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Review

A 40-Year Bibliometric Analysis of Maritime English Research: Insights and Implications

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Abstract: This study aims to obtain a critical review of the characteristics and trends in Maritime English (ME) research over the last four decades. This study contributes to a comprehensive analysis of ME based on Web of Science and Google Scholar databases by VOSviewer software. Bibliometric indicators including trends, authors, scholarly journals, references, and keywords were used in it. Results show that ME education and ME communication are the main themes in the ME research field. The International Maritime English Conference (IMEC), International Maritime Lecturers Association (IMLA), and maritime journals affiliated with maritime universities published most of the ME research articles. Most of the productive and influential scholars and academic institutions are concentrated in Europe. Quantitative analysis is the main research method in ME. The study promotes a comprehensive understanding of ME research globally and provides valuable insights into its prospects.

Keywords: bibliometric analysis; Maritime English research; VOSviewer software; Maritime English education; Maritime English communication

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1. Introduction

Maritime transport has been carrying cargo in various parts of the globe as a pillar of global trade development [1]. More than 80 percent of the volume of international cargo trade is carried by maritime transport [2]. Transportation of cargo by sea emerges as crucial significance to delivering different items and devices required for day-to-day life as well as supplying substances, provisions, and equipment for production [3]. As shipping strives internationally, Maritime English (hereafter called "ME") has become a universal language for global maritime business and communication. ME is extremely important to the highly internationalized maritime industry. The relationship between ME and ship safety has always been one of the highlights of the International Maritime Organization (hereafter called "IMO"). The establishment of IMO aims to improve the safety of shipping from vessels. After the maritime piracy attacks around the globe, the demand for implementing tightened safety measures both at sea and ashore surged [4]. ME is a British seafaring tradition that has existed across centuries, and it is also seen as jargon used during human activity today [5]. In 1978, the International Convention on Standards of Training, Certification, and Watchkeeping (STCW Convention) defined English as an official language in the maritime industry [6]. Maritime safety is closely related to ME proficiency [3]. Indeed, the International standard of ME is a means to improve safety in shipping [7] and minimize human error in ship operations [8]. The competence of ME as one of the human factors is of vital importance for maritime safety [9]. Hence, ME research is in urgent demand for the development of ME skills and proficiency of future industrial practitioners and navigators [3].

Although some achievements have been made in ME studies, there still lacks a systematic review of ME studies, especially those based on bibliometrics and knowledge maps. To fill the research gap, our research study aimed to address the following research questions: (1) what are the characteristics of ME studies in the past 40 years?; (2) what are the key trends of ME studies?; and (3) what are the implications of the current research studies for future research directions of ME studies? In doing so, the existing bibliometric study explores the main characteristics of ME research by using publicly available databases, including Web of Science (hereafter called "WoS") and Google Scholar. As expected, we generated a thorough research study and created a macroscopic overview of the key characteristics of ME over the past four decades by quantitative analysis based on bibliometric analysis.

VOSviewer (1.6.15) was used to map the ME overall structure in the study. The study is organized as follows: Section 2 provides a literature review, and Section 3 describes the research design including data and methods used in the study. Section 4 illustrates the results in detail, including the trends, authors, scholarly journals, academic institutions, references, and keywords. Section 5 highlights the discussion, and finally, Section 6 concludes the main findings of the review and addresses the future research directions of ME studies.

2. Literature Review

ME is a division of English for specific purposes (ESP) [10] that covers "a range of academic and professional sectors, but also encompassing inter-ship, ship-to-shore and on-board communications" [11]. Tenkner [12] further elaborated that it is "the entirety of all those means of the English language which, being used as a device for communication within the international maritime community, contribute to the safety of navigation and the facilitation of the seaborne trade". Bocanegra-Valle [13] defined it as follows: "Maritime English is an umbrella term which refers to the English language used by seafarers both at sea and in port and by individuals working in the shipping and shipbuilding industry". According to the specific purpose, ME consists of "English for navigation and maritime communications, English for maritime commerce, English for maritime law, English for marine engineering, and English for shipbuilding" [13].

For over 40 years, the themes of ME are mainly focused on ME education, ME communication, and ship safety. IMO stipulates that ME courses consist of General Maritime English (GME) and Specialized Maritime English (SME) [14]. Zhang and Cole [15] proposed a "genre-based ESP curriculum development framework", which was applied to the revision of *IMO Model Course 3.17*, *Maritime English*. Pyne and Koester [16] identified that the occurrence of human communicative errors was related to cultures and languages. Vidhiasi et al. [17] conducted a qualitative study of the learning modules of *IMO Model course 3.17* and concluded that ME was the medium of instruction to teach Marine science. Silalahi et al. [18] pointed out that ME was not only about teaching language and ocean-related terms but also about cross-cultural issues. This advocates the use of FAIES (First Aid in English System) as a teaching method that emphasizes communication. Nasaruddin et al. [19] adopted situational pedagogy (CTL) to integrate knowledge with applied context by qualitative methods. According to the characteristics and requirements of online teaching and ME, Aydin et al. [20] suggested that online oral communication plays a vital role in ship-based external communication and the minimum requirements for ME training. Saray et al. [21] assessed the level of general English and ME education at the Maritime Vocational College in Istanbul, Turkey, the shortcomings of education, and measures to improve the quality of education. Ahmmed et al. [22] applied a hybrid approach to understanding the ME skills needed by Bangladeshi seafarers for them to work onboard and increase employability in the maritime sectors. Ugurcan et al. [23] analyzed ship accidents through survey questionnaires aimed at identifying the root causes of common communication problems onboard the ship and developing communication-based learning and practical assessment materials. Through corpus analysis, Silvia et al. [24] identified basic English vocabulary in ocean engineering documents, optimized maritime English courses,

and developed textbooks suitable for nautical students. Ziarati et al. [25] recognized that most accidents that happened at sea were due to communication failures. Thus, it is necessary to develop common standards for ME. Bocanegra-Valle [9] put forward that the use of ME was to reduce accidents. Poor command of ME would endanger human safety, intensify marine environment pollution, and induce numerous catastrophic incidents.

Bibliometrics allows a quantitative analysis of information on the feature and the evolution of a specific research field [26]. Price [27] was recognized as the "Father of Scientometrics". Pritchard [28] proposed the term 'bibliometrics' to replace the ambiguous term 'statistical bibliography'. Bibliometrics is an interdisciplinary research area with multi-function such as structural, dynamic, evaluative, and predictive scientometrics [29], as well as including citation analysis, co-citation analysis, bibliographic coupling using citations, and co-word analysis using keywords.

3. Research Design

3.1. Data Collection

In the present analysis, the data were downloaded from the Web of Science (WoS), Core Collection database, and Google Scholar. WoS database and Google Scholar database is as our indicators. The use of WoS is available for us to get high-quality articles to ensure the reliability of the data sources. Since Google Scholar covers key academic databases including Web of Science, Scopus, and Essential Science Indicators, it enables us to obtain articles on a large scale to ensure the reliability of the data.

Firstly, the data was searched from Google Scholar by Publish or Perish (PoP). PoP realizes Google Scholar's potential to democratize citation analysis [30]. On the PoP homepage, the "Google Scholar" option was chosen, and then, "Maritime English" was inputted in the column of "title words" in the Google Scholar query. "lookup" was clicked and 603 articles were retrieved. A total of 585 articles were valid data. Secondly, we used the following criteria when retrieving articles from the WoS Core Collection database: (1) database = WoS Core Collection; (2) topic = "Maritime English"; (3) time spans = "all year (1900–2022)"; (4) index = in WoS Core Collection, and all the citation indexes were selected. Overall, 51 articles were downloaded. The data were all retrieved on 15 December 2022.

After manually removing articles including conferences, patents, newspapers, yearbooks, dispatchings, etc., the Endnote data was exported in RIS format and then imported into VOSviwer. It adopts the ideas of literature import, word frequency co-occurrence, visual analysis, and result interpretation.

3.2. Methodology

3.2.1. The Functionality of VOSviewer

VOSviewer is a program used to construct and view bibliometric maps of authors, journals, or references based on co-citation data and to construct maps of keywords based on co-occurrence data [31]. Developed jointly by Nees Jan van Eck and Ludo Waltman, the software is freely available from Websites (see www.vosviewer.com accessed on 15 December 2022) VOS is the abbreviation for visualization of similarities, and the aim is to provide a low-dimensional visualization in which objects are located in such a way that the distance between any pair of objects reflects their similarity as accurately as possible [32]. There are three kinds of mapping approaches, namely creating a map based on network data, creating a map based on bibliographic data, and creating a map on text data.

3.2.2. The Application of VOSviewer

VOSviewer normalized the co-occurrence of high-frequency words between texts based on the idea of probability theory. The clustering algorithm of VOSviewer is mainly based on the algorithm of correlation strength.

There are three main approaches to carrying out the analysis. The first is a method of descriptive statistical analysis to reveal the current state of ME research, including the

trend of articles and network analysis of authors, scholarly journals, academic institutions, and references. The second is citation analysis and co-citation analysis, which can measure the correlation degree between two different articles. The third is co-occurrence analysis, which helps us analyze the main topic in ME research.

Nodes of different colors are used to distinguish different clustering. The closeness and similarity between subject words are reflected by the distance between nodes. The size of nodes represents the frequency of occurrence, and the higher the density, the closer and stronger the correlation.

4. Results

4.1. Publication Output and Trend

The number of academic publications on a subject or a scientific discipline is a vital indicator to measure the development trend in that research area, which reflects the change in the subject knowledge. By plotting the amount of literature over time and conducting multivariate statistical analysis, we can understand the research output and future trends in a certain field.

Figure 1 shows the number of Maritime English publications from 1979 to 2022. After removing invalid information without the year, 585 articles could be used. It shows that the current study period of ME research can be divided into three main phases. (1) Initial phase (1979–1998): The number of published papers on ME was less than 5. (2) Development phase (1999–2008): The articles published in this phase were between 5 and 10, which represents a slight growth. (3) Maturity phase (2009–2022): The research on ME increased significantly in a waveshape in this phase, with the peak reaching 56 publications in 2021. The earliest article on ME was found to be written by Weeks [33]. The book *Essential Maritime English* was submitted by Weeks to Exeter University as a thesis for the degree of Master of Arts in Language Centre of Exeter University in 1979. The book's content is about maritime conversation and phrases for sailors, and naval art and science. The most recent one was by Aeni, Nur, et al. [14], which was published in the *Journal of Language Teaching and Research* on the topic of students' needs in Maritime English classes.

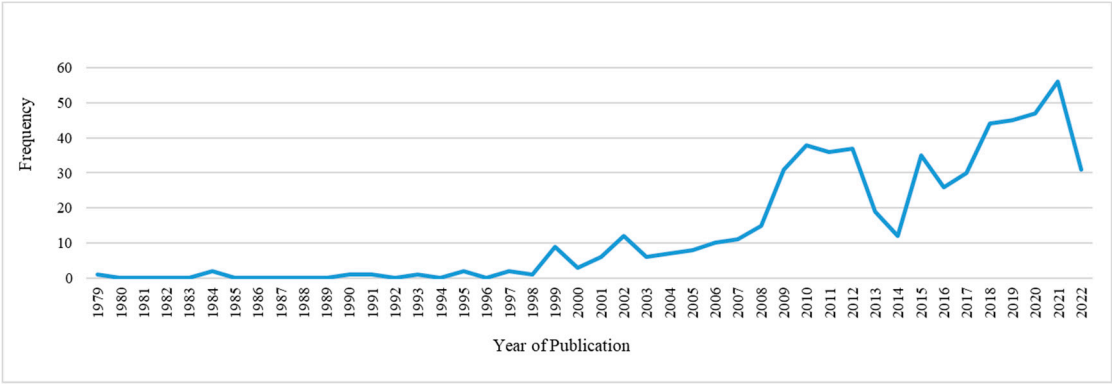

Figure 1. Number of Maritime English publications from 1979 to 2022 indexed by Google Scholar. Note: The data for this article were downloaded on 11 Nov 2022, and therefore, only two weeks of data were included in Nov.

4.2. Authors

Authorship analysis can help us identify influential authors in the ME research area and know about scholars with similar research directions and interests.

Table 1 shows the eight authors with more than five articles searching by Google Scholar. The author with the highest number of publications is Boris Pritchard (University of Rijeka, Croatia), and the author with the highest number of citations is Peter Trenkner (Wismar University, Germany). Most of the authors are affiliated with Europe; 51% to South Europe, 16% to Central Europe, 14% to North Europe, 9% to East Europe, and 9% to

Asia. In addition, B Pritchard, P Trenkner, and C Cole have close partnerships with each other with the article *Maritime English Instruction Ensuring Instructors' Competence* [34] published on *Ibérica*. The article illustrates Maritime English instructions to enrich instructors' competence.

Table 1. Top eight most productive authors indexed by Google Scholar.

S/N	Author	Number	Public. Dates	No. Citations	Country of Author	Academic Institution
1	B Pritchard	19	1999–2013	83	Croatia	University of Rijeka
2	P Trenkner	12	1998–2012	95	Germany	Wismar University
3	C Cole	10	2005–2012	61	Sweden	World Maritime University
4	C Astratinei	8	2014–2017	0	Romania	Naval Academy
5	SE Jhang	7	2011–2017	11	Korea	Korea Maritime University
6	N Demydenko	7	2010–2012	23	Ukraine	Kyiv State Maritime Academy
7	V Jurkovic	6	2015–2016	1	Slovenia	University of Ljubljana
8	A Culic-Viskota	5	2012–2022	6	Croatia	University of Split

Note: The ranking is subject to the first author without regard to the second and the third author.

Authors with articles indexed by WoS are a relative rarity in general. There are 55 authors in total, including the second author, the third author, and so on. Among them, 12 authors published more than one article indexed by WoS, as follows: Ulf Schriever (Australian Maritime College, Australia), Lidong Fan (Australian Maritime College, University of Tasmania, Australia), Si Fan (University of Tasmania, Australia), Jiangang Fei (University of Tasmania, Australia), A Culic-Viskota (University of Split, Croatia), Laura Cignoni (Consiglio Nazionale delle Ricerche, Pisa, Italy), Rita Marinelli (C.N.R.Via Moruzzi 1 Pisa, Italy), Carmen Astratinei (Mircea cel Batran Naval Academy, Romania), Ana Bocanegra-Valle (University of Cádiz, Spain), Laura Cizer (Mircea cel Batran Naval Academy, Constanta), Peter John (Jade University, Germany, Australian Maritime College, University of Tasmania, Australia), and Delia Lungu (Mircea cel Batran Naval Academy, Romania).

Author co-citation analysis (ACA) focuses on the interrelationship among authors in the literature instead of individual publications [35]. Two authors are considered to be co-cited if they appear together in the reference lists of other documents. Authors that are more often cited together are more likely to present similar subject areas or be related. This means that they have been researching similar subjects or in related areas, generating citations from other researchers in the same articles. Figure 2 describes the main clusters of co-cited authors as follows: (1) cluster 1: Bocanegra-Valle, Johnson, Cole, IMO, Hyland, Basturkmen, Bhatia; (2) cluster 2: Pritchard, Blakey, Baleghizadeh, Hutchinson, Belcher; (3) cluster 3: Trenkner, Theotokas, Ziarati, Wang, Magramo, Fan, Hymes; (4) cluster 4: Čulić-Viskota, Crystal; and (5) cluster 5: Marinelli, Miller.

4.3. Journals

Academic journals are important forums to present the latest research findings and scientific achievements. Journals as scholarly information carriers to disseminate information are critical to a research field.

Table 2 shows the top 10 active journals and the top 10 most cited journals published on ME indexed by Google Scholar. *IMEC* and *IMLA* rank first and second place, respectively, in terms of publications and citations. As shown in Table 2, IMEC, IMLA affiliated with IMO, and most maritime journals attached to maritime universities published most of the articles.

There are 41 articles indexed by WoS, which were published in 30 journals in total. According to the co-citation analysis, *English for Specific purpose* and *Maritime Policy and Management* present at least 11 citations.

In conclusion, *IMEC*, *IMLA*, *English for Specific purpose*, and *Maritime Policy and Management* are, perhaps, the most active and influential journals in the field of ME.

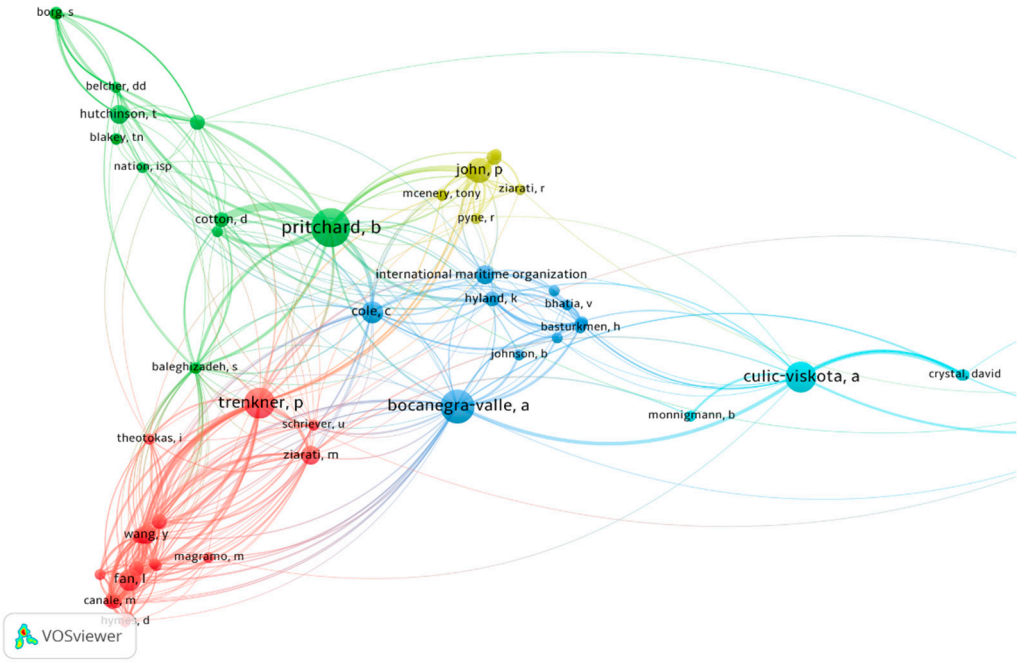

Figure 2. Author co-citation network of ME publications indexed by WoS.

Table 2. Top 10 of the active journals and top 10 most cited journals indexed by Google Scholar.

S/N	Journal Title	Number of Publications	Journal Title	Number of Citations
1	*IMEC*	58	*IMEC*	158
2	*IMLA*	15	*IMLA*	84
3	*Journal of Zhejiang Institute Communications*	10	*Literature Compass*	65
4	*Constanta Maritime University Annals*	10	*The encyclopedia of applied linguistics*	23
5	*Journal of Qingdao Ocean Shipping Mariners College*	7	*WMU Journal of Maritime Affairs*	20
6	*"Mircea cel Batran" Naval Academy Scientific Bulletin; Constanta*	6	*Ibérica*	20
7	*Journal of Shipping and Ocean Engineering*	5	*International Association of Maritime Universities (IAMU)*	19
8	*Journal of Guangzhou Maritime College*	5	*World Englishes*	19
9	*Journal of Nantong Vocational & Technical Shipping College*	5	*English Language Teaching*	12
10	*English Language Teaching*	5	*English in the European context*	12

4.4. Research Organizations

The research organization is an indicator that reflects the country's abilities in scientific research and innovation.

According to institutions in ME research indexed by WoS, 32 academic institutions have contributed more than one article, accounting for 9% of the total publications. These institutions primarily guide the development of ME. Table 3 shows the top five most productive academic institutions in terms of the number of publications. Europe accounts for all of the high-quality ME research.

Table 3. The Top five most productive institutions in ME research indexed by WoS.

Rank	Institution	Total Publication	Geographical Location
1	University of Split	5	Croatia
2	"Mircea cel Batran" Naval Academy	5	Romania
3	University of Tasmania	4	Australia
4	University of Cadiz	4	Spain
5	CNR	3	Italy

4.5. Citation Analysis

The citation of an article reflects the acceptance degree of the research, which is viewed as a significant indicator to measure the influence of a publication. The number of citations is the main factor to reflect the quality of an article. Citation is bidirectional, which covers the knowledge input and the knowledge output [36]. The references that are used in the publication are called the 'citing analysis' [36]. Other publications that use the publication as a reference are called the 'cited analysis' [36]. The number of cited articles reflects the influence, popularity, and attention received by the scientific community.

The citation quantity analysis method is to evaluate the quality of an article by the number of cited articles. Table 4 exhibits the 11 most frequently cited articles indexed by Google Scholar. The data were retrieved from Google Scholar by using PoP. The cited analysis gives the number of times that the publications have been cited by other publications. The most cited publication and the paper with the highest average citations per year are "*Toward a Blue Cultural Studies: The Sea, Maritime Culture, and Early Modern English Literature*" by Mentz, followed by '*Maritime English. An Attempt of An Imperfect Definition*' from Trenker, and '*Improving Safety at Sea and Port by Developing Standards for Maritime English*' from Ziarati. Looking at the ten most frequently cited publications, Sweden is best represented as the country of the first author with three publications, followed by Germany and Croatia with two publications. Cole is the only first author occurring thrice in the list, followed by Trenker and Pritchard twice. The most frequently cited articles are in Europe.

Reference co-citation analysis is an important means to detect the structure and evolution path of a specific domain, which can reflect the important knowledge bases of the research field. The more two publications are cited together, the more similarities between them can be assumed [36]. The concept of co-citation analysis was first put forward by Small [37]. The citing analysis gives the number of references used by the 41 publications indexed by WoS on ME culture. In total, 702 references were used, which is the total number of references. In the reference co-citation network, the importance of nodes does not reveal the high number of citations but illustrates the research themes that are closely related to ME-related research. Figure 3 shows that there are four clusters with different colors in terms of the number and weight of the nodes. Among them, the representatives are Bocanegra-Valle, A. and Pritchard, B. The article of Bocanegra-Valle, A. [13], University of Cádiz, Spain, is entitled "*Maritime English*" and published in *The Encyclopedia of Applied Linguistics.* The article defines Maritime English. The other, Pritchard, B., University of Rijeka, Croatia, has articles entitled "*Maritime English Syllabus for the Modern Seafarer: Safety-related or Comprehensive Courses?*" published in *WMU Journal of Maritime Affairs.*

4.6. Keyword Co-Occurrence Analysis

Keyword analysis uses keywords in the literature to construct a semantic map of the field. It is a quantitative approach to scientifically discover linkages among sub-fields and trace the tendency. Keywords co-occurrence analysis is used to analyze the link strength between co-occurrence keywords by studying their co-occurrence relation in numerous documents.

Table 4. Top 11 of the most frequently cited articles indexed by Google Scholar.

S/N	Cites	Per Year	Authors	Institution	Country	Journal Name	Articles	Main Topic	Published Year
1	65	7.22	S Mentz	St. John's University	USA	*Literature Compass*	Toward a blue cultural study: The sea, maritime culture, and early modern English literature	Maritime Culture	2009
2	42	2.33	P Trenker	Wismar University	Germany	*Proceedings of the 2nd IMLA Workshop on Maritime English in Asia*	Maritime English—An attempt at an imperfect definition	Overview of ME	2000
3	25	2.78	R Ziarati, M Ziarati, B	TUDEV Institute of Maritime Studies, İstanbul	Turkey	*Bridge conference, Finland*	Improving safety at sea and port by developing standards for maritime English	ME Communication	2009
4	23	3.83	A Bocanegra-Valle	Universidad de Cádiz	Spain	*The encyclopedia of applied linguistics*	Maritime English	Overview of ME	2012
5	20	1.33	B Pritchard	University of Rijeka	Croatia	*WMU Journal of Maritime Affairs*	Maritime English syllabus for the modern seafarer: Safety-related or comprehensive courses?	ME syllabus	2003
6	19	1.90	C Cole, P Trenkener	World Maritime University	Sweden	*Proceedings of IMLA 16th Conference*	The yardstick for maritime English STCW assessment purposes	ME Communication	2008
7	18	1.64	C Cole, B Pritchard, P Trenker	World Maritime University	Sweden	*Ibérica: Revista de la Asociación Europea de Lenguas para Fines Específicos*	Maritime English instruction, ensuring instructors, competence	ME Communicative competence	2007
8	17	1.21	B Pritchard	University of Rijeka	Croatia	International Association of Maritime Universities, 2004	A survey of maritime English teaching materials: a report on the current state of the art	ME teaching	2004
9	15	2.50	C Cole, P Trenkner	World Maritime University	Sweden	*Proceedings of the Twenty-fourth IMLA International Maritime English Conference*	Whither Maritime English?-2012	The future Development of ME	2012
10	14	2.33	N Demydenko	Kyiv State Maritime Academy	Ukraine	*Journal of Shipping and Ocean Engineering*	Teaching maritime English: A linguistic approach	ME teaching	2012
11	14	1.75	P Trenker, C Cole	Wismar University	Germany	*Proceedings of the 22nd international maritime English conference*	Raising the Maritime English bar: The STCW Manila Amendments and their impact on Maritime English	ME Communication	2010

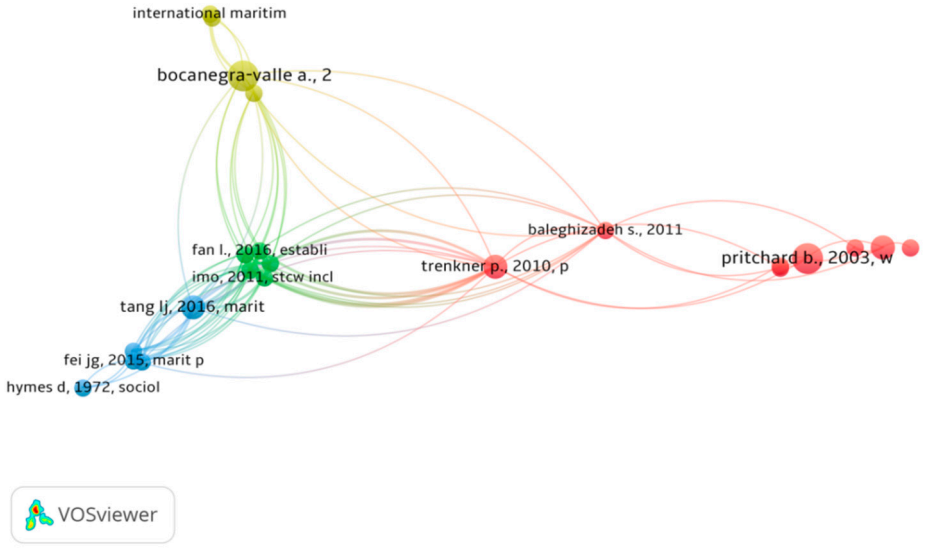

Figure 3. The references co-citation network of ME publications.

