

# Developing Professional Linguistic Competence in Multilingual Ship Crews: A Psycholinguistic Approach

V. Zheliaskov, O. Soroka, O. Kolmykova, O. Demchenko & L. Turlak  
*Danube Institute National University "Odesa Maritