of training vessels. SAMSA regulations on seafarer

education and training do not consider implications of eLearning or the 4th Industrial Revolution (SAMSA, 2019). They focus more on updating South African maritime law to align it with the 1995 STCW Convention for Fishing Vessel Personal and International Convention for the Safety of Life at Sea via the amended 2013 Merchant Shipping Regulations.

2.6 DUT (Durban University of Technology)

Of the few South African maritime orientated tertiary institutions in South Africa, the Durban University of Technology (DUT) is becoming more alert to e-Learning and envisioning it as an integral part of its curriculum. The Nautical Science degree specifically targets navigation, meteorology, shipboard management, construction and stability. DUT also offers short professional courses with simulators in ECDIS, electronic navigation, maritime education and human elements in thought and leadership (Durban University of Technology website, 2019). Students and lecturers employ blended and web-based learning via Blackboard where lecturers are trained and encouraged to upload course materials. As part of its recruitment process, the University also lecturers to demonstrate potential to integrate eLearning techniques to teaching and learning. However, DUT does not currently focus on distance learning. This further justifies the decision in this study to recruit participants from DUT.

Other maritime education and training institutions that are yet to fully embrace e-Learning in South Africa include Cape Peninsula University of Technology, University of Stellenbosch, Nelson Mandela Metropolitan University, South African Maritime School and Transport College, SAMSA and several TVET colleges.

2.7Advantages and Disadvantages of Online Distance Learning

2.7.1 Advantages of Online Distance Learning

Online distance education in MET can give a flexible alternative on the job training for seafarers. While traditional classroom training programs require seafarers to be at a fixed location at a particular time, online distance education can reach seafarers anywhere

anytime. Distance education can also relatively decrease training fees and allow students to learn without coming to school. Moreover, with the highly changes in maritime technology and legal requirements, many refresher courses can also be delivered through distance education. (Jiang Y & Li Q, 2017)

According to Chen and deNoyelles (2017), it is believed that online distance learning cannot only significantly reduce the costs of classroom infrastructure, but also reduce travel expenses and shorten the training time. Additionally, students can study while working through in-service training. This will not affect the work, but also save on many cost types, and improve the efficiency (Chen and deNoyelles, 2017). It should be noted that online distance learning also supports personalized learning. Furthermore, e-learning can provide independent learning space for different learning styles. According to their, through e-Learning, students can independently adjust learning styles, working time, study habits, and learning needs. They can also learn certain skills over and over again, thereby, improving their proficiency in those skills. E-learning could also be combined with adult training where students do not have to learn step by step. To make learning more free and flexible, students can choose between autonomous and collective learning.

Aside from the previously stated advantages, e-Learning is gradually proving to be an effective method for competency-based training and assessment. Blended learning advantages have been identified as saving time, ensuring more effective use of class time, easier differentiation of individual student needs, ensuring active learning and creativity among students. It is often perceived as better in preparing students for 21st century digital skills. It has less paperwork, thus it is ecologically sustainable and cost effective (Its Learning Inc, 2015). It centralises learning resources in one remote location so that they can be accessed by anyone anywhere as needed. It retains resources longer and can better inform parents, family and others who may not be directly involved in the education. (Bauk, 2019)

Lastly, an e-learning training system does not only, through a simple document transfer traditional theoretical knowledge to students, but can also provide numerous pictures,

audios and video files to make training courses lively and interesting. It allows students to enjoy learning and it creates a relatively relaxed learning environment and atmosphere.
E-Learning education e satisfies the requirements of students at their preferred time, location and pace. It can also aid exam revision by providing to access accurate material compared to depending on memory and partially complete lecture notes. E-learning makes it simpler to amend or update as knowledge and when it becomes available. Lessons and lectures can be provided more rapidly, (although preparation time for the lecturer takes significantly longer), thus diminishing learning time needed. It reduces distractions from other learners as lessons can start and end sooner and no time is wasted on slower/more ignorant others. Students may only focus on what they find useful rather than trying to conceptualise and understand everything. It helps in the delivery of consistent education, it reduces challenges of miscommunication and simplifies the dissemination of new concepts. It is more profitable than the traditional method that requires physical campus venues. As previously mentioned, certain studies have emphasised its capacity to improve educational performance via information retention, increased pass and student satisfaction rates. (Bauk, 2018)

A study by O-Dwyer and Swapp (2018) focuses on the extent to which offering STCW courses via online and distance learning can guarantee not only cost-effectiveness but also the same quality assurance guaranteed by physical campuses. The study provides a cost analysis for hosts and users but emphasises the need to select the right media, technology and approach. It cites the example of the Caribbean Maritime Institute which launched a pilot distance learning project as early as 1998 originally by post before moving onto electronic media. One company, Seagull AS provided STCW courses via distance education since the 1990's. The study speculates as to whether simulator focused training could be offered via distance/online education as it currently requires students to be physically present. Nevertheless, distance and online education can strive towards providing continuously updated seafarer education without diverting significantly from normal shipping duties and requirements.

2.7.2: Disadvantages of Online Distance Learning

It is noteworthy that while e-learning has advantages it also has some disadvantages. Lack of social interaction has been identified as one of the main disadvantages. While students can have some interaction through email, chat rooms and other on-line platforms, these are relatively different from traditional classroom education. Moreover, not all courses can be offered online. Some courses with practical skills are hard to deliver through distance education therefore they need direct contact. The lack of robust interaction opportunities on digital platforms affect seafarers who require social skills as part of their duties.

Furthermore, online distance learning does not support face to face communication between teachers and students or among students. It only provides technical interaction such as telephone and video conferencing both of which do not offer human social contact. Thus, when compared with traditional face-to-face interaction, online distance learning deprives students of direct emotional communication as it promotes human-computer interaction. Increased global digitisation technology trends and the Fourth Industrial Revolution have created increased automated vessels, digital ports and interconnected maritime logistics supply chains. This has further increased the pressure for virtual rather than real time training and the need for fewer, more technically sophisticated seafarers/staff. Associated studies have shown that when students are in a team learning environment and atmosphere, their ability to learn is better and their proficiency higher. As a result, more organizations have started to embrace blended learning for network training and learning. (Chen, 2017)

Other sources focus on the current challenges faced by teachers who are less familiar with e-Learning (Sadek and Cronje, 2017). Comparatively, few teachers and lecturers across many countries are quick and responsive to the potential of myriad forms of eLearning. Many use it for acquiring information, social interaction and administration rather than to facilitate dynamic and interactive communication and learning. Implementation challenges remain as few universities, colleges and high schools that utilise e-Learning, actively monitor their lecturers' and student's utilisation of these platforms, tools and technologies so as to subsequently take remedial measures or actions. Nor do they focus on improving educational outcomes via upgrading technology and e-Learning tools/techniques. Sadek

and Cronje's (2017) study indicates that technologies such as interactive white boards, Social Network Service and LMS-VLE cloud-based services/the Internet were employed to locate information, complete and create online activities/lessons and social communication.

Distance and online learning can improve certain outcomes for individuals without affecting one's income and personal/work/family commitments provided certain factors are addressed. These include issues of separating students from practical vessel experience and applying theories to specific real life experiences. The current approach to maritime education focuses on passing exams rather than acquiring the needed experience (Maringa, 2015). Students also learn individually without engaging in social interactions and teamwork. Although this approach deprives students of work-related experience, r, it may partially assist in overcoming existing shortages of qualified MET lecturers.

Developing countries such as South Africa experience myriad, well documented barriers to e-Learning (Esterhuyse and Scholtz, 2015). E-learning requires much effort from underpaid and overworked lecturers who are often not technologically qualified to undertake it successfully. For e-Learning to present a viable substitute, it needs to equate to and extend beyond existing education and training offerings. The challenge is to determine whether students actually pass or fail or outperform via blended, e-Learning, distance learning as opposed to physical campus, face to face learning methods. Stakeholders need to be actively encouraged and supported for e-learning to flourish. Sufficient funding and IT infrastructure/software is required for an effective e-learning program. High quality information equivalent to or beyond that delivered through physical lectures needs to be provided, whilst the system needs to be functional and user-friendly. E-learning needs a proactive approach from certain people or parties acting as passionate lobbyists championing its potential. (Dyer,2019)

Table 3. 1. Table on barriers and challenges

Lack of Resources	(financial, physical, training, content development costs; computer ownership and availability; Internet access, computer/IT literacy, uncertain electricity and Internet supply, slow connectivity and speed); ensuring enough personal time to commit to it as educators;
Infrastructure -	digital divide; insufficient infrastructure support;
Technical issues	security and privacy concerns.
Organisational management	lack of implementation expertise and limited technical support;
Lack of social/cultural interaction;	Contact education can obtain immediate responses to questions and issues.

Source. (Tucker, 2004)

2.8 Summary

Evolving technologies forced a redefinition of online distance education in the last decade. Consequently, the online distance education research agenda has also significantly progressed. The focus of education has shifted to learner-centered approaches. Researchers are not only looking at learner success rates but also examining learner attributes and perceptions as well as interaction patterns and how these contribute to the overall learning environment. While there is continued interest in technology, the focus is not on determining which medium is that best, but on ascertaining what features of the medium can contribute to an optimistic, equivalent learning experience.

In conclusion, the literature review confirms that there is an intense interest within the field of educational research to determine which factors affect learning outcomes and student satisfaction in e-learning, online learning and blended learning in higher education. Having discussed and presented the literature review on ODL, the next chapter focuses on ODL challenges for developing environments in the digital age, using South Africa as focal point.

CHAPTER 3

ONLINE DISTANCE LEARNIG CHALLENGES FOR DEVELOPING COUNTRIES IN THE DIGITAL AGE (THE CASE OF SOUTH AFRICA)

3.1 Introduction

This chapter discusses the challenges in ODL on developing environments with a specific focus on South Africa. It highlights South African policies on and attitudes towards ODL. Since this study focuses on MET, challenges regarding maritime education are highlighted. Furthermore, challenges faced by the DUT Maritime Studies Department, Faculty of Applied Sciences are also identified as they were a trigger for this research

The previous chapter identified numerous advantages of embracing online and distance education in developing countries. These include limited costs to students and universities, flexibility in determining one's own pace and approach to learning and ease of access to information. Online distance education can be customized to individual requirements and it allows sharing of concepts among students (Arkorful and Abaidoo, 2014). It overcomes many challenges faced by learning institutions in developing environments such as shortage of qualified lecturers, high student enrolment numbers, budget cuts, low salaries and limited incentives leading to brain drain. In South Africa, racial, demographic and political issues, including student riots affects the appointment of qualified staff to previously disadvantaged institutions. The maritime industry and education and training institutions have to compete for limited skilled personnel with more lucrative government, private sector and international opportunities.

A study by Bates (2019) affirmed that e-Learning and distance-based education provides I the most effective means for teachers to adapt their practices to the Digital Age (Bates, 2019). E-learning fundamentally enables students to become more personally responsible for improving Information Technology Skills and Digital Literacy. It relates more to increasing digitization trends that affect the futures of the economy and employment, irrespective of whether educators and students prefer campus based, traditional learning experiences or not. Pedagogical practices will need to consider integrating computers, web centred learning, texts, videos and social media. Bates (2019) proposes a sections model

that considers the needs of student, ease of use associated with e-learning, low costs, increased interaction and social networking. To adapt to the digital age successfully, e-Learning, online and distance-based education requires learner support, digital skills/literacy, sufficient resources, finance, quality control, appropriate content management and capacity for skills development. Provided it is carefully designed, students can gain communication skills, independent learning, responsibility, ethics, flexibility, teamwork and collaboration along with critical education via blended and full online learning (Bates, 2019).

3.2 ODL challenges for developing countries

As Chapter 2 has highlighted, many ODL and e-Learning initiatives and proposals for South Africa and other developing nations are faced with numerous social, political, legal, economic, environmental, cultural constraints and challenges. One study on postgraduate black students in South African higher education highlights the difficulties not only of accessing the Internet and other resources but also of adapting to full digital literacy and online learning participation (Takalani, 2008). The need for effective institutional and senior management support is perceived as vital to the functionality of e-Learning. This needs to be accompanied by commitment from tutors/lecturers and active responsibility for self-learning among the students. Apart from the digital divide and technology/access challenges, there are also issues of securing data, limited Internet bandwidth, initial starting costs and lack of capacity to enforce student participation. Even when facilities are provided, students may face high queues for printers and computer laboratories. Lecturers also express concern about being subjected to peer critical appraisal when they place their materials online and loss of potential copyright as the institution asserts intellectual property ownership on their material. Teachers also lack financial incentives to participate in online teaching, given the time constraints involved and the pressures of publishing scores at most colleges and universities.

3.3 South Africa

A study conducted at three different South African universities with 43 workshop participants mentioned issues of legal/copyright access, infrastructure access, the need to develop and provide pertinent materials, along with psychological, social and cultural factors (Cox and Trotter, 2017). The study advocated an Open Educational Pyramid based on factors such as access, intellectual property permission, sufficient awareness, capacity, availability and personal volition. Some lecturers lack the formal technical training to maximise the benefits of Internet and computer related learning. South Africa's 2008 Copyright Act mirrors that of many developing nations. It disincentivises lecturers by making all developed material the intellectual property of the college or university. Certain lecturers do not know where to access resources online. Harvard, Yale and Massachusetts Institute of Technology are among the renowned academic universities that provide numerous free courses and resources on e-learning. These could subsequently aid local institutions to enrich content delivery via ensuring access. African initiatives include the African Virtual University's electronic archive, African Veterinary Information Portal, OER Africa, Open UCT and TESSA.

Other lecturers who manage to bridge these barriers have been in supportive environments where e-learning is frequently used. In introducing e-Learning to public Kenyan universities, Mutisya and Makokha (2016) conducted a survey that included 420 lecturers and 210 students. The study also indicated issues of restricted Internet and computer facilities; few incentives, scarce technical skills, high workloads and lack of copyright protection as barriers. Only 2/7 universities had specific policies, while 35% of students and 32% of lecturers actually used eLearning. Increasing student numbers further complicate the uptake of e-learning as some lecturers faced up to 500 students per course while supervising up to 40 projects and postgraduate students each year. E-Learning is frequently used as a pretext to justify greater workloads aside from high publication and administrative duties. Only 17% of lecturers received formal e-Learning training but faced few facilities, short training periods and poor work venues. E-learning had few promotion prospects for lecturers. It should be noted that 29% of lecturers lacked a personal computer or laptop. Student residences and lecturer dwellings also lacked the Internet. Furthermore, 72% of students surveyed still downloaded printed materials and attended lectures anyway.

Certain lecturers were afraid to criticise e-Learning as they feared that their online material would be criticised by others. The study recommended that all students should own a computer or laptop before enrolling for e-learning. Moreover, funding and other resources should be increased to support e-Learning with proper policies to facilitate the online transition.

Few studies appear to evaluate teacher motivations for embracing or rejecting ODL and web based learning. The need to ensure competent social, pedagogical and cognitive expertise was urgently emphasised (Martins and Ungerer 2015). Technological literacy and personal motivation/satisfaction and awareness of the prospective benefits were considered essential in motivating lecturers. Lecturers needed self-discipline, empathy, punctuality, the ability to convey interest/passion, diligence and commitment. A twenty-year systematic literature review of ODL and technology for education in South Africa affirmed that e-learning acceptance has moved from simply using a computer or projector to technology becoming an integral part of the lecture and overall educational experience (Ng'ambi et al., 2016). Other studies have focused on cloud linked computing that offers access to ever greater online educational resources with significant progress towards reducing the "digital divide." Yet as previously stated, the implementation of e-Learning maritime education and training in South Africa has been left to individual stakeholders and institutions.

3.4 Maritime education and Training

Although maritime education and training institutions in South Africa are not directly mandated or required to consider elements of web, simulation, blended and other forms of electronic learning, this section will identify the extent to which certain institutions have implemented or are considering using technology to assist traditional learning approaches. However, limited research is available for most institutions and besides the Durban University of Technology, information about performance and approaches to teaching and learning obtained from other institutions could not be ascertained or verified. The Maritime, Ports, Transport and Logistics Academy, like other short course providers, does not employ online learning management systems. They focus on class videos, Power

Points, lectures and provide recommended readings. University of KwaZulu Natal (UKZN) offers postgraduate studies in law, Customs, maritime and port economics delivered traditionally with only partial access to Moodle (UKZN, 2019)

Table 3. 2. South African Maritime Education and Training Institutions

Institution	**Programme/Structures**
Cape Peninsula University of Technology	Marine Engineer/Seafarer
Durban University of Technology	Degree/Diploma in Nautical Sciences
False Bay TVET College	Short courses/vocational
Umfolozi Maritime Academy	Marine Engineers
Maritime, Ports, Transport and Logistics Academy -University of Stellenbosch	Short courses in ports and terminals, maritime and shipping, transport and logistics
Nelson Mandela Metropolitan University	Degree/Postgraduate Diploma
South African Maritime School and Transport College	Various courses/diplomas
SAMTRA[18]; SA Naval College	Various Courses and naval officers
Transnet Maritime School of Excellence	Port related courses
University of KwaZulu-Natal, Unit for Maritime Studies	Master of Maritime Law, Master of Commerce Maritime Studies
Others are minor course providers listed by SAMSA[19], TETA[20]	Minor/short courses, certificates and diplomas

Source: This Study

[18] South African Training Academy (SAMTRA)
[19] South African Maritime Safety Authority (SAMSA)
[20] Transport Education and Training Authority (TETA)

Technology also provides continuous professional development through shorter courses such as those offered by STC-SA, SAMTRA and the SA Maritime School and Transport College (STC-SA, 2019). Examples of coursed offered include pilot, tug and VTS training with simulators and professional SAMSA. Transnet's Maritime School of Excellence incorporates technology into its seafarer deck and engine ratings, tug, pilot, STCW, Master, Skipper and VTS courses among others (Transnet, 2018). It offers twenty classrooms through stacker, crane, VTS, logistics supply chain and trailer suction hopper dredging simulators. These provide safer and more cost-effective substitutes to actual vessel experience. The Dutch who used it to reduce average seagoing time by two months in 2002. Simulators remain expensive and they need specialised skills. In contrast, the South African Navy has very limited evidence of technology utilisation at its Gordon Bay Cape Town campus.

Significant prospects and opportunities therefore are present for introducing online and distance education in South Africa and other emerging/developing countries specifically for maritime education and training. The Fourth Industrial Revolution and increasing digitisation of shipping radically require continuous professional educational development just to catch up and remain globally competitive. One future skills requirement analysis for the maritime industry mentions the need to overcome a predicted shortage in skilled seafarers and technological capacity (Cicek, Akyuz and Celik, 2019). The analysis follows the International Association of Maritime Universities (Nippon Foundation and International Association of Maritime Universities, 2020) to rank the need for technical competencies in the short term, technological awareness in the medium and long terms out of 15 skills. Some of the skills which ODL will have to consider include adaptability and flexibility; computing and informatics; teamwork, communication, leadership, discipline, environmental sustainability, learning and self-development; complexity and critical thinking. Other skills which are more appropriate to face to face learning include language ability, professionalism and ethical behaviour, responsibility, inter-personal and social skills. ODL is most suitable for technical skills relating to operations, equipment and data. It has yet to replicate the capacity for teamwork, emotional intelligence, communication, presentation and negotiation of campus based learning or creativity and problem solving

skills. However, both approaches can encourage self-learning discipline, organisation, study, motivation, sustainability, pressure and flexibility

3.4.1 Maritime Policies

As early as 2003, the South African Department of Education drafted a White Paper on e-Education which highlighted the need to address concerns about the digital divide in IT infrastructure and connectivity as well as creating local content to overcome psychological restrictions and concerns. It proposed to deal with coordination and collaboration issues and monitoring and evaluation. It proposed forming e-Schools, which were never implemented along with the need for content relevance, reliability, durability and scalability. The DHET[21] draft policy framework's policy goal is to ensure that "*Every South African learner in the general and further education and training bands will be ICT capable (that is, use ICT confidently and creatively), to help develop the skills and knowledge they need to achieve personal goals and to be full participants in the global community by 2013*." (DHET, 2012).

Formal maritime education and training standards including decisions on what electronic, online and distance based education should be legally authorised, funded and valued in South Africa remains primarily in the hands of the South African Maritime Safety Authority (SAMSA) and Transport Education Training Authority, under the South African Department of Transport. The South African International Maritime Institute in Port Elizabeth has a theoretical mandate to coordinate all maritime related research and policies including the National Cadet Training Programme but this is largely organised by SAMSA and the individual shipping companies/education and training institutions. The programme is limited to 110 seafarers who will find positions among 12 potential companies. Other professional associations that may potentially be interested in ODL for maritime education and training include SAIMENA, the Nautical Institute, National Sea Rescue Institute, KZN Sharks Board, Moses Kotane Institute and SAMTRA.

[21] Department of Higher Education and Training (DHET).

TETA[22] operates under various transport sections or chambers including a Maritime Chamber. Currently it provides postgraduate funding abroad to overcome existing critical qualification shortages. E-Learning could further assist its primary mandate of skills development, introducing maritime studies into TVET curricula and scarce finance/labour skills to implement Operation Phakisa more effectively. Its Annual Report (TETA 2019) and Strategic Plan also fails to investigate the potential of ODL, blended or e-Learning to resolve political, economic, technological, environmental, legislative and societal risks (TETA 2020). It estimated, however, that the national demand for seagoing employment and training berths exceeded the potential supply by a 20:1 ratio. Technology could also counteract skills shortages and labour concerns and help to implement the National Transport Master Plan 2050, the 2009 Human Resource Development Strategy and the National Development Plan among others. TETA and SAMSA's prime weaknesses include the fact that no targets have been proposed or set for MET related to ODL and eLearning.

Blended and ODL learning are conspicuously absent from many of the leading policies and approaches South Africa is considering to implement Operation Phakisa and a sustainable blue economy future. Examples include the Research, Innovation and Knowledge Management Road Map for the Maritime Sector which emphasises structured research, finance, knowledge sharing, management and collaboration (CSIR, 2017). The policy fails to contemplate the significant opportunities that potentially existing in insufficiently trained seafarers, artisans and other professionals who service or crew the over 12,000 ships passing through South African waters each year. It fails to see how it could retain South Africa's position on the White List of global seafarers and update intellectual property protection and other incentives to pursue ODL. Modern technology and educational approaches could radically assist the SAIMI and CSIR vision for world class research, training and educational facilities. The South African International Maritime Institute has also ignored emerging technology and competency based educational practices (SAIMI, 2016), preferring to focus more on conventional training, education and skills development

[22] Transport Education and Training Authority

for the ocean economy. Therefore, this section confirms that there is significant lack of current prioritisation for ODL and e-Learning among stakeholders in South Africa and other developing African countries, despite the considerable advantages that exist.

3.5 Maritime Education and Training at DUT

The Department of Maritime Studies in the Faculty of Applied Sciences at the Durban University of Technology, seeks to comply with STCW requirements via investing in ODL, and adapting e-Learning to the curriculum (Manqele, 2019). Since 2011, it has embarked on a Curriculum Renewal Project. The two Diplomas in Nautical Studies and Shipping and Logistics were implemented in 2016. Two Advanced Diplomas in Nautical Studies and Shipping and Logistics were implemented in 2019. Two more qualifications - the Diploma in Marine Engineering and the Postgraduate Diploma in International Shipping will be implemented in 2020. The Department is working on a Master's and PhD in Maritime Studies. E-Learning at the University primarily utilizes Blackboard, Moodle and MS Teams platforms. Navigation, ECDIS, Radar/Arpa and naval architecture courses depend on simulators. With sufficient investment, it could apply to engine rooms, electro-technology and marine environmental/risk awareness courses. Simulator training aims to assist women, who have unfortunately, far fewer local and global prospects for securing berths. Since 2018, the DUT Maritime Studies Department has been involved in several Collaborative International Online Learning (COIL) SUNNY[23] (Brazil and Mexico) and Erasmus+[24] projects towards improving the level of teachers and students virtual engagement in the global e-classroom.

3.6 Conclusion

In conclusion, it should be noted that the state of ODL and e-Learning in South Africa is similar to what obtains in other developing environments. Nevertheless, there is need to upgrade and offer continuous education through ODL and e-Learning mechanisms. This is important because the digital age in which we live demands digital literacy and team work in virtual environments which can only be possible through ODL and e-Learning. Furthermore, everything in the world is becoming globalise and the classrooms will soon

[23] State University of New York (USA)
[24] EU Ikudu (2020/21) Project

become global at least to a certain extent, especially when it comes to MET, whose qualifications should be global recognised and accredited to ensure safety, efficiency and effectiveness. In addition, the development and implementation of effective policies in South Africa c still lags behind other countries in the developed world, thus slowing down MET development and its harmonization with the highest standards in the field. The next chapter focuses on research methodology and data collection process.

CHAPTER 4 RESEARCH METHODOLOGY

4.1 Research Approach

The main objective of this chapter is to provide an overview of the quantitative analysis of the processes and factors which were crucial to students and lecturers in their decision to embark on ODL in maritime studies. The empirical work was conducted with a diverse group of students and lecturers from four different universities. Even though the chosen universities offer different programmes, having respondents from four different academic institutions provides for a more and wholesome perspective on students' and lecturers' motivations for ODL in MET

On the basis of previously conducted research (discussed in Chapter 3), there are many research findings on education and educational policies in South Africa. In an attempt to contribute to existing knowledge on maritime education and training, this study gathered data from lecturers and students from three METs in South Africa, namely, Durban University of Technology (DUT), Umfolozi Maritime Academy (UMA) and Cape Peninsula University of Technology (CPUT).

The assumptions of the study are based on extensive literature review as indicated in previous chapters. Explorative, descriptive and causal approaches were applied. The explorative approach was preferred because there is not a lot of research in this field in South Africa. Results from existing research have some limitations that this study seeks to address. The topic is complex and there is not enough theory to guide the development of new theoretical frameworks. The descriptive helps to familiarise readers with the topic and collect data that describes the actual situation in relation to ODL and e-Learning in South African maritime tertiary education institutions. The causal approach is useful for delineating or outlining factors that cause problems. The intention is to propose a theory that can assist top managers and policy makers in MET to develop strategies and ODL and e-Learning implementation measures.

Although I have discussed other approaches, majority of this chapter will focus on the causal approach. The objective of the research is to state that variable X causes variable Y (Sekaran and Bougie, 2016). Using the main and associated research questions, the

researcher identified variables, developed hypotheses, tested them and after extensive statistical analysis, came up with a theory that can facilitate the effective deployment of ODL and e-Learning in the South African maritime domain. In developing the theory, the pragmatic research philosophy that stresses the relationship between theory and practice was applied. Pragmatism insists that the value of research is in its practical relevance. In fact, the purpose of theory should be to inform practice.

The readiness of lecturers and students to adopt ODL and e-Learning in relation two sets of independent variables in the proposed model were correlated. The lecturers' attitude towards ODL and e-Learning were evaluated through variables such as the way they appraised students' curiosity and creativity, collaboration between students and lecturers, improving learning outcomes, bringing innovation into teaching and learning, availability of e-instructional materials, allowing asynchronous modes of teaching and learning, overcoming physical distance barriers etc. In the case of the students, their willingness to adopt ODL and e-Learning was evaluated through their computer skills, availability of gadgets, internet access, readiness to learn alone, belief in ODL and e-Learning and their capacity to make the learning process easier and more convenient.

4.2 Applied Methodology

In order to highlight the most significant issues regarding the importance of ODL, quantitative analysis, in the form of survey questionnaires were carried out with students and lecturers. The chosen research methodology empowered the respondents to express their genuine opinions and highlight issues that they considered important when making decisions to implement ODL in MET.

As a core for conceiving and developing methodology, the Golden Thread Method was used. Each research question was supported by key literature sources, data to be collected, data analysis methods and assumptions. Following this structure, a draft of questionnaires was conceived and sent to few experienced researchers in the field in order for them to give suggestions on how to avoid redundancies and make the questionnaires understandable to the respondents. The Applied Golden Thread Method is attached in the Appendix. After an extensive and critical review of relevant literature resources and consultations with

experienced researchers in the field, a fixed research was conducted. A fixed research constructs questions developed through triangulation of different theories on employing ODL in developing environments.

In developing countries, there is very little preliminary research on the adaptation of Cloud resources in education. The model proposed here (see Figure 1) was inspired by a study carried out in sub-Saharan Africa (Humphrey, 2016). This model represents the basis for designing a questionnaire to ascertain the readiness of higher education institutions in a developing country (South Africa) to implement this type of education. The model is based on triangulation (reconciliation) of two theories of adoption and expansion of ICTs: theory of diffusion of innovations (Rogers, 2003) and the theory of a technologically acceptable model.

The model, which is proposed here, includes one *dependent variable*: intention to adopt Cloud into education. The *independent variables* in the model are organized in several subgroups: innovative, economic, technical, contextual and organizational factors (attributes). The last, but not the least, is the independent variable: actual use of Cloud in high education. In Figure 1, direct and indirect links between dependent and independent variables are presented.

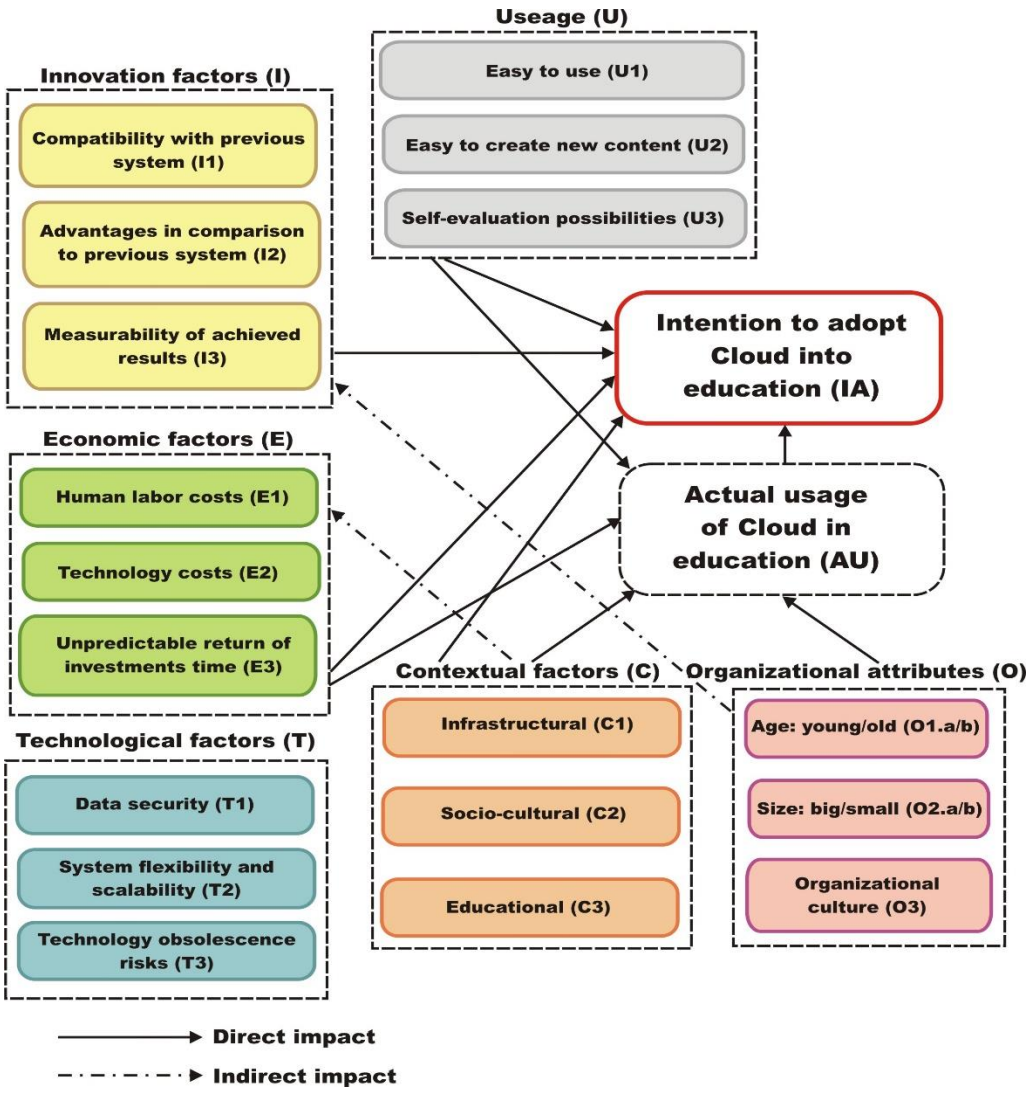

Figure 4. 1 Relations between relevant factors for moving education into cloud.

4.3 Data collection

Data was collected through a questionnaire. A questionnaire is a pre-formulated written set of questions to which respondents record their answers. Respondents answer the questions by choosing one number on the Likert interval scale to the best of their knowledge, experience and/or intuition. The Likert scale is designed to examine how strongly respondents agree or disagree with the statements on a five-point scale with the following anchors, which can be modified depending on the question formulation: strongly disagree (1); disagree (2); neither agree nor disagree (3); agree (4) and strongly agree (5). The questionnaire was sent to the respondents via email. After completing the questionnaire,

the respondents send it back. Respondents who delayed to respond were kindly reminded via mail to send their responds in due time.

The preliminary questionnaire contained: 37 questions for lecturers and 35 questions for students. After consultation with experts the number of questions was reduced to 25 questions for lecturers and 25 questions for students. At the end, questionnaires were designed in accordance with the code of conduct and ethical requirements at WMU. The final version of questionnaires for both lecturers and students are given in Appendix (2 &3). After getting ethics approval, questionnaires were sent vial email to **40 lecturers** and **200 students** at DUT, CPUT and UMA. The prospective respondents were reminded twice to send back their responses in due time. Thanks to their kindness after less than a month all responses were collected. The collected data were stored and their validity were tested as well. The majority of the response were numerical (Likert's scale) and all responses passed the preliminary test. Respondents' additional narrative comments were left for the discussion in Chapter 6. In total **35** responses received from lecturers and **99** responses from students.

The three Universities included in this study have been selected because they offer Maritime studies for seafaring officers in South Africa. Other Universities, for example, the University of KwaZulu-Natal, offer Maritime qualifications such as Maritime law and Maritime Economics which are not specifically designed for seafaring officers. The focus of the study was specifically on institutions that provide qualifications for ships officers.

The emails of students from the three Universities were obtained through work and research-related connections that the researcher has with the institutions. Firstly, the researcher is currently a lecturer at DUT, therefore she approached students registered for seafaring qualifications and requested their email addresses. In turn, the researcher emailed the questionnaire to all the students who provided their email addresses. Secondly, the researcher is also a part-time lecturer in Maritime Law at Umfolozi Maritime Academy. The same method was thus used to access emails of students registered for seafaring qualifications. Lastly, the researcher is also involved in the Erasmus+ collaborative

research project with the Cape Peninsula University of Technology (CPUT). Emails of students at CPUT were thus obtained through co-collaborators who teach maritime students at the institution.

4.4 Data analysis

The hypothetico – deductive approach chosen for this study corresponds to quantitative analysis of collected data. The multiple regression analysis was used since the whole set of independent variables were regarding both lecturers' and students' approaches and attitude towards ODL and e-Learning. Prior to multiple regression analysis, basic statistical descriptors of the data set were tested. Quantitative analysis was conducted in SPSS and Excel Module for multiple linear regression graphical analysis. Simulation was done in a very short time frame - over a couple of minutes. The results and extensive explanation of the applied multiple regression method including errors and the acceptable limits will be discussed in Chapter 5. Proposed hypothesis were tested for the strength of correlation between dependent and independent variables for both the lecturers' and students' sets of responses. Statistical relevance of observed correlations was tested via ANOVA in SPSS and it was proven to be major over the whole set of data. Upon the proven hypothesis, the researcher offered a theoretical proposal for higher MET stakeholders in terms of faster and more effective implementation of ODL and e-Learning. It must be emphasized once again that emergency situations such the Covid-19 pandemic urged the researcher to undertake the study. At the time of writing, all teaching and learning activities at DUT were moved to virtual platforms such as Moodley and MS Teams, while all communications between lecturers and students were conducted via Zoom, WhatsApp and other social media (Facebook, Twitter and Instagram).

4.5 Summary

This chapter discussed research methodologies applied in this study and the data collection process. Data analysis will be discussed in the following chapter.

CHAPTER 5 DATA ANALYSIS

5.1 Results and Discussion

The results and discussion in this Chapter were drawn from the responses of lecturers and students interviewed through questionnaires sent to them via e-mail. In total, 35 responses from lecturers (from DUT, CPUT and UMA MET higher education institutions) were received and 99 responses from students (from DUT, CPUT and UMA MET higher education institutions) were received.

Through extensive literature review, two sets of questions for both lecturers and students at selected METs were conceived. The questions were organized logically and neatly in appropriate sections along with the instructions on how to complete them. This helped the respondents to answer the questions without difficulty. All questionnaires were administrated in person. Through that approach, doubts were clarified, and respondents were easily motivated. Almost 100% response rate was obtained and the anonymity of respondents was high. The questionnaires were sent to the respondents via mail. In addition, respondents took time to respond at their convenience.

As a measurement tool, Likert scale was used as a commonly exploited method of measuring opinions and attitudes. It measures the extent to which participants agree or disagree with given statements, and typically range from 1 (strongly disagree) to 5 (strongly agree) with a neutral point in the middle (i.e. neither agree nor disagree). It is both a semantic differential scale and a numerical scale.

The applied approach was quantitative. Thereafter, the data were analysed in order to answer the research questions. Before statistical analysis, data accuracy, completeness and suitability for further analysis were ensured.

The results of quantitatively analysed data are presented and discussed in the following sections, one contains descriptive statistics derived from SPSS ver.17.0, the other deals with multiple linear regression model analysis in Excel Modules (special software modules embedded into MS Excel) analysis.

5.2. Descriptive statistics

Descriptive statistics gives information on minimum, maximum and mean values (as measures of central tendency) of the constructs, i.e. respondents (lecturers' and students') answers in line with Likert's scale (1-5). The mean, or the average, is a measure of central tendency that offers a general picture of the data without unnecessary inundation of one with each of the observations in a data set. Measures of dispersion, i.e. variance and standard deviation were calculated as well. The variance was calculated by subtracting the mean from each of the observations in the data set, taking the square of this difference, and dividing the total of these by the number of respondents. The standard deviation, which is another measure of dispersion for interval and ratio scaled data, offers an index of the spread of a distribution or the variability in the data. It is a very commonly used measure of dispersion, and is simply the square root of the variance. The values of these statistical descriptors are given in Tables 5.1 and 5.2.

Table 5. 1 Descriptive statistics for lecturers’ responses

Question	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Q1	35	2.00	5.00	3.6000	.77460	.600
Q2	35	3.00	5.00	3.7143	.62174	.387
Q3	35	2.00	5.00	3.5429	.81684	.667
Q4	35	2.00	5.00	4.0286	.74698	.558
Q5	35	2.00	5.00	4.0000	.68599	.471
Q6	35	1.00	5.00	3.6571	.96841	.938
Q7	35	2.00	5.00	4.0000	.76696	.588
Q8	35	2.00	5.00	4.0571	.93755	.879
Q9	35	3.00	5.00	4.3143	.67612	.457
Q10	35	1.00	5.00	4.0857	.78108	.610
Q11	35	1.00	5.00	4.0286	.82197	.676
Q12	35	1.00	5.00	4.0000	.97014	.941
Q13	35	1.00	5.00	4.0571	.83817	.703
Q14	35	2.00	5.00	4.0286	.78537	.617
Q15	35	3.00	5.00	4.3714	.59832	.358
Q16	35	3.00	5.00	4.3714	.64561	.417
Q17	35	2.00	5.00	4.4571	.70054	.491
Q18	35	2.00	5.00	4.2000	.79705	.635
Q19	35	2.00	5.00	3.6000	.94558	.894
Q20	35	1.00	5.00	4.0000	1.13759	1.294
Q21	35	2.00	4.00	2.6000	.65079	.424
Q22	35	2.00	5.00	3.2286	1.03144	1.064
Q23	35	3.00	5.00	4.3429	.53922	.291
Q24	35	1.00	5.00	4.4286	.81478	.664
Q25	35	4.00	5.00	4.5143	.50709	.257

Graphical presentations of mean values of examined constructs are given in Figures 1 and 2, to provide better visual perception of predominantly high mean values of the respondents' attitudes towards introducing and adopting e-Learning into Maritime Education and Training (MET) tertiary institutions in South Africa.

Table 5. 2 Descriptive statistics for students' responses

Question	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Q1	99	1.00	5.00	4.0303	1.07337	1.152
Q2	99	1.00	5.00	4.1919	.79124	.626
Q3	99	1.00	5.00	4.2929	.84820	.719
Q4	99	1.00	6.00	3.5354	1.01331	1.027
Q5	99	1.00	5.00	4.1414	1.00010	1.000
Q6	99	1.00	5.00	3.9394	.80582	.649
Q7	99	1.00	5.00	3.7778	.92091	.848
Q8	99	1.00	5.00	3.7475	1.22344	1.497
Q9	99	1.00	5.00	3.9091	.89318	.798
Q10	99	1.00	5.00	2.4343	1.18805	1.411
Q11	99	1.00	5.00	2.2626	1.13915	1.298
Q12	99	1.00	5.00	2.2828	1.27007	1.613
Q13	99	1.00	5.00	3.5253	1.21507	1.476
Q14	99	1.00	5.00	4.0101	.92024	.847
Q15	99	1.00	5.00	3.7778	1.09317	1.195
Q16	99	1.00	5.00	3.6869	1.07520	1.156
Q17	99	1.00	5.00	3.6667	1.05946	1.122
Q18	99	1.00	5.00	3.7677	1.15023	1.323
Q19	99	1.00	5.00	3.6061	1.20219	1.445
Q20	99	1.00	5.00	3.3636	1.16457	1.356
Q21	99	1.00	5.00	3.6162	1.18414	1.402
Q22	99	1.00	5.00	3.3434	1.36398	1.860
Q23	99	1.00	5.00	2.9091	1.35595	1.839
Q24	99	1.00	5.00	3.4949	1.18126	1.395
Q25	99	1.00	5.00	3.6667	1.08797	1.184

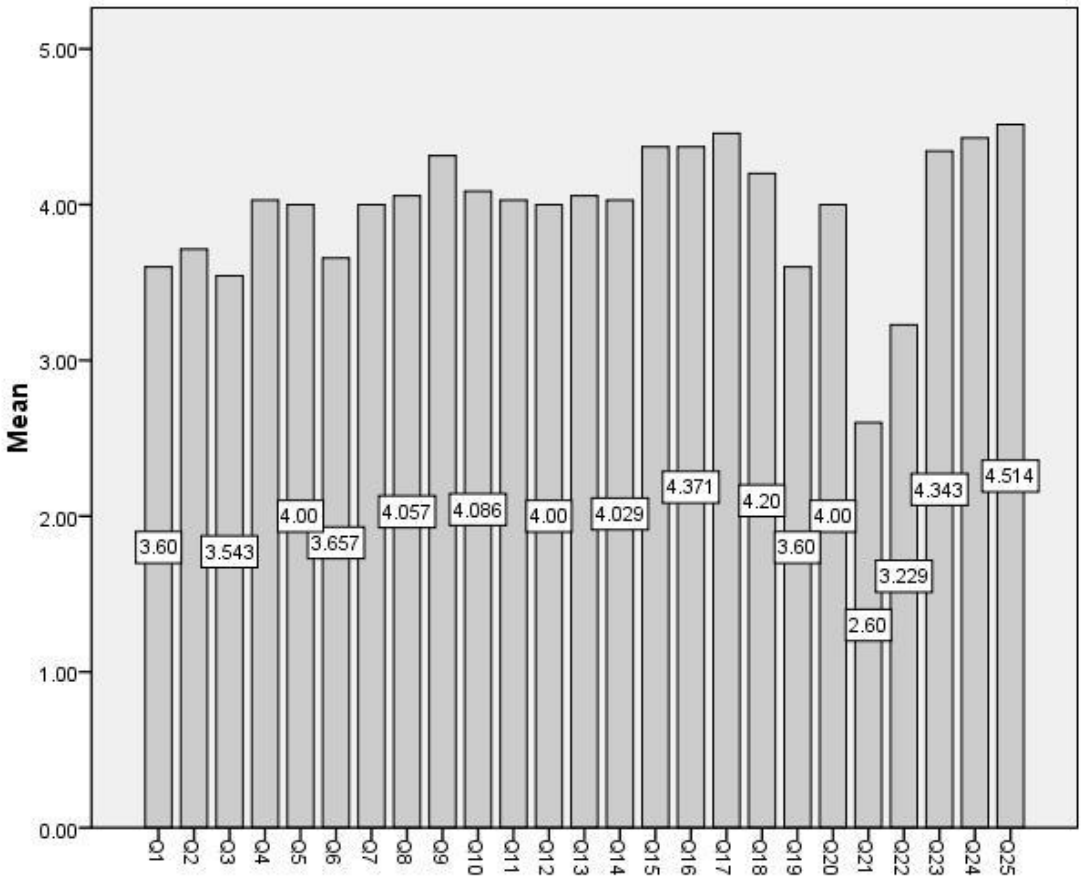

Figure 5. 1 Mean values of lecturers' responses per each construct

The interviewed lecturers assessed the real need for introducing ODL in METs in SA as relatively high (3.6 at 1-5 scale). They emphasized the need for free Internet access for lecturers and students (4.5), as well as the need for permanent institutional technical support in realizing ODL (4.4). On the other hand, they expressed scepticism towards the hypothesis that ODL can enable access to higher maritime education to students living in rural areas and to those who are somehow socially marginalized. Also, lecturers were sceptical about the assumption that ODL can upraise lecturers' and students' digital skills. This opens room for further investigation through in-depth interviews with lecturers.

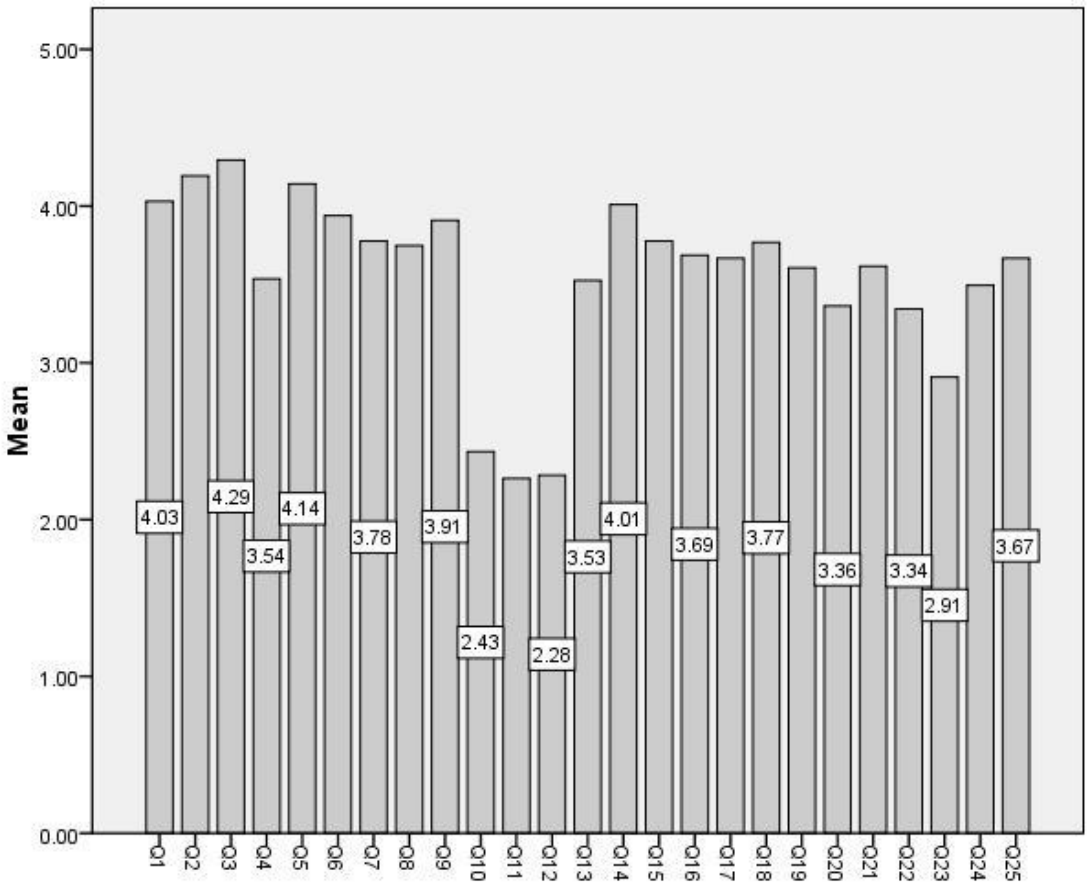

Figure 5. 2 Mean values of students' responses per each construct

Interviewed students assessed the real need for introducing and adopting ODL at METs in South Africa as a high one (4.03 at scale 1-5). They believed that ODL can support them to reach higher digital skills (4.29) and to upraise their thinking skills (4.14). However, they were also highly aware that the number of South African maritime higher education institutions which can provide lecturers and students with Internet access and computer labs, is constrained (4.01). The investigation revealed that a small number of students had personal tablets, laptops or smart phones (2.28). most student were not well informed about similarities and differences in meaning among: blended-, e-, computer based-, web based-, and Cloud-learning (2.43). Moreover, students were a bit sceptical about the assumption that ODL was a good way of knowledge transfer, knowledge refreshment and lifelong learning for seafarers (2.91). All the above should be further interrogated through in-depth interviews with the students.

5.2.1. Cross-correlation analysis

Besides the basic statistics, this sub-section gives cross-correlation analysis among all constructs in the model. The results are presented in Tables 3 and 4 in a way that "*" represents strong positive correlation (Pearson coefficient less than 0.05) and "**" represents significantly strong positive correlation (Pearson coefficient less than 0.01) among each pair of the analysed constructs. A Pearson correlation matrix indicates the direction, strength, and significance of the bivariate relationships among all the variables that were measured at an interval or ratio level. A significance of $p = 0.05$ is the generally accepted conventional level in social science research. This indicates that 95 times out of 100, we can be sure that there is a true or significant correlation between two variables/constructs in the model, and there is only 5% chance that the relationship does not truly exist. If there is a correlation of 0.56 (denoted as a $r = 0.56$) between two variables/constructs, with $p < 0.01$, then one knows there is a positive relationship between the two variables and the probability of this not being true is 1% or less. That is, over 99% of the time one would expect this correlation to exist. The correlation of 0.56 also indicates that the variables/constructs in the model explain the variance in one another to the extent of 44%.

The correlation is derived by assessing the variations in one variable as another variable also varies. Cross-correlation means that one measures correlation between each pair of variables/constructs in the model. More precisely, the correlations and their statistical significance among numerical values for each question given by each respondent were calculated. Of course, it would not be feasible without SPSS as a powerful tool for such kind of quantitative data analysis. Due to the correlation coefficients, it should cannot be determined which variable causes what, but it is clear that the two variables are associated with each other. Thus, a hypothesis that postulates a significant positive (or negative) relationship between two variables can be tested by examining the correlation between the two.

Table 5. 3 Cross-correlations upon lecturers' responses

(Legend: Pearson significance coefficient <0.01** and <0.05*; '+' - positive correlation; '-' - negative correlation)

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	1	+*	+*															-*							
2		1																							
3			1	+**		+*											+*					-**			
4				1	+**	+**						+*	+*												
5					1	+**		+*			+**	+**	+**	+*											
6						1							+*	+**					+**	-**					
7							1		+*		+*	+*													
8								1	+*		+*	+*										-**			
9									1						+				+						

														*				*						
10										**1**	**+***	**+***								**+***			**+***	**+***
11											**1**	**+***	**+***		**+***		**+***							
12												**1**	**+***	**+***	**+***		**+***							
13													**1**	**+***										
14														**1**	**+***				**+***				**+***	
15															**1**		**+***		**+***					
16																**1**	**+***							
17																	**1**							
18																		**1**					**+***	**-***
19																			**1**					

20																			**1**	**-** ****	**-** ****		**+** ****	
21																				**1**	**+** ****			
22																					**1**			
23																						**1**		**+** ****
24																							**1**	
25																								**1**

In accordance with previous explanations, the data in Table 5.3 can be interpreted as follows: raising up students' thinking skills is in positive linear correlation with integration of formal and informal learning styles; level of ODL adoption in South African METs is in positive correlation with availability of Internet access and computer labs; lecturers' readiness to adapt curricula is positively correlated with availability of online assessments, etc. On the other hand, easier learning through ODL is in negative correlation with allowing ODL access to socially marginalized groups, which can be explained through the assumption that such a way of learning might not be the most convenient one for those learners. In addition, reducing costs due to the introduction ODL is in negative correlation with making learning easier to socially marginalized students. This might be explained by the assumption that marginalised students prevented from participating due to the absence of Internet access, gadgets, etc. By analogy, the other pairs of constructs which are in strong correlation with certain significance can be argued.

Table 5. 4 Cross-correlation analysis upon students' responses

(Legend: Pearson significance coefficient <0.01** and <0.05*; '+' - positive correlation; '-' - negative correlation)

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	**1**	+**	+**		+**	+**	+**	+**	+**	-**			+**	+**	+**		+**								
2		**1**	+**		+**	+**	+**	+**	+**	-**		+**	+**	+**	+**						+*				
3			**1**	+**		+**	+**	+**	+**	-**		-**	+**	+**			+*				+*				
4				**1**			+**					+*								+*					+*
5					**1**	+**	+*	+**	+**		+*	-**	+*	+**	+**		+**	+**	+**	+*	+**				+**
6						**1**	+**	+**	+**				+**	+**	+*		+**	+*			+**				
7							**1**	+*	+**				+*	+**	+*		+**	+*			+**				
8								**1**	+**				+**	+*			+*						+**		
9									**1**			+	+	+	+			+		+*		+			

												***	***	***	***			***				***			
10										**1**	+**	+**	+**									+*			
11											**1**	+**	-**		+*				+*	+**		+*			+*
12												**1**	-**						+*						
13													**1**	+**	+**	+**			+*	+*	+*		+*		
14														**1**	+**		+*						+	*	
15															**1**		+**			+	**				
16																**1**	+**	+**	+**	+**	+**	+**	+**	+**	+**
17																	**1**	+**	+**	+**	+**	+**	+**	+**	
18																		**1**	+**	+**	+**	+**	+**	+**	+*
19																			**1**	+	+	+	+		+

																			**	**	**	**		**
20																			**1**	+**	+**	+**	+**	+**
21																				**1**	+*			+*
22																					**1**	+**	+**	
23																						**1**	+**	+**
24																							**1**	
25																								**1**

By analogy with the previous interpretations, the data in Table 5.4 can be interpreted in the following manner: the level of students' preparedness for ODL is in strong positive linear correlation with their ability to manage their time well, their self-discipline and belief that ODL is more interesting than classical face-to-face learning. Also, upraising students' digital skills through ODL adoption is in strong positive correlation with significance with fostering their curiosity, innovativeness, and virtual engagement in the global e-classroom. On the other hand, students' belief that ODL can increase their digital skills is in strong negative linear correlation with the low level of their familiarity with e-Learning terminology and basic principles, including the lack of personal laptops. In a similar manner the rest of the positively and negatively correlated pairs of constructs in the model can be discussed

5.2. Multiple linear regression analysis

In addition to the key statistical descriptions given in the previous section, in this sub-section, some more complex analysis will be presented. These considerations include developing a multiple linear regression model upon some previously categorized key constructs. This means that further analysis may take into consideration different categorization of constructs, but the idea here was to show how this advanced statistical method might be used to better understand the obtained results.

5.2.1. Multiple linear regression model

The idea is to determine a mathematical model using multiple linear regression analysis, that is, a functional relationship between the dependent variable (Y) and independent variables (X_1, X_2, X_3, X_4, X_5, and X_6) over the sets of lecturers' and students' responds in this research study.

Firstly, the analyses are realized over the set of lecturers' responses, where the dependant variable (Y) is: the real need, benefits and challenges for implementing online distance learning (ODL) in maritime high education in South Africa (Q1) and independent variables (X_1, X_2, X_3, X_4, X_5, and X_6) are following categories formed over the certain associated research questions (Table 5):

(a) MET competence based learning (Q2, Q4, Q9);
(b) Benefits for students and lecturers (Q3, Q5, Q6, Q7, Q8);
(c) Lecturers' knowledge about ODL and complementary e-Learning modes (Q10, Q11, Q12);
(d) Capacities and attitudes towards ODL implementation and adoption (Q13, Q14, Q15, Q16, Q17, Q18, Q19);
(e) Rising MET accessibility and affordability (Q20, Q21, Q22, Q23), and
(f) Additional costs concerns (Q24, Q25).

Categorization of constructs (questions) in the model, which refer to organizing, arranging, and classifying coding units (here responses to certain questions), was based on critical literature review. But, there is no available theory. Even though our approach is quantitative, we used categorization of constructs, which is usually used in qualitative analysis, just to make further quantitative analysis clearer, more understandable and to make relaxation of multiple linear regression model. Such model with twenty-five independent variables will be cumbersome. The idea was, in fact, to establish linear correlation between dependent variable and six independent variables composed of different sets of constructs (questions) in the model. Of course, further research in this domain can include different independent variables and different combinations of constructs (analysed questions), which form them. It is important to highlight that average values of constructs forming each independent variable are taken into account in performing multiple linear regression analysis in ExcelModules.

Table 5. 5 Categories of questions from lecturers' questionnaire

Dependant variable		
Q1	Real needs, benefits and challenges for adopting ODL in SA	
Independent variables		
Q2	… Benefits to competence based MET	*Category 1:* **MET competence based learning**
Q4	… To which extent STCW supports ODL	
Q9	… ODL as enabler of MET "global e-classroom"	
Q3	… ODL and upgrading L & S digital skill	*Category 2:* **Benefits for students and lecturers**
Q5	… Upraise students thinking skills	
Q6	… Integration of formal and informal learning styles	
Q7	… Students creativity and curiosity	
Q8	… Easier learning	
Q10	… Convenience of blended learning in comparison to ODL and face-to-face learning	*Category 3:*

Q11	… How well lecturers are informed about different e-Learning modes	**Lecturers' knowledge about ODL and complementary e-Learning modes**
Q12	… Are lectures informed about COIL	
Q13	… Level of ODL adoption in SA	*Category 4:* **Capacities and attitudes for ODL implementing and adopting**
Q14	… Capacities for ODL: Internet access and labs	
Q15	… Lecturers' willingness to adapt curricula to e-Learning	
Q16	… Lecturers' willingness to develop e-Instructional materials	
Q17	… Introducing computer/Internet supported assessments	
Q18	… Lecturers' time availability and schedules appropriateness	
Q19	… Intellectual property protection issues	
Q20	… Reducing costs of time, space and commuting	*Category 5:* **Rising MET accessibility and affordability**
Q21	… Access to high MET for students from rural areas	
Q22	… Access to high MET for socially marginalized groups	
Q23	… Access to high MET for active seafarers	
Q24	… Need for technical support	*Category 6:* **Additional costs concerns**
Q25	… Free Internet access to lecturers and students	

Secondly, the analyses are done over the set of students' responses, where the dependant variable (Y) is: the real need, benefits and challenges for implementing online distance learning (ODL) in maritime higher education in South Africa (Q1) and independent variables (X_1, X_2, X_3, X_4, X_5, and X_6) are following categories formed over the certain associated research questions (Table 6):

(a) MET competence based learning (Q2, Q7);
(b) Benefits for students and lecturers (Q3, Q4, Q5, Q6, Q8, Q9, Q20, Q21);
(c) Students' knowledge about ODL and virtual engagement in general (Q10, Q11);
(d) Capacities and attitudes towards ODL adoption (Q12, Q13, Q14, Q15, Q16, Q17, Q18, Q19);
(e) Rising MET accessibility and affordability (Q23, Q24, Q25), and
(f) Costs concerns (Q22).

The same principle of categorization of constructs applied in the case of analysed lecturers' responses was applied to students' responses. The intention was to establish linear correlation between dependent variables and six independent variables composed of different sets of constructs (questions) in the model. As in the previous case, further research in this domain can include different independent variables and different combinations of constructs, which form them. The average values of coded constructs forming each independent variable were taken into account in performing multiple linear regression analysis in ExcelModules.

Table 5. 6. Categories of questions from students' questionnaire

Dependant variable		
Q1	Real needs, benefits and challenges for adopting ODL in SA	
Independent variables		
Q2	… Increasing maritime knowledge and competences	*Category 1:* **MET competence based learning**
Q7	… path to the global MET e-classroom	
Q3	… Increasing digital skills	*Category 2:* **Benefits for students and lecturers**
Q4	… Fostering curiosity	
Q5	… Easier learning	
Q6	… Innovativeness of ODL	

Q8	… More flexible than face-to-face learning	
Q9	… Blended learning benefits	
Q20	… ODL as more interesting way of learning	
Q21	… More effective learning	
Q10	… Taxonomy knowledge	*Category 3:* **Students' knowledge about ODL and virtual engagement in general**
Q11	… Familiarity with term "virtual engagement"	
Q12	… Laptops possession	*Category 4:* **Capacities and attitudes for ODL adoption**
Q13	… Internet access availability	
Q14	… Capability of following written instructions	
Q15	… Willingness to continue education via ODL	
Q16	… Preparedness for adopting ODL	
Q17	… Time management issue	
Q18	… Need for supervision	
Q19	… Self-discipline issue	
Q23	… Students from rural areas	*Category 5:* **Rising MET accessibility and affordability**
Q24	… Students belonging to marginalized groups	
Q25	… Seafarers	
Q22	… Reducing costs	*Category 6:* **Costs concerns**

Our goal is to estimate the realistically expected mean values of the dependent variables ($\overline{Y}$) in both cases, based on individual estimation of the respondents. Since the respondents have estimated, through a survey and on their own discretion, the dependent variables Y and independent variables (X_1, X_2, X_3, X_4, X_5, and X_6), our task is, in line with the requirements of multiple linear regression, to determine the coefficients ($b_1, b_2, b_3, b_4, b_5, b_6$) and to calculate $\overline{Y}$, using equation (1), for lecturers' and students' sets of responds separately:

$$\overline{Y} = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 \quad (1)$$

Where,

$\overline{Y}$ - is the mean expected value of the dependent variable;

b_0 - is Y-axis intercept, determined on the basis of an appropriate sample;

$b_1, b_2, b_3, b_4, b_5, b_6$ - are coefficients of variables $X_i, i = \overline{1,6}$, respectively, or slopes of the corresponding lines.

This practically means that for any new value of each independent variable from a predefined interval, we can estimate the value of the dependent variable. It should be said that $\overline{Y}$ is an average estimated value, because it is the mean value of the probability distribution of possible values of Y for a given value $X_i, i = \overline{1,6}$. To determine $\overline{Y}$ is used the least-squares method (Bertskas et al., 2008). In fact, our goal here is to determine the coefficients ($b_1, b_2, b_3, b_4, b_5, b_6$), so as to minimize the sum of squared errors (SSE), which is given by formula (2):

$$SSE = \sum_{k=1}^{n} \left(Y_k - \overline{Y}_k\right)^2 = \sum_{k=1}^{n} \left(Y_k - \left(b_0 + b_1X_{1k} + b_2X_{2k} + b_3X_{3k} + b_4X_{4k} + b_5X_{5k} + b_6X_{6k}\right)\right)^2 \quad (2)$$

Where,

Y_k - is actual value of the dependent variable, given by the k respondents ($k = \overline{1,n}$);

$\overline{Y}_k$ - is the estimated value of the dependent variable on the basis of the model, in the case of k respondents ($k = \overline{1,n}$);

n – is the total number of respondents (36 for lecturers and 99 for students sets), $k = \overline{1,n}$.

Using the least-squares method, here is actually determined a straight line, which minimizes the sum of vertical differences for each pair of points (Balakrishnan et al., 2007). In other words, identified is a straight line that best fits the given set of points, by

determining the optimal value of Y-axis intercept (b_0), as well as coefficients ($b_1, b_2, b_3, b_4, b_5, b_6$), in order to obtain a more accurate value of $\overline{Y}$ for the given (estimated) values of $X_i, i = \overline{1,6}$ and Y (for $\forall k$, $k = \overline{1,n}$). The realization of multiple linear regression is very complex, and therefore it is better to leave it to the computer. For this purpose, the following can be used: SPSS (Coakes, 2013; Pallant, 2011), or special Excel VBA tools as ExcelModules solver, which we used in the analyses.

5.3.2. A brief description of analyzed statistical values

In addition to the forecasted average value of the dependent variable $\overline{Y}$ and vector ($b_1, b_2, b_3, b_4, b_5, b_6$), based on the model applied here, the following statistical values can be determined: mean absolute deviation, mean square error, mean absolute percent error, standard error of regression estimate, correlation coefficient and coefficient of determination. The formulas used to calculate these values are given below, as well as their brief explanations.

Mean absolute deviation (MAD), indicates the numbers on how much the value of the dependent variable, obtained through multiple regression analysis, corresponds to the estimated value by the respondents, or in other words, to what extent the model reflects the perception of the respondents (3).

Mean square error (MSE) is the mean value of squares of the individual errors of assessment. In other words, if we have n number of respondents, MSE value is calculated using the formula (4). MSE points expressed deviations.

Mean absolute percent error (MAPE), indicates the error between the estimated value and value of dependent variable as a percentage, obtained by using the model. MAPE is the simplest statistical value for interpretation (5).

The formulas for determining the values of the previously generally described errors in the model are given below:

$$MAD = \sum_{k=1}^{n} |A_k - F_k| / n \quad (3)$$

$$MSE = \sum_{k=1}^{n} (A_k - F_k)^2 / n \quad (4)$$

$$MAPE = 100 \sum_{k=1}^{n} [|A_k - F_k| / A_k] / n \quad (5)$$

Where

A_k - is an actual value of a variable (value estimated by respondents), $k = \overline{1,n}$;

F_k - is an estimated value (by model), $k = \overline{1,n}$;

n – is a number of respondents (35 for lecturers' and 99 for students' sets).

Standard error of the regression estimate (SE), is also called the standard deviation of regression. This statistical value is suitable for the formation of the so-called confidence intervals around the regression line. It indicates how much the value of the dependent variable, obtained by the model, can vary (numerically) (6).

Correlation coefficient – r, is used to estimate the strength of linear relationships. Generally, if correlation coefficient is higher than 0.6, it is considered to be a strong linear relation (7).

Coefficient of determination - r^2, is a value between 0 and 1, which indicates to what extent (percentage) dependent variable depends on the independent variables included in the model. E.g. if r^2 is 60%, it means that the value of the dependent variable 60% depends on the independent variables in the model, and 40% on other factors (variables) that are not included in the model (8).

General formulas for calculating the standard deviation, correlation coefficient, and coefficient of determination are given below:

$$SE = \sqrt{\sum (A_k - F_k)^2 / (n-2)} \tag{6}$$

$$r = \frac{n\sum A_k F_k - \sum A_k \sum F_k}{\sqrt{\left[n\sum A_k{}^2 - \left(\sum A_k\right)^2\right]\left[n\sum F_k{}^2 - \left(\sum F_k\right)^2\right]}} \tag{7}$$

$$r^2 = \left\{ \frac{n\sum A_k F_k - \sum A_k \sum F_k}{\sqrt{\left[n\sum A_k{}^2 - \left(\sum A_k\right)^2\right]\left[n\sum F_k{}^2 - \left(\sum F_k\right)^2\right]}} \right\}^2 \tag{8}$$

Where,

A_k - is an actual value of a variable ($k = \overline{1,n}$);

F_k - is an estimated value ($k = \overline{1,n}$);

n – is a number of respondents (35 for lecturers' and 99 for students' sets).

5.3.3. Discussion on the results of multiple regression analysis

The respondents, namely 35 lecturers and 99 students, were asked to estimate the dependent (Y) and six independent variables (X_1, X_2, X_3, X_4, X_5, and X_6) in the corresponding models, each with a number on a scale from 1 to 5. Also, the values of statistical parameters, described in the previous section, have been determined in order to analyse the reliability of the resulting predictive model.

Using ExcelModules solver, the results of multiple regression analysis are obtained, for both categories of respondents. In fact, determined are coefficients in a function of the dependent variable, that is, the slice on the Y-axis (b_0) and coefficients ($b_1, b_2, b_3, b_4, b_5, b_6$) which correspond to the independent variables, $X_i, i = \overline{1,6}$ seriatim. Based on these values and average values, estimated by the respondents, for each of the independent variables, are calculated „average" values of the dependent variable $\overline{Y}_s$ (see Table 5). Calculus are made on PC processor AMD at 1.9 GHz, RAM 4GB.

Table 5. 7 Mean values of the dependent variable: lecturers' and students' responses

	Lecturers	**Students**
b_0	7.731	-0.191
b_1	0.231	0.566
b_2	0.053	0.472
b_3	-0.412	-0.090
b_4	-0.066	0.342
b_5	-0.840	-0.213
b_6	-0.078	-0.037
$\overline{Y}_s$	**3.600**	**4.030**

Table 6 contains numerical values: mean absolute deviation (MAD), mean square error (MSE), mean absolute percent error (MAPE), standard error of the regression estimate (SE), correlation coefficient (r), and coefficient of determination (r^2).

Table 5. 8. Errors, coefficients of correlation and determination

	Lecturers	**Students**
MAD	0.535	0.629
MSE	0.402	0.685
MAPE	15.08%	21.80%
SE	0.709	0.859
r	0.577	0.632
r^2	31%	40%

Based on the data in Table 4, the following can be concluded:

(i) Mean absolute percent errors in the analysed cases of lecturers and students are respectively: 15.08% and 21.80%;

(ii) $\overline{Y}_s$ value can vary based on standard error of regression estimate (SE) for the values: ±0.709 in the case of lecturers' responds, and ±0.859 in the case of students' responds;

(iii) Correlation coefficient values (r) are both above 0.56 that indicates strong linear correlation among considered dependent and independent variables in both analysed cases, and

(iv) Coefficient of determination (r^2) indicates that $\overline{Y}_s$ is determined in 31% samples in the first analysed case, suggesting a satisfying linear dependence, while in the second case it is 40%, suggesting also satisfying linear correlation.

The following graphs (Figures 3 and 4) show the actual values of the dependent variable Y, determined on the basis of subjective estimation of 35 interviewed lecturers and 99 interviewed students in the pilot study, (**blue line – Actual**) as well as those calculated by the model, that is, $\overline{Y}$. (**pink line- Forecast**)

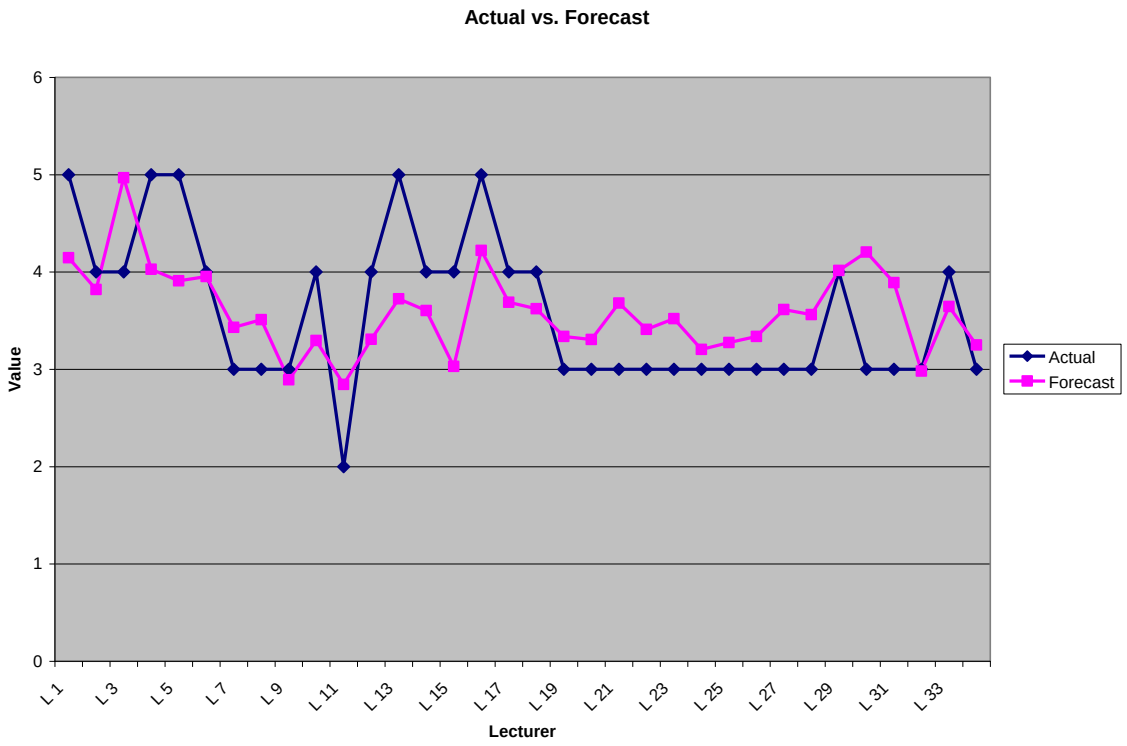

Figure 5. 3 The values of the dependent variables, estimated by the lecturers and those determined by the model

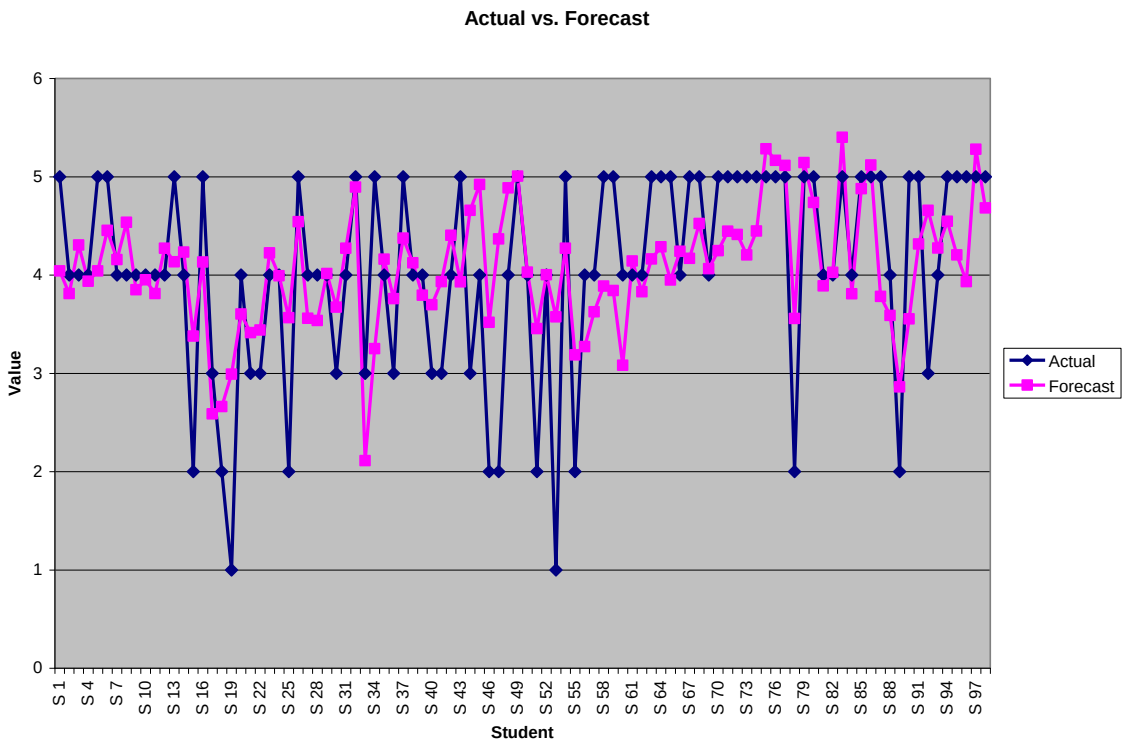

Figure 5. 4 The values of the dependent variables, estimated by the students and those determined by the model

5.3.4. ExcelModules calculus

As a supplement to the afore given description of linear multiple regression model, obtained results and discussion, this sub-section provides calculus made by ExcelModule solver imbedded into Excel. The input and output sets of data for both analysed cases (for lecturers and students) are given in Tables.

Tables 5.9 and 5.11 present input data collected from the respondents, both lecturers' and students'. Data are collected through questionaries' in accordance to the Likert (1-5) scale. After data were obtained through questionnaires, they were coded, keyed in, and edited. A categorization scheme was set up before the data was typed in. There were no outliers, inconsistencies, and blank responses.

Table 5. 9. Lecturers' input data set

Lecturer	Input Data Set						
	Y	**X1**	**X2**	**X3**	**X4**	**X5**	**X6**
L1	5	4	4	3	4	3	5
L2	4	3	3	3	3	4	5
L3	4	5	4	1	4	4	4
L4	5	4	4	3	4	4	3
L5	5	4	4	3	4	4	5
L6	4	4	4	4	4	3	5
L7	3	4	4	4	3	4	5
L8	3	4	3	4	4	4	4
L9	3	4	3	4	4	4	5
L10	4	4	3	4	4	4	5
L11	2	4	3	4	4	4	5
L12	4	4	4	5	5	4	4
L13	5	5	5	5	4	3	5
L14	4	4	4	4	4	4	4
L15	4	3	4	4	4	4	5
L16	5	4	4	4	4	3	4
L17	4	4	4	4	4	4	5
L18	4	5	4	4	4	4	5
L19	3	3	4	4	4	4	4
L20	3	4	4	4	4	4	5
L21	3	4	3	4	4	4	4
L22	3	4	5	5	4	4	4
L23	3	4	4	4	5	4	5
L24	3	4	4	5	5	4	5
L25	3	4	4	4	4	4	5
L26	3	4	4	5	4	3	5

L27	3	4	4	4	4	4	5
L28	3	4	5	5	5	3	4
L29	4	4	4	4	4	3	5
L30	3	4	5	5	5	3	4
L31	3	4	3	4	4	3	4
L32	3	4	3	4	4	4	5
L33	4	4	4	4	4	4	5
L34	3	5	5	5	5	4	5
L35	4	4	4	4	5	3	4

Table 5. 10 ExcelModels multiple linear regression analysis (lecturer

Forecast	**Error**	**Absolute error**	**Squared error**	**Absolute % error**
4.146	0.854	0.854	0.728	17.07%
3.821	0.179	0.179	0.032	4.49%
4.967	-0.967	0.967	0.936	24.19%
4.027	0.973	0.973	0.947	19.46%
3.909	1.091	1.091	1.189	21.81%
3.954	0.046	0.046	0.002	1.16%
3.430	-0.430	0.430	0.185	14.34%
3.510	-0.510	0.510	0.260	17.00%
2.892	0.108	0.108	0.012	3.61%
3.296	0.704	0.704	0.496	17.61%
2.845	-0.845	0.845	0.713	42.23%
3.309	0.691	0.691	0.478	17.29%
3.724	1.276	1.276	1.627	25.51%
3.604	0.396	0.396	0.157	9.90%

3.030	0.970	0.970	0.941	24.25%
4.221	0.779	0.779	0.607	15.58%
3.689	0.311	0.311	0.097	7.78%
3.622	0.378	0.378	0.143	9.46%
3.336	-0.336	0.336	0.113	11.20%
3.306	-0.306	0.306	0.094	10.21%
3.680	-0.680	0.680	0.462	22.66%
3.409	-0.409	0.409	0.167	13.64%
3.520	-0.520	0.520	0.271	17.34%
3.204	-0.204	0.204	0.042	6.81%
3.274	-0.274	0.274	0.075	9.13%
3.337	-0.337	0.337	0.114	11.25%
3.613	-0.613	0.613	0.376	20.44%
3.563	-0.563	0.563	0.317	18.76%
4.016	-0.016	0.016	0.000	0.40%
4.204	-1.204	1.204	1.449	40.12%
3.890	-0.890	0.890	0.792	29.66%
2.982	0.018	0.018	0.000	0.60%
3.644	0.356	0.356	0.126	8.89%
3.249	-0.249	0.249	0.062	8.30%
3.777	0.223	0.223	0.050	5.59%
Average		0.535	0.402	15.08%
		MAD	**MSE**	**MAPE**
		0.709	0.557	0.311
		SE	**Multiple-r**	**Square-r**

Tables 10 and 12 represent sub-scores of ExcelModules calculations, i.e., data processing step-by-step. These data represent iterative nature of multiple linear regression method and

the process of generating final solution. Values such as MAD, MSE, MAPE, SE, multiple-r and square-r are described in detail in the previous sub-section.