In VOSviewer, co-occurrence analysis was used to generate the keywords co-occurrence network of ME studies, as described in Figure 4. The size of the nodes and words shows the weights of the nodes. The bigger the node and word are, the larger the weight is. The distance between two nodes represents the strength of the relation between two nodes. A shorter distance generally reveals a stronger relationship. The nodes with the same color are attached to the same cluster. The keyword "Maritime English" has the highest frequency of 24. Other keywords with a high frequency include "Chinese seafarers", "communication competence", "effective communication", "maritime education and training", "ESP", "communication", "genre analysis", "labor-market", "bridge team communication", "multilingual", "CLIL", "lexical semantic databases", "corpus linguistics", and "ship".

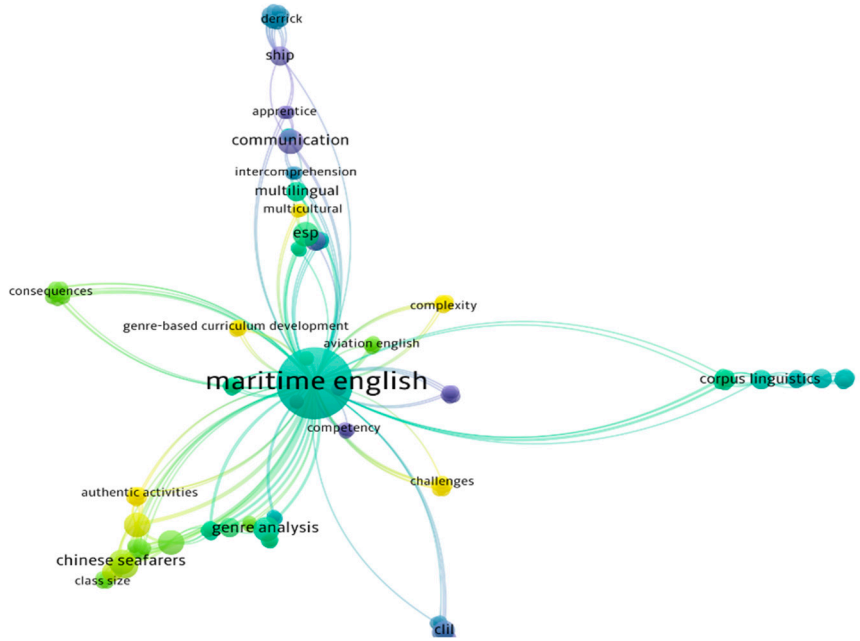

Figure 4. Keywords occurrence in ME research indexed by WoS.

The relationship between "Maritime English" and "Chinese seafarers" indicates the close correlation between Maritime English and Chinese seafarers. The relationship between "Maritime English" and "communication competence", as well as "effective communication" implies that ME requires communication competence, especially effective

communication. Pyne & Koester [16] analyzes human communicative error in the Maritime domain. Fan et al. [38] point out that Maritime English communicative competence is the top determinant for seafarers to be employed on foreign ships empirical research. The relationship between "Maritime English" and "Maritime education and training", as well as "Content and Language Integrated Learning (CLIL)" reflects that maritime education plays an important role in ME research. Fan et al. [39] reveal that English communicative incompetence of Chinese seafarers was due to the maritime English examinations system, teaching materials, teaching methods, teachers, and students themselves. The relationship between "Maritime English" and "genre analysis" indicates that ME has close relations with the genre. Zhang & Cole [15] examine the genre-based ESP curriculum development framework in the context of the revision and subsequent validation of *IMO Model Course 3.17*, *Maritime English*. John [40] creates a linguistic profile to quantify maritime language patterns and provides a quantitative model for this genre.

4.7. Term Analysis

Terms analysis can provide insight into main topics and research trends on ME. Terms were automatically extracted from the titles and abstracts of all documents in the dataset and were used to construct a map based on textual data. Terms were counted in a binary fashion, meaning that each term was counted only once per item.

VOSviewer was used to analyze and visualize the terms. First, all noun phrases were extracted from the titles and abstracts of the 585 ME publications. Terms with a general meaning, such as 'article' and 'conclusion', were not included. In VOSviewer, we chose "create a map based on a text corpus" and then created a term co-occurrence map, as presented in Figure 5. The size of the circles represents the occurrence of a term, i.e., the bigger the size, the higher the occurrence of a term in the abstracts and titles of the ME publications. The overall distance between terms provides information on their relatedness. The shorter the distance between terms, the stronger their relationship is. The relatedness of terms is determined by counting the number of times that terms occur together in the titles and abstracts. The colors are used to distinguish different clusters. As Figure 4 demonstrates, ME education (ME teaching, ME training, and ME course) occupies a great portion; ME communication is the second. STCW, competency, conference, ME technology, and its application and acquisition also attracted more attention.

4.7.1. ME Education

ME teaching occupies the majority of ME research. In ME teaching, topics on ME teaching methodology take a larger proportion. ME teaching methodology and teaching model include "problem-based learning in Maritime Education" [41], "The Students' Needs in Maritime English Class at Ami Aipi Makassar, Indonesia" [14], "Developing a model on improving maritime English training for maritime transportation safety" [6], "E-learning Maritime English course-final results after piloting stage" [42], "Maritime English Training for Non-native Speaking Mariners" [43], and "Teaching maritime English: A linguistic approach" [44].

In terms of course objectives, Cole and Pritchard [34] provide useful guidelines for Maritime Education and Training and ME instructors to ensure the instructor's competence according to the minimum maritime background knowledge and linguistic and pedagogical aspects of Maritime English instruction. In terms of curriculum development and course structure, there is a topic on "Maritime English as a code-tailored ESP: Genre-based curriculum development as a way out" [13]. On instructional design, there is a topic on "Raising the Maritime English bar: The STCW Manila Amendments and their impact on Maritime English" [45]. According to course content, "Essential English for Pilotage and Tug Assistance-Proposal for SMCP Extension" [46] and "Maritime English syllabus for the modern seafarer: Safety-related or comprehensive courses?" [47] are included. There have been a few types of research related to ME curriculum and teaching implementation, ME course evaluation, organizational form of teaching, and teaching media.

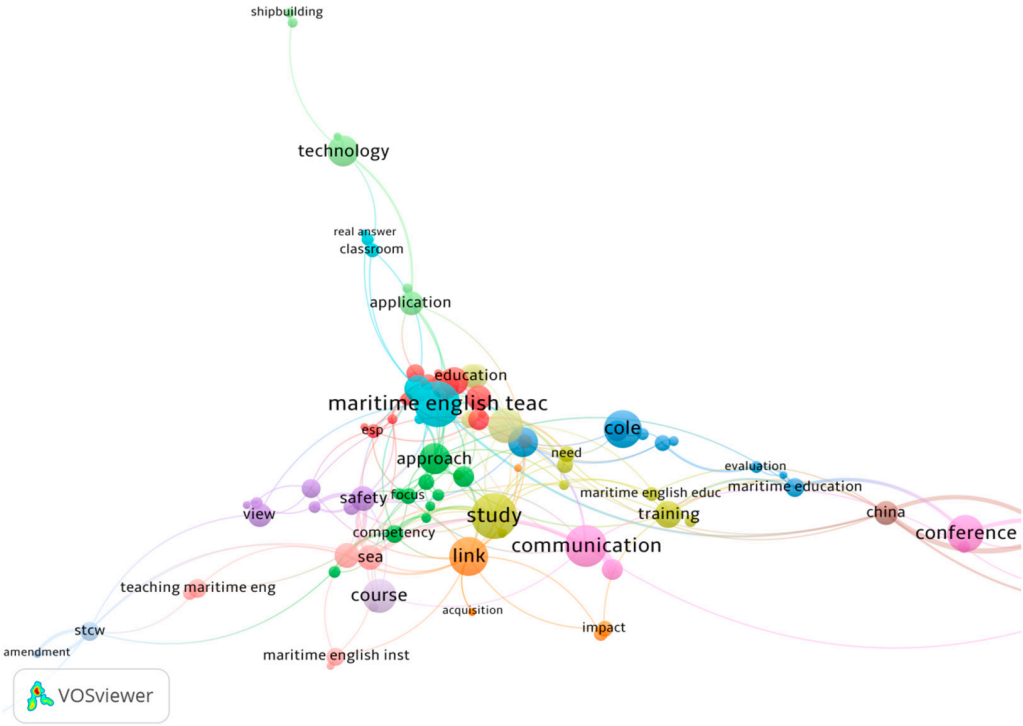

Figure 5. Terms analysis of ME articles indexed by WoS.

4.7.2. ME Communication

Effective communication and communication competence are the top priorities. Cole and Trenkner [48] propose a standard instrument to identify the ME communication performance, which helps train and test candidates to reach the STCW operational and management levels. Johnson [49] puts forward that ME is still quite essential in the global Maritime distress and safety system. Pyne and Koester [16] analyze methods and means for crew communication in the Maritime domain. John et al. [38] create a linguistic profile using quantitative linguistics for the genre of the ME discourse community, which makes a quantitative comparison between the baseline and standard marine communication phraseology. In addition, "Is Maritime English the key to solving communication problems within multinational crews?" [50], and "Maritime English–what does it communicate?" [5] are both on ME communication.

5. Discussion

5.1. Lacks the Theoretical Support of Related Disciplines

ME teaching research focuses on linguistic theory, which lacks the theoretical support of related disciplines. The research on ME teaching aims to cultivate compound talents who are proficient in professional knowledge and skills and can control ME for fluent communication [51]. It is specialized English teaching carried out mainly by colleges and universities. The theory and practice of ME teaching should also be based on the relevant theoretical research of pedagogy, psychology, linguistics, applied linguistics, etc. Moreover, it must also consider the research of professional theories to form a systematic theoretical framework for the ME course. It is important that as a field of pedagogy, the ME education research should respect and attach importance to the relevant research of pedagogy and psychology and fully absorb the advanced achievements in the field of education. It is not appropriate to have a research model and practice operation that emphasizes language but ignores education, and it is not appropriate to abandon the research of pedagogy and explore the research of language teaching [52].