Table 5. 11 Students' input data set

Student	Input Data Set						
	Y	**X1**	**X2**	**X3**	**X4**	**X5**	**X6**
S1	5	4	5	5	4	3	5
S2	4	4	4	5	5	5	5
S3	4	5	4	2	4	3	5
S4	4	4	4	3	5	5	5
S5	5	4	5	5	4	3	5
S6	5	5	4	4	4	4	4
S7	4	4	4	4	5	5	5
S8	4	5	4	5	5	4	5
S9	4	4	4	2	3	3	4
S10	4	4	4	2	3	2	5
S11	4	4	4	5	4	4	5
S12	4	4	4	2	4	4	2
S13	5	5	4	4	4	3	2
S14	4	4	4	3	4	3	4
S15	2	4	3	1	2	2	4
S16	5	4	4	4	5	4	4
S17	3	3	3	2	3	3	3
S18	2	4	3	3	2	3	4
S19	1	4	2	3	3	3	3
S20	4	4	3	5	4	3	4

S21	3	4	3	3	3	3	1
S22	3	4	3	5	4	3	3
S23	4	4	4	2	4	3	4
S24	4	4	4	5	5	5	5
S25	2	4	3	3	3	2	1
S26	5	5	4	3	4	4	5
S27	4	4	3	3	3	2	4
S28	4	4	4	3	3	2	3
S29	4	4	3	2	4	3	4
S30	3	4	3	4	4	3	3
S31	4	4	4	2	4	4	2
S32	5	5	5	5	5	5	5
S33	3	2	2	3	2	1	3
S34	5	4	3	4	4	4	2
S35	4	4	4	3	4	3	4
S36	3	4	3	2	3	3	5
S37	5	5	4	2	4	3	4
S38	4	5	3	2	4	3	4
S39	4	4	4	2	3	4	5
S40	3	3	4	3	3	2	4
S41	3	4	3	3	4	3	3
S42	4	4	5	2	4	5	5
S43	5	4	4	3	4	4	1
S44	3	5	4	2	4	5	5
S45	4	5	5	2	4	3	3
S46	2	4	4	3	3	5	4
S47	2	5	4	3	4	4	5
S48	4	5	5	1	4	4	3
S49	5	5	5	2	3	4	2
S50	4	4	4	2	4	3	2

S51	2	3	4	3	4	4	3
S52	4	4	4	2	4	4	3
S53	1	4	4	3	3	3	2
S54	5	4	4	2	4	3	2
S55	2	3	4	3	2	2	1
S56	4	3	4	3	4	4	5
S57	4	4	3	3	3	3	2
S58	5	5	4	2	3	4	1
S59	5	4	4	1	4	4	1
S60	4	3	4	2	3	4	2
S61	4	5	4	2	3	4	1
S62	4	4	3	2	3	3	2
S63	5	4	4	3	4	3	4
S64	5	4	5	2	4	4	5
S65	5	4	4	2	3	3	1
S66	4	4	4	2	4	5	1
S67	5	4	4	2	3	3	2
S68	5	5	4	2	3	3	1
S69	4	4	4	2	4	3	2
S70	5	4	4	2	4	3	4
S71	5	5	4	1	4	4	3
S72	5	4	4	1	5	5	5
S73	5	4	4	2	3	2	1
S74	5	5	4	3	4	3	4
S75	5	5	5	2	4	3	4
S76	5	5	5	1	4	3	3
S77	5	5	4	2	4	3	2
S78	2	4	3	3	4	3	2
S79	5	5	5	2	4	3	4
S80	5	5	4	2	4	3	2

S81	4	4	4	2	3	2	4
S82	4	4	3	2	4	3	4
S83	5	5	4	1	4	2	2
S84	4	4	4	2	4	4	5
S85	5	5	4	1	4	4	5
S86	5	5	4	1	3	2	1
S87	5	4	4	2	4	4	5
S88	4	4	4	2	3	4	4
S89	2	3	4	2	4	5	5
S90	5	4	4	2	3	3	5
S91	5	5	5	2	3	5	4
S92	3	4	5	2	4	3	3
S92	4	4	4	2	4	4	2
S93	5	4	4	1	4	3	2
S94	5	4	4	2	4	3	4
S95	5	4	4	2	2	2	4
S96	5	5	5	1	4	4	4
S97	5	5	4	2	3	3	3
S98	1	1	1	2	2	1	3
S99	5	4	5	5	4	3	5

Table 5. 12. ExcelModels multiple linear regression analysis (students)

Forecast	**Error**	**Absolute error**	**Squared error**	**Absolute % error**
4.040	0.960	0.960	0.921	19.19%
3.810	0.190	0.190	0.036	4.74%

4.305	-0.305	0.305	0.093	7.63%
3.936	0.064	0.064	0.004	1.60%
4.040	0.960	0.960	0.921	19.19%
4.453	0.547	0.547	0.299	10.94%
4.156	-0.156	0.156	0.024	3.89%
4.535	-0.535	0.535	0.287	13.39%
3.850	0.150	0.150	0.023	3.75%
3.950	0.050	0.050	0.003	1.25%
3.811	0.189	0.189	0.036	4.71%
4.271	-0.271	0.271	0.074	6.78%
4.135	0.865	0.865	0.749	17.30%
4.232	-0.232	0.232	0.054	5.80%
3.378	-1.378	1.378	1.899	68.90%
4.131	0.869	0.869	0.755	17.38%
2.588	0.412	0.412	0.170	13.74%
2.662	-0.662	0.662	0.438	33.08%
2.990	-1.990	1.990	3.959	198.98 %
3.602	0.398	0.398	0.158	9.95%
3.413	-0.413	0.413	0.170	13.75%
3.439	-0.439	0.439	0.193	14.63%
4.225	-0.225	0.225	0.051	5.62%
3.992	0.008	0.008	0.000	0.21%
3.565	-1.565	1.565	2.449	78.25%
4.542	0.458	0.458	0.210	9.16%
3.559	0.441	0.441	0.195	11.03%
3.537	0.463	0.463	0.214	11.58%
4.015	-0.015	0.015	0.000	0.37%
3.672	-0.672	0.672	0.452	22.41%
4.271	-0.271	0.271	0.074	6.78%

4.894	0.106	0.106	0.011	2.11%
2.111	0.889	0.889	0.791	29.65%
3.250	1.750	1.750	3.064	35.01%
4.161	-0.161	0.161	0.026	4.03%
3.759	-0.759	0.759	0.577	25.31%
4.376	0.624	0.624	0.390	12.48%
4.123	-0.123	0.123	0.015	3.07%
3.795	0.205	0.205	0.042	5.13%
3.698	-0.698	0.698	0.487	23.26%
3.931	-0.931	0.931	0.867	31.04%
4.403	-0.403	0.403	0.162	10.07%
3.930	1.070	1.070	1.145	21.40%
4.657	-1.657	1.657	2.747	55.25%
4.922	-0.922	0.922	0.849	23.04%
3.517	-1.517	1.517	2.301	75.85%
4.368	-2.368	2.368	5.606	118.38 %
4.885	-0.885	0.885	0.783	22.12%
5.004	-0.004	0.004	0.000	0.09%
4.028	-0.028	0.028	0.001	0.70%
3.454	-1.454	1.454	2.115	72.71%
4.002	-0.002	0.002	0.000	0.05%
3.573	-2.573	2.573	6.622	257.33 %
4.273	0.727	0.727	0.529	14.55%
3.186	-1.186	1.186	1.406	59.30%
3.271	0.729	0.729	0.531	18.22%
3.625	0.375	0.375	0.141	9.39%
3.888	1.112	1.112	1.238	22.25%
3.841	1.159	1.159	1.343	23.18%

3.082	0.918	0.918	0.842	22.95%
4.141	-0.141	0.141	0.020	3.54%
3.829	0.171	0.171	0.029	4.29%
4.163	0.837	0.837	0.701	16.75%
4.286	0.714	0.714	0.510	14.28%
3.948	1.052	1.052	1.107	21.04%
4.241	-0.241	0.241	0.058	6.01%
4.169	0.831	0.831	0.691	16.62%
4.524	0.476	0.476	0.227	9.53%
4.063	-0.063	0.063	0.004	1.58%
4.247	0.753	0.753	0.567	15.06%
4.445	0.555	0.555	0.308	11.10%
4.412	0.588	0.588	0.346	11.76%
4.203	0.797	0.797	0.635	15.93%
4.446	0.554	0.554	0.306	11.07%
5.283	-0.283	0.283	0.080	5.67%
5.167	-0.167	0.167	0.028	3.33%
5.114	-0.114	0.114	0.013	2.29%
3.558	-1.558	1.558	2.427	77.89%
5.143	-0.143	0.143	0.021	2.86%
4.737	0.263	0.263	0.069	5.26%
3.890	0.110	0.110	0.012	2.76%
4.027	-0.027	0.027	0.001	0.67%
5.400	-0.400	0.400	0.160	8.01%
3.809	0.191	0.191	0.036	4.76%
4.878	0.122	0.122	0.015	2.45%
5.117	-0.117	0.117	0.014	2.35%
3.781	1.219	1.219	1.485	24.37%
3.588	0.412	0.412	0.169	10.29%
2.861	-0.861	0.861	0.742	43.06%

3.554	1.446	1.446	2.091	28.92%
4.316	0.684	0.684	0.468	13.68%
4.657	-1.657	1.657	2.746	55.24%
4.274	-0.274	0.274	0.075	6.84%
4.546	0.454	0.454	0.206	0.091
4.204	0.796	0.796	0.633	0.159
3.931	1.069	1.069	1.142	0.214
5.280	-0.280	0.280	0.078	0.056
4.682	0.318	0.318	0.101	0.064
0.975	0.025	0.025	0.001	0.025
4.040	0.960	0.960	0.921	19.19%
3.810	0.190	0.190	0.036	4.74%
4.305	-0.305	0.305	0.093	7.63%
3.936	0.064	0.064	0.004	1.60%
4.040	0.960	0.960	0.921	19.19%
4.453	0.547	0.547	0.299	10.94%
4.156	-0.156	0.156	0.024	3.89%
4.535	-0.535	0.535	0.287	13.39%
3.850	0.150	0.150	0.023	3.75%
3.950	0.050	0.050	0.003	1.25%
3.811	0.189	0.189	0.036	4.71%
4.271	-0.271	0.271	0.074	6.78%
4.135	0.865	0.865	0.749	17.30%
4.232	-0.232	0.232	0.054	5.80%
3.378	-1.378	1.378	1.899	68.90%
4.131	0.869	0.869	0.755	17.38%
2.588	0.412	0.412	0.170	13.74%
2.662	-0.662	0.662	0.438	33.08%
2.990	-1.990	1.990	3.959	198.98 %

3.602	0.398	0.398	0.158	9.95%
Average		0.629	0.685	0.218
		MAD	**MSE**	**MAPE**
		0.859	0.632	0.399
		SE	**Multiple-r**	**Square-r**

Conclusion

On the basis of key statistics, in particular mean values of examined variables, upon the sets of 35 lecturers' responses and 99 students' responses, the following was concluded:

(i) *Lecturers:* The interviewed lectures assessed real needs for introducing ODL in MET in SA as relatively high (3.6 at 1-5 Likert's scale). They emphasized the need for free Internet access to lecturers and students (4.5), as well as the need for permanent institutional technical support towards realizing ODL (4.4). On the other hand, they expressed scepticism towards the hypothesis that ODL can enable access to higher maritime education to students living in rural areas and to those who are somehow socially marginalized. Moreover, lecturers were sceptical about the assumption that ODL can upraise lecturers' and students' digital skills. This opens room for further investigation through in-depth interviews with lecturers.

(ii) *Students:* The interviewed students assessed the real need for introducing and adopting ODL at METs in South Africa as a high one (4.03 at 1-5 Likert's scale). They believed that ODL can support them to reach higher digital skills (4.29) and to upraise their thinking skills (4.14). However, they were also highly aware that the number of South African maritime higher education institutions, which can provide lecturers and students with Internet access and computer labs, is constrained (4.01). The investigation revealed that a

small percentage of students has personal tablets, laptops or smart phones (2.28). students were not well informed about similarities and differences in meaning among blended-, e-, computer based-, web based-, and Cloud-learning (2.43). Moreover, students were a bit sceptical that ODL was a good way of knowledge transfer, knowledge refreshment and lifelong learning for seafarers' (2.91). All the above findings should be further interrogated through in-depth interviews with the students.

Following a cross-correlation analysis of each pair of analysed variables in the model, the following conclusions were drawn:

(i) Lecturers: The data in Table 3 can be interpreted as follows: upraising students' thinking skills is in positive linear correlation with integration of formal and informal learning styles; level of ODL adoption in South African METs is in positive correlation with availability of Internet access and computer labs; lecturers' readiness to adapt curricula is positively correlated with availability of online assessments, etc. On the other hand, easier learning through ODL is in negative correlation with allowing ODL access to socially marginalized groups, which can be explained through the assumption that such a way of learning might not be the most convenient one for those learners. Moreover, reducing costs by introducing ODL is in negative correlation with making learning easier to socially marginalized students. This might be explained by the assumption that marginalised students are anyway prevented from participating due to the absence of Internet access, gadgets, etc. By analogy, the other pairs of constructs which were in strong correlation with certain significance can be discussed in the same manner.

(ii) *Students:* The data in Table 4 can be interpreted in the following manner: the level of students' preparedness for ODL is in strong positive linear correlation with their ability to manage their time well, self-discipline and belief that ODL is more interesting than classical face-to-face learning. Moreover, upraising students' digital skills through ODL adoption is in strong positive correlation with the significance of fostering their curiosity, innovativeness, and virtual engagement in the global e-classroom. On the other hand, students' belief that ODL can increase their digital skills is in strong negative linear

correlation with the low level of their familiarity with e-Learning terminology and basic principles, including the lack of personal laptops. In a similar, manner the rest of the positively and negatively correlated pairs of constructs in the model can be discussed.

On the basis of the multiple regression analysis over the set of available data, the following was found:

(i) Mean absolute percent errors in the analysed cases of lecturers and students were respectively: 15.08% and 21.80%;

(ii) Calculated $\overline{Y}_s$ value by multiple linear regression can vary based on standard error of regression estimate (SE) for the values: ±0.709 in the case of lecturers' responses, and ±0.859 in the case of students' responses;

(iii) Correlation coefficient values (r) are both above 0.56 that indicates strong linear correlation among considered dependent and independent variables in both analysed cases, and

(iv) Coefficient of determination (r^2) indicates that $\overline{Y}_s$ is determined in 31% samples in the first analysed case, suggesting a satisfying linear dependence, while in the second case it is 40%, suggesting also satisfying linear correlation.

CHAPTER 6 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

In conclusion, it should be noted that research results on ODL and e-Learning in South Africa are more or less similar to those in other developing environments. Nevertheless, there is need to upgrade higher education through employing ODL and e-Learning mechanisms. It is imperative in the digital age in which we live to acquire the necessary digital literacy and team work skills for ODL and e-Learning. Furthermore, everything is going global and classrooms are on the road to become global at least to a certain extent. Moreover, qualifications in MET should be globally recognised and accredited to meet safety, efficiency and effectiveness requirements. In addition, the development and implementation of policies in South Africa still lags behind other countries in the first world, thus slowing down MET development and its harmonization with the highest standards in the field.

From the surveys carried out it is evident from the study that the need for online distance education opportunities exists. This is specifically required in the Maritime industry as sea-going graduates often are not able to continue with their studies after completing their initial Diploma qualification. The possibility of offering the Advanced Diploma via online distance education will fulfil the need and provide wider access to students. The online distance education model is widely supported by both the Department of Higher Education and Training and the STCW. The Department of maritime studies, faculty of applied Sciences requires the support of the Universities in executing a pilot project of online distance learning for their qualifications. The pilot will allow the Department and its staff to develop plans and processes in conjunction with the CQPA to design, deliver, assess and evaluate the offering of online distance education.