5.2. Mainly Non-Empirical Research

Although theoretical exploration is important, the test of the theory in practice is also an important part of the research. The restriction of research methods on the development of ME leads to the roughness of the research on ME teaching, which makes it impossible to carry out effective quantitative research, thus greatly reducing the guiding effect of theory on practice [53]. The construction of the corpus is not comprehensive and imperfect, which also affects the integrity and scientificity of the research. In recent years, while ME scholars continue to focus on the importance of research methods for this discipline and their theoretical and practical significance, there is still a problem of the low proportion of empirical studies, which needs to be remedied by subsequent studies as soon as possible.

5.3. Few Studies on ME Teacher Education

There are few studies on ME teacher education. Modern curriculum and teaching theories emphasize the principal position of students and the leading role of teachers in the teaching process. As a special language teaching course, teachers are required to have multiple excellent theoretical knowledge and skills. A competent ME teacher needs to have the professional knowledge of a certain subject system, the knowledge of education and psychology necessary, as well as the ontology knowledge of the English language as the main information medium in the whole course implementation process. Therefore, compared with the teaching of other subjects, most teachers think that ME teaching is time-consuming and laborious because of the large amount of lesson preparation and the dual requirements of navigation specialty and language for teachers [54,55]. Research papers on ME teacher education and related education policies are relatively rare, which cannot guide teaching practice systematically and effectively.

5.4. Limited Research Content

The distribution of the research content of ME is highly uneven. The urgent need to improve seafarers' ME skills was highlighted at the 2006 meeting of the IMO Maritime Safety Committee. This is no doubt to show the international community the need to improve the ME communication ability of seafarers as the focus of ME teaching and research [56]. Attention should be paid to the cultivation of seafarers' language ability for effective communication. In addition to focusing on the cultivation of listening and speaking ability and cross-cultural communication ability, the research on the cultivation of sailors' effective communication language ability should focus on the setting of ME courses, the use of ME teaching materials, and the improvement of ME testing and evaluation system. Unfortunately, it can be seen from the above statistical data that these studies are quite lacking. This research situation is not conducive to the development of ME teaching and the training of international seafarers, and the subsequent research should focus on it.

ME belongs to ESP (English for Specific Purposes) and has quite strong professional characteristics. The STCW Convention serves as an important basis for the training and education of seafarers around the world, the navigation simulator, which is an important piece of equipment for the training and evaluation of seafaring technicians around the world, and the SMCP of compulsory courses in maritime colleges and universities stipulated by the STCW Convention, are all key contents of ME teaching. However, among the collected papers, there are few papers containing the above content.

The research on ME mainly focuses on the general rules of ME teaching, but there is little research on the characteristics of ME language. The teaching and research of ME only pay attention to the research of teaching methods but neglect the research of corpora and ME assessment test in the field of ME. As a means of teaching evaluation, the study of language testing is extremely important. Language testing is a key link in ME teaching. It not only identifies students' language ability, provides auxiliary information for them to adjust learning strategies, improves learning methods, and enhances learning efficiency, but also objectively evaluates teachers' teaching effect and provides the basis for improving teaching management and ensuring teaching quality. In addition, the results of

the language testing can help the teaching administration grasp the teaching and learning situation comprehensively and provide support for its decision making. Nevertheless, research on ME language testing is under-researched, which fails to serve the teaching practice systematically and effectively.

6. Conclusions

ME is a kind of English used for specific purposes that are different from other special purposes in English, in that the purpose of learning and mastering ME is to achieve effective communication between ship and shore, and ship and ship. Effective communication is closely related to shipping safety. According to the investigation of the IMO, 80% of maritime accidents are caused by human factors [57,58]. Among the human factors, the proportion of ship accidents caused by poor language communication or misunderstanding is larger [59,60]. The study of ME is conducive to the realization of effective communication among seafarers or maritime practitioners, which is in turn conducive to the sustainable development and safety of the maritime industry. To align with Sustainable Development Goal 11, it needs to create a safe, resilient, and sustainable maritime transport system in the future.

ME research has experienced undulating growth. Firstly, productive and influential scholars and academic institutions are mainly located in Europe. The most cited publications and papers also appeared in Europe. *IMEC*, *IMLA* affiliated with IMO, and maritime journals attached to maritime universities published most of the research articles. Secondly, according to the research contents, ME education and ME communication are the main topics in the ME research field. ME communication is closely linked to safety. Thirdly, in terms of methodology, the research generally focuses on qualitative analysis, and quantitative research is relatively scarce.

The current study falls into limitations that may become the future research direction. The data source was restricted to journal articles without reference to graduation dissertations on ME. Furthermore, the data source was limited to the title word or keyword with "Maritime English", without regard to title word or keyword with "nautical English", "marine engineering English", "navigation English", and so on. As such, inevitably, the research conclusion was not completely investigated. In subsequent research, we may include other disciplines such as oil spills, trade conflicts, and Anglo-American linguistic imperialism to contribute to a new research perspective and content.

Future research should include more graduation dissertations for better generalizability. Other types of research techniques such as co-word analysis and correspondence analysis can be incorporated to generate additional meaningful insight. Finally, other relevant research materials and archives such as marine accident reports, IMO proposals, and resolutions deserve research and may be taken into account for future research studies.

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