It is noteworthy to mention that the Covid-19 pandemic has highlighted the necessity for e-Learning in developing environments and the results of the study show the positive benefits of online distance learning. In addition, this study becomes more relevant during

the global crisis and institutions for higher learning are using Zoom and MS Teams to conduct teaching and learning on the other hand primary and secondary education are on a stand still. Public schools are on a disadvantage of the situation and do not have other option but to close schools. Teaching and learning is not happening except for private schools which can afford and access e-learning platforms.

6.2 Recommendations for further research

Further investigations should be done using a larger cohort of lecturers and students at METs in South Africa. In addition, relevant stakeholders from DHET, SAMSA, EMSA, and researchers in the field of higher education should be involved as respondents. In future studies, in-depth interviews should be conducted instead of questionnaires. This can give better insight into the analysed preferences, needs and constraints in relation to introducing and adopting e-Learning at METs in South Africa. Besides quantitative analysis, in-depth interviews will provide better background for additional qualitative analysis. Moreover, instructional design components should be involved in future investigations. Benchmarking with METs in other developing and developed countries in Africa and Europe, respectively, should be done. This will give a broader picture. In addition, opportunities of collaborative online international learning with other developing and/or developed countries should be explored in some more detail. The issue of lecturers' intellectual properties should be examined as well, since it is an important dimension of the challenges facing ODL and e-Learning. Using specific cases, the impact of Covid-19 on METs should be explored. This can reveal some important facts about (un)successful practices in implementing e-Learning in emerging institutions. Besides the pragmatics of raising competences and achieving positive economic effects, exploring e-Learning adoption in higher METs in South Africa should include social dimensions, along with lecturers' and students' emotions about working separately or in some kind of isolation. This important constructivist component should be, among others, a part of future investigations on ODL and e-Learning.

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APPENDICES

Appendix 1 Summary of study conducted in developing countries

Study	Issue	Conclusion

Gumbo and Minnaar 2019 -UNISA, South Africa	• Existing family and work commitments • Incoherence of actual lectures	• Benefits of flexible and collaborative learning, work at own pace.
Balfour et al 2015 - Northwest University, South Africa	• Poor technical literacy • Issues of postal service for correspondence • Transport Costs • Limited Timeframes for assignments • Online students not participating in group activities	• Provide resources and technical support • Use special couriers/registered post/online. • Reduced if minimal campus visits • Provide online materials in advance • Check online logon, access and participation of student records
Rakoma 2018 - Stellenbosch University, South Africa	• High transport access costs • Poor IT service, high data costs	• ODL is cheaper -aids rural student access, improve technical literacy. • Provide rural support centres as for UNISA, offer course materials, assignments, tutorials, library archives, study and technical support along with apps and more online discussion forums for collaborative learning.
Sabi, Uzoka and Njeh 2016	• Reliability, high printing costs, Data Security, • Physical security/ instability- poor maintenance, climate	• Cloud computing -remote storage and access of resources. • Avoiding campus visits and physical threats.

	related events and natural disasters, political-economic-social instability, student riots and resultant fires	• Provision of infrastructure, network, institutional capacity, organisation,
SADC Secretariat 2013 -SADC	• Skills, budget shortages and other constraints • Low tertiary education completion/participation rates. • scarcity of teachers, scarcity of funding, limited education access, a shortage of core teaching/learning material, outdated curricula and insufficient monitoring and evaluation data rating to educator, student and institutional performance	• Capacity, education and training building, more ODL resources, availability. • Easier to update information and materials continuously. • Improved monitoring and evaluation, revised ODL quality standards. • Extended learner/technical support
Association for the Development of Education in Africa 2001	• High initial sunk capital and establishment costs, scarce IT education skills, slow/limited Internet connectivity. TVETS remain comparatively fewer, less resourced and	• Improved curriculum/course and assignments delivery • Mauritius financial incentives - 25,000 rupee tax deduction under the 1995 Income Tax Act and deducted up to 200,000 rupees for tertiary education

	mostly unintegrated into ODL and eLearning approaches	bank loans under the 2001 Finance Act
Trines 2018 -Sub-Saharan Africa and South Asia	• High population and student number growth - more pressure on lecturers/ universities/colleges • High Internet Data Costs.	• Provision of Technology and Massive Open Online Courses • Need for support centres
Mathew and Ilonanya 2017 -Botswana	• Concerns of quality of education, slow lecturer responses, technophobia • Social experience • Lack of localized content	• Need to ensure marketing and awareness initiative, provide social sessions/ tutorials assignments online. Real time monitoring • Need to adapt/provide materials
Oladejo and Gesinde 2014-Africa	• Access problems for women, rural people disabled youth/marginalised	• ODL provides access – • More networking partnerships, training, local policies, budget resources and devoted research
Omer et al. 2015-Somalia	• Civic/Political instability • Internet connectivity faces slow species/poor support. • Limited social interaction	• Able to access ODL • More technical support • Provision of group forums, webinars, assignments

Mgendi 2010 -Ardhi University Tanzania	• Limited funding, timeframe and implementation training • Lack of student motivation	• Ensure sufficient resources are present for ODL • Encourages participation/IT literacy
Kotoua, Ilkan and Kilic 2015 -Ghana	• Budget, time, other pressures • Challenges of avoiding family distractions • Poor income levels, chronic poverty, computer and actual illiteracy and unemployment • Limited access to computers	• Access to working lives simultaneously, allows continuous professional educational development and overcomes the immense budget pressures currently experienced by tertiary institutions • Reduced physical education, transport, accommodation costs • Exempted customs duties on importing computers
Betchoo 2015- Africa	• Equity -access for insufficient qualifications, finance constraints, a shortage of finance or failing existing institutions • Social Isolation • Distractions	• Greater access to education • Digital connection to those in other countries and globally via collaborative media, group forums and social media/webinars • Flexible -work at own pace
Dyer 2017 -Africa	• Scarce skills, institutional capacity and supply of education	• ODL -enables multi-tasking and access, process more students, enable flexibility of learning including translation

	and professionals for the maritime sector. • Language and awareness challenges	and additional surrogate materials to facilitate comprehension
Takalani 2008 -South Africa	• Digital Divide between rural/urban, wealthier and poor. • technology/access to computers, issues of securing data, limited Internet bandwidth, initial starting costs and low capacity to enforce student participation • Intellectual Property/ Copyright Uncertainty	• Need for effective institutional and senior management support • Leadership/Commitment/ Decisiveness • Need to ensure and retain student motivation • Training • Redundancy of servers to cope with excess users simultaneously • Financial and other incentives as well for academics for IP.
Arkorful and Abaidoo 2014 - Ghana	• Delays in receiving feedback or clarity, avoiding cheating, piracy and plagiarism for assignments • high congestion and traffic for certain websites.	• Uploading and communicating marks swifter. • Online monitoring • Providing redundancy network capacity
Cox and Trotter 2017 -South Africa	• Legal/IP access • Infrastructure access • Awareness, capacity • Time Pressures for lecturers/loss of income	• Need for a policy, sufficient resources and support factoring access, intellectual property permission, sufficient awareness, capacity,

	from copyrighted materials • Where to access resources	availability and personal volition. • Need for training
Mutisya and Makokha 2016 - Kenya	• restricted Internet and computer facilities; few incentives, • scarce technical skills, high workloads and lack of copyright protection • Greater time workloads • Fear to critique e-Learning	• More resources, training, facilities and IT access and financial support • Anonymous surveys and interviews • All students should be obligated to own a computer or laptop before enrolment • Funding/other resources should be increased to support eLearning with proper policies.
Gunga and Rickets 2006-Africa	• poor Internet connectivity and technophobia	• collaborative private sector and international partnerships • More PR -guidance, marketing
Reju 2016 -Nigeria	• Need for practical demonstrations in mathematics/sciences	• Instructional delivery, assessment procedures, learning facilitation and support services monitored and evaluated via surveys, descriptive and inferential statistical analysis • Regular presence/access from lecturers • Augmented training

OECD 2005 -OECD -Brazil, Mexico, Thailand	• IP, infrastructure, content, IT network • flexibility, quality, cost, economies of scale and consistency of materials presented.	• funding and professional academic/ student development, marketing • Market demand, provision of technical standards and online course material locally adapted. • Need for professional recognition/ accreditation of online courses and materials, coordinated bureaucracy.
Queiros and De Villiers 2016; Cloete 2017; Letseka, 2015- South Africa	• Social isolation • Time constraints	• social presence, tools, punctual feedback and informative technological aspects. • ODL materials improve flexibility
Madge et al 2015 - South Africa	• Retaining student motivation	• Using social media - WhatsApp, they utilised Facebook, You Tube, Linked In, Instagram and Twitter - abilities to locate more information, connect for career guidance, social support, friendships and motivation • more informal networks so students felt freer to openly discuss issues, rather than a regulated university environment
Letseka and Pitsoe 2018 -South Africa	• revolving door syndrome" or low	• Greater student access to materials, resources, flexibility

	graduation/curse completion rates and high student throughput	and motivation via ODL provision • need for sufficient resources including training, staff, distance contact centres, finance and educational quality to be assured
UNISA 2015 -South Africa	• Need to deliver cost-effective mass education	• Ensuring policy frameworks and support, training requirements
University of Zululand 2010 - South Africa	• Potential student riots and dissatisfaction -need for a stakeholder requirement analysis • Scarcity of resources • Lack of policy/guideline	• a coordinated, cohesive vision across departments and faculties; • adequate funding and investments; policies and procedures, • student access to eLearning resources and support along with the technological infrastructure to support it • need for developing businesss services, course design and development and funding/staff/IT support
Ngubane-Mokiwa 2017 -UNISA South Africa	• Poor technical cultural literacy	• Need for induction, training and student/lecturer support
Arko-Achemfour 2013 -UNISA, South Africa	• Ensuring mass education access	• Greater integration and extension of existing administrative/systematic,

	Delayed feedback, poor student-lecturer interaction and contact times; shortage of computers, high delays; ignorance over most web platform functions along with contradictory or absent financial, administrative, technical, academic and personal guidance from the support staff.	cognitive/academic, and effective support facilities • coaching, mentoring, vocational guidance, communication and frequently asked questions,
Ng'ambi et al. 2016	• Poor tech/IT literacy	• More training and guidance
Bauk 2019 -DUT, South Africa	• Actual student learning from diverse backgrounds	• ODL provides flexibility, user friendliness, ability to collaborate virtually and accessibility of services.
Tran 2018 -Vietnam	• Lack of resources including shortages of qualified staff • Limited national education budgets exist.	• technical feasibility, costs of solutions i.e. hardware and software, potential economic benefits, supply and demand labour market dynamics and extent of regulatory and social acceptability

Appendix 2 Questionnaire for Lecturers

In advance, I would like to thank you for your time, patience and commitment to access the survey. By fulfilling this survey, i.e., by marking one of the numbers from 1 to 5 along with your comments if applicable, you give your contribution to the research aimed to

investigate and analyze the feasibility and practicability of Online Distance Learning (ODL) at Maritime Education and Training (MET), in general and with the emphasize on the South African developing environment.

1. How would you assess the real need, benefits and challenges for implementing online distance learning (ODL) in maritime higher education and training (MET) in South Africa?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

2. At which extent can ODL bring benefits to competence based maritime higher education and training?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

3. At which portion, due to your opinion, can ODL adoption at maritime higher education and training institutions upgrade lecturers' and students' digital skills?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

4. To which extent, due to your knowledge, maritime Conventions (primarily STCW) support ODL?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

5. Do you believe that ODL appraises students thinking skills?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

6. Does ODL allow, due to your opinion, integration of formal and informal learning styles?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

7. Do you agree that ODL fosters students' curiosity and creativity?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

8. Do you believe ODL can make learning easier?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

1	2	3	4	5
Comments:				

9. Do you consider intensive deployment of ODL as a key enabler of MET "global e-classroom"?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

10. How convenient, from your perspective, is blended learning (combination of ODL and face-to-face learning)?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

11. How well are you informed about similarities/differences in meaning of the following terms: e-, computer based-, web based-, and Cloud-learning?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

12. Are you familiar with the terms collaborative online learning (COIL) and "virtual engagement"?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

13. At which level of adoption is currently ODL in South African maritime high education due to your knowledge/experience?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

14. Is the number of South African maritime higher education institutions, which can provide lecturers and students Internet access and computer labs constrained, and to which extent, due to your knowledge/experience?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

15. To which extent are you willing to adapt your curricular in accordance to the requirements of new technology and ODL?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

16. To which extent are you willing to put extra effort to develop e-instructional material?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

17. Are you ready to put extra effort to design computer supported assessments/tests?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

18. Would you be able to access your ODL course(s) regularly (daily or weekly) to update the content and send the announcements?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

1	2	3	4	5
Comments:				

19. Do you have doubts when it comes to your intellectual property protection in ODL context?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

20. At which piece can ODL reduce the costs of space, energy, infrastructure, and commuting in maritime higher education and training?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

21. Can ODL enable access to higher maritime education to the students living in rural areas?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

22. To which extent can ODL provide access to higher maritime education to those who are somehow socially marginalized?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

23. Do you consider ODL as a good way of knowledge transfer for seafarers' knowledge refreshment and their life long learning?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

1	2	3	4	5
Comments:				

24. Do you think that ODL requires permanent institutional technical support?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

25. Is South Africa as developing country able to cover the costs of ODL development and implementation, and to provide free Internet access to lecturers and students due to your opinion?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

Thank you for your time, kind and valuable contribution!

Appendix 3 Questionnaire for Seafarers and shore-based personnel

In advance, I would like to thank you for your time, patience and commitment to access the survey. By fulfilling this survey, i.e., by marking one of the numbers from 1 to 5 along with your comments if applicable, you give your contribution to the research aimed to investigate and analyze the feasibility and practicability of Online Distance Learning (ODL) at Maritime Education and Training (MET), in general and with the emphasize on the South African developing environment.

Questions:

1. How would you assess the real need, benefits and challenges for implementing online distance learning (ODL) in maritime high education and training (MET) in South Africa?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

2. In which piece ODL can increase your maritime knowledge and competitiveness?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

3. In which extent ODL can support you to reach higher digital skills?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

4. Do you believe that ODL can foster your curiosity and creativity?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

5. Do you believe ODL can make learning easier?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

6. Do you consider ODL innovative and to which extent?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

7. Do you see ODL as a path towards establishing “global e-classroom” in MET?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

8. Do you consider ODL more flexible than traditional face-to-face learning?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

9. How convenient, from your perspective, is blended learning (combination of ODL and face-to-face learning)?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

10. Are you informed, and to which extent, due to similarities/differences in meaning of: blended-, e-, computer based-, web based-, and Cloud-learning?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

11. Are you familiar with the terms collaborative online learning and "virtual engagement"?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

12. Do you have your personal tablet, laptop or smart phone?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

13. Do you have (reliable) Internet access?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

14. Are you able to read well and follow written directions well?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

15. Are you willing to further your studies via ODL?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

16. Are you prepared to learn and study in ODL environment?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

17. Would you be able to access your ODL course(s) regularly (daily or at least weekly) to check the announcements?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

18. Would you be able to maintain a schedule and complete work in ODL environment without direct supervision?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

19. Do you believe that ODL can assist you with time management and self- discipline?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

20. Do you think that ODL makes learning process easier?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

21. Do you consider ODL an effective learning channel/method?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

22. Do you think that ODL can reduce costs of space, infrastructure and commuting?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

23. Do you think that ODL can provide opportunities for students living in rural areas?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

24. Do you think that ODL can provide opportunities for students how are socially under-represented (marginalized)?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

25. Do you consider ODL as a good way of knowledge transfer for seafarers' knowledge refreshment and their life long learning?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
Comments:				

Thank you for your time, kind and valuable contribution!

Appendix 4 Golden Thread Method

Research question (Associated research questions)	**Literature review (Critical literature review)**	**Data to be collected – your research instrument (Questions for lecturers (RQ_LX.Y) and questions for students (RQ_SX.Y))**	**Method and data collection (E-mailed questionnaires)**	**Data analysis method (Quantitative and qualitative)**	**Results (Assumed)**
RQ1: How ODL can influence competence based MHE and training, lecturers' and students' digital skills, and is this mode of knowledge transfer and generation sufficiently supported by STCW?	**Competence based learning and training** ○ **Maritime education and training** ○ **IMO Conventions** Key Ref. [1] Akyeampong, M., 2019. *Maritime*	**<u>Lecturers</u>** RQ_L1.1: To what extent can ODL bring benefits to competence based maritime high education and training? RQ_L1.2: To what extent portion, due	Data will be collected through a questionnaire. A questionnaire is a preformulated written set of questions to which respondents record their answers. Respondents will have to answer the	Collected data will be analyses through both quantitative and qualitative approaches. Quantitative analysis will be conducted into two directions. One will contain descriptive statistics	Assumptions based on preliminary search, experience and intuition: **<u>Lecturers</u>** RQ_L1.1: Likert scale mean value between [3-4] RQ_L1.2: Likert scale

Key words: ODL, competence based MHE, training, digital skills, STCW	*Education and Training to Empower Women in the Maritime Administration in Ghana*, World Maritime University, Master's Thesis, Malmo. [2] Aung, M., 2009. *Improving Maritime Community Communication Through Information Communication Technology: A Feasibility Case Study at the Myanmar Maritime University*, World	to your opinion, can ODL adoption at maritime high education and training institutions upgrade lecturers' and students' digital skills? RQ_L1. 3: To what extent, due to your knowledge, maritime Conventions (primarily STCW) support ODL? RQ_L1. 4: Do you believe that ODL appraises	questions in such way to choose one number of Likert interval scale due to the best of their knowledge, experience and/or intuition. The Likert scale is designed to examine how strongly respondents agree or disagree with the statements on a five-point scale with the following anchors, which can be modified depending on the question formulation: strongly	derived as minimum, maximum, mean value, standard deviation and variance values upon the whole set of collected data. It will be conducted in SPSS. The other direction will be focused on multiple linear regression model in which main research question is treated as dependant variable and the rest of research questions as independent variables. It	maen value between [3-4] RQ_L1.3: Likert scale mean value between [2-3] / STCW is obsolete in some domains, including ODL RQ_L1.4: Likert scale mean value between [4-5] RQ_L1.5: Likert scale maen value between [4-5]

	Maritime University, Master's Thesis, Malmo. [3] IMO, 2010, *International Conventiono n Standards of Training, Certification and Watchkeepin g for Seafarers*. First Edition. IMO: London. [4] IMO, 2014. Maritime Education and Training. *World Maritime Day*, 21. IMO: London.	students thinking skills? RQ_L1. 5: Does ODL allow, due to your opinion, integration of formal and informal learning styles? RQ_L1.6: Do you agree that ODL fosters students' curiosity and creativity? RQ_L1.7: Do you believe that ODL can improve learning outcomes? RQ_L1.8: Do you think	disagree (1); disagree (2); neither agree nor disagree (3); agree (4) and strongly agree (5). The Word document with questionnaire will be sent via email to the respondents. After completing it, the respondents will send it back. In the case on need, responders will be kindly reminded via mail to send their responds in due time.	will derive details on mean absolute deviation, mean square error, mean absolute percent error, standard error of the regression estimate, correlation coefficient and coefficient of determinatio n. These statistics will be obtained via ExcelModule s dedicated software package imbedded into Excel. Qualitative analyses that deal with	RQ_L1.6: Likert scale mean value between [4-5] RQ_L1.7: Likert scale mean value between [3-4] RQ_L1.8: Likert scale maen value between [4-5] RQ_L1.9: Likert scale mean value between [3-4]

	[5] Zhang, W., 2017. *Assessing the Competency of Seafarers Using Simulators in Bridge Resource Management (BRM) Training*, World Maritime University Master's Thesis, Malmo. [6] Win, S., 2018. *An Analysis of Advanced Training Courses Beyond the Requirements of STCW and Applications in Myanmar*,	that introducing and adopting ODL, more extensively, will bring innovations into both teaching and learning? RQ_L1.9: From your viewpoint, shall intensive deployment of ODL be a step forward to a "digital campus"? RQ_L1.10: Do you see intensive deployment of ODL as a key enabler of MET "global e-classroom"?		words will be conduced upon the results of the previously conducted quantitative analysis in the form of the discussion.	RQ_L1.10: Likert scale mean value between [4-5] **<u>Students</u>** RQ_S1.1: Likert scale mean value between [3-4/4-5] RQ_S1.2: Likert scale maen value between [3-4/4-5] RQ_S1.3: Likert scale mean value between [4-5]

	World Maritime University Master's Thesis, Malmo.	**Students** RQ_S1.1: In which piece ODL can increase your maritime knowledge and competitiveness? RQ_S1.2: To what extent ODL can support you to reach higher digital skills? RQ_S1.3: Do you believe that ODL can foster your curiosity and creativity? RQ_S1.4: Do you believe ODL can			RQ_S1.4: Likert scale mean value between [3-4] RQ_S1.5: Likert scale maen value between [4-5] RQ_S1.6: Likert scale mean value between [4-5]

		make learning easier? RQ_S1.5: Do you consider ODL innovative and to which extent? RQ_S1.6: Do you see ODL as a path towards establishing "global e-classroom" in MET?			
RQ2: To which extent is the respondent familiar with face-to-face, blended and ODL principles and naming?	**Taxonomy** ○ **ODL** ○ **E-learning** ○ **Computer based learning** ○ **Web based learning**	**<u>Lecturers</u>** RQ_L2.1: Do you consider ODL more flexible than traditional face-to-face learning?	See above	See above	Assumptions based on preliminary search, experience and intuition: **<u>Lecturers</u>** RQ_L2.1: Likert scale

Key words: face-to-face learning, blended learning, ODL, meaning, taxonomy	○ **Cloud based learning** ○ **Blended learning** Key Ref. [1] Its Learning Inc, 2015. *Blended Learning and Learning Platforms: How You Can Start Blended Learning Tomorrow*, viewed 3 February 2020, https://www.itslearninginc.com. [2] Jeffrey, L., Milne, J., Suddaby, G., and Higgins, A., 2014.	RQ_L2.2: How convenient, from your perspective, is blended learning (combination of ODL and face-to-face learning)? RQ_L2.3: How well are you informed about similarities/differences in meaning of the following terms: e-, computer based-, web based-, and cloud-learning? RQ_L2.4: Are you familiar with the terms			mean value between [3-4] RQ_L2.2: Likert scale maen value between [4-5] RQ_L2.3: Likert scale mean value between [2-3] RQ_L2.4: Likert scale mean value between [2-3]

	Blended Learning: How Teachers Balance the Blend of Online and Classroom components, *Journal of Information Technology, Education and Research*, Vol. 13, pp. 121-140, viewed 3 February 2020, https://www.jite.org/documents [3] Jethro, O., Grace, A., and Thomas, A., 2012. eLearning and its	collaborative online learning (COIL) and "virtual engagement" ? **<u>Students</u>** RQ_S2.1: Do you consider ODL more flexible than traditional face-to-face learning? RQ_S2.2: How convenient, from your perspective, is blended learning (combination of ODL and face-to-face learning)?			**<u>Students</u>** RQ_S2.1: Likert scale mean value between [2-3/3-4] RQ_S2.2: Likert scale maen value between [2-3/3-4] RQ_S2.3: Likert scale mean value between [2-3]

	Effects on Teaching and Learning in a Global Age, *International Journal of Academic Research in Business and Social Sciences*, Vol 2, Issue 1, London. [4] Nordin, ., and Norlidah, N., 2013. Web Based Teaching and Learning Approach Usability in Institutions of Higher Learning in Malaysia, *The Malaysian Online Journal of Educational*	RQ_S2.3: Are you informed, and to which extent, due to similarities/differences in meaning of: blended-, e-, computer based-, web based-, and Cloud-learning? RQ_S2.4: Are you familiar with the terms collaborative online learning and "virtual engagement"?			RQ_S2.4: Likert scale mean value between [2-3]

	Technology, Kuala Lumpur. [5] Bauk, S., 2019. Concerning Cloud based learning at maritime studies departments in South Africa and Montenegro, *The 1st joint IMLA-IMEC-ICERS Conference*, 22-25 October, Bataan and Mania, Phillippines, 2018, p.6 (Book of Abstracts), Key speech at the Conference.				

RQ3: At which level is ODL adoption in South African MHE and training context and what is about the constrains and concerns regarding this issue? Key words: ODL, South African context, limitations, concerns	**Adoption** ○ **South African context** Key Ref. [1] Dyer, J., 2017. *Establishing Operation Phakisa From Dreams To Reality: The Future of African Maritime Education*, viewed 6 February 2020, https://www.blueeconomyfuture.org.za. [2] Maringa, T., 2015. *Assessment of Quality of Education and Training*	**<u>Lectures</u>** RQ_L3.1: At which level of adoption is currently ODL in South African maritime high education due to your knowledge/experience? RQ_L3.2: Is the number of South African maritime high education institutions, which can provide lecturers and students Internet access and computer	See above	See above	Assumptions based on preliminary search, experience and intuition: **<u>Lectures</u>** RQ3.1: Likert scale mean value between [1-2] RQ3.2: Likert scale maen value between [4-5] RQ3.3: Likert scale mean value between [4-5]

	of Seafarers in South Africa and Ghana, World Maritime University Master's Thesis, Malmo. [3] SAMSA, 2019. *Draft Regulations relating to Seafarers Education, Training, Assessment and Certification and the Safe Manning of Ships*, SAMSA Report, Durban.	labs constrained and to which extent, due to your knowledge/experience? RQ_L3.3: At which extent do you agree with the statement that students can learn faster, but lecturers have to put an additional effort to prepare e-instructional materials? RQ_L3.4: To what extent are you willing to adapt your curricular in accordance			RQ3.4: Likert scale mean value between [2-3/3-4] RQ3.5: Likert scale maen value between [2-3/3-4] RQ3.6: Likert scale mean value between [2-3/3-4]

	[4] Taslim, M., 2019. *Introduction of eLearning: Assessment and its Impact on the Fijian Seafarers*, World Maritime University, Malmo.	to the requirements of new technology and ODL? RQ_L3.5: To what extent are you willing to put extra effort to develop e-instructional material? RQ_L3.6: Are you ready to put extra effort to design computer supported assessments/tests? RQ_L3.7: Would you be able to access your ODL course(s)			RQ3.7: Likert scale mean value between [3-4] RQ3.8: Likert scale mean value between [3-4/4-5] **<u>Students</u>** RQ_S3.1: Likert scale mean value between [2-3/3-4] RQ_S3.2: Likert scale maen value

		regularly (daily or weekly) to update the content and send the announcements? RQ_L3.8: Do you have doubts when it comes to your intellectual property protection in ODL context? **<u>Students</u>** RQ_S3.1: Do you have your personal tablet, laptop or smart phone? RQ_S3.2: Do you have			between [2-3/3-4] RQ_S3.3: Likert scale mean value between [3-4] RQ_S3.4: Likert scale maen value between [2-3/3-4] RQ_S3.5: Likert scale mean value between [3-4] RQ_S3.6: Likert scale maen value between [2-3/3-4]

		(reliable) Internet access? RQ_S3.3: Are you comfortable using a computer and Internet? RQ_S3.4: Are you able to read well and follow written directions well? RQ_S3.5: Are you willing to further your studies via ODL? RQ_S3.6: Are you prepared to learn and			RQ_S3.7: Likert scale mean value between [3-4] RQ_S3.8: Likert scale maen value between [2-3/3-4] RQ_S3.9: Likert scale mean value between [2-3/3-4] RQ_S3.10: Likert scale mean value between [3-4] RQ_S3.11: Likert scale mean value

		study in ODL environment? RQ_S3.7: Do you consider yourself a responsible, disciple person, good in time management ? RQ_S3.8: Are you able to set your own schedule and complete your own work in time? RQ_S3.9: Would you be able to access your ODL course(s) regularly (daily or at least weekly)			between [3-4]

		to check the announcements? RQ_S3.10: Would you be able to maintain a schedule and complete work in ODL environment without direct supervision? RQ_S3.11: When you encounter a difficult task, would you be willing to seek assistance from the proper people?			
RQ4: How would you assess the efficiency of	**Advantages and Disadvantages of ODL**	**<u>Lecturers</u>** RQ_L4.1: Do you believe	See above	See above	Assumptions based on preliminary search,

ODL in South African context and in general? Key words: costs, energy, space, infrastructure, culture, return of investments	Key Ref. [1] Chang, F., 2001. Intelligent assessment of distance learning. *Information Sciences,*, 140, 105-125. [2] Esterhuyse, M., and Scholtz, B., 2015. *Barriers to e-learning in a Developing Country: An Explorative Study*, in "Beyond Development. Time for a New ICT4D paradigm?" (Steyn, J., and Van	that ODL is more flexible than traditional learning, since instructional materials are available at any time, from any device, which is connected to Internet and has a browser? RQ_L4.2: Do you believe that ODL enables smoother cooperation among teachers and students? RQ_L4.3: Do you believe that ODL can			experience and intuition: **<u>Lecturers</u>** RQ_L4.1: Likert scale mean value between [4-5] RQ_L4.2: Likert scale maen value between [4-5] RQ_L4.3: Likert scale mean value between [4-5] RQ_L4.4: Likert scale mean value

	Belle, J.P. (Eds.), P*roceedings of the 9th IDIA Conference*, Nungwi. [3] Jiang, Y., and Li Q., 2017. The Implication of Distance Learning in Competence Based Maritime Education and Training, *International Journal of Learning, Teaching and Educational Research*, Vol. 16, Issue 5, pp. 31-41. [4] Sadeck, O., and	assist you with time management and self-discipline? RQ_L4.4: Do you consider ODL an effective teaching method/channel? RQ_L4.5: At which piece can ODL reduce the costs of space, energy, infrastructure, and commuting in maritime high education and training? RQ_L4.6: Can ODL			between [4-5] RQ_L4.5: Likert scale maen value between [4-5] RQ_L4.6: Likert scale mean value between [2-3/3-4] RQ_L4.7: Likert scale mean value between [2-3/4-5]

	Cronje, J., 2017. A Continuum of Teacher's eLearning Practises, *The Electronic Journal of eLearning*, Vol. 15, Issue 5, pp. 396-409, viewed 3 February 2020, https://. www.ejel.org	enable access to high maritime education to the students living in rural areas? RQ_L4.7: To what extent can ODL provide access to high maritime education to those who are somehow socially marginalized ? RQ_L4.8: Do you consider ODL as a good way of knowledge transfer for seafarers' knowledge refreshment			RQ_L4.8: Likert scale maen value between [4-5] RQ_L4.9: Likert scale mean value between [3-4/4-5] RQ_L4.10: Likert scale mean value between [3-4/4-5] RQ_L4.11: Likert scale maen value between [2-3,3-4]

		and their life long learning? RQ_L4.9: Do you think that ODL requires permanent institutional technical support? RQ_L4.10: At which level shall newly developed ODL courses imply vagueness return of investment in MET high education? RQ_L4.11: Is South Africa as developing country able			**<u>Students</u>** RQ_S4.1: Likert scale mean value between [4-5] RQ_S4.2: Likert scale maen value between [3-4/4-5]

		to cover the costs of ODL development and implementation, and to provide free Internet access to lecturers and students due to your opinion? **<u>Students</u>** RQ_S4.1: Do you believe that ODL is more flexible than traditional learning, since instructional materials are available at any time, from any device, which is			RQ_S4.3: Likert scale mean value between [3-4/4-5] RQ_S4.4: Likert scale mean value between [3-4/4-5] RQ_S4.5: Likert scale mean value between [3-4/4-5] RQ_S4.6: Likert scale mean value between [4-5]

		connected to Internet and has a browser? RQ_S4.2: Do you believe that ODL enables smoother cooperation among students and teachers? RQ_S4.3: Do you believe that ODL can assist you with time management and self-discipline? RQ_S4.4: Do you think that ODL makes learning process easier?			RQ_S4.7: Likert scale mean value between [2-3/3-4] RQ_S4.8: Likert scale mean value between [2-3/3-4] RQ_S4.9: Likert scale mean value between [3-4/4-5]

		RQ_S4.5: Do you consider ODL an effective learning channel/method? RQ_S4.6: Do you think that ODL can reduce costs of space, infrastructure and commuting? RQ_S4.7: Do you think that ODL can provide opportunities for students living in rural areas? RQ_S4.8: Do you think that ODL can provide			

		opportunities for students who are socially under-represented (marginalized)? RQ_S4.9: Do you consider ODL as a good way of knowledge transfer for seafarers' knowledge refreshment and their life long learning?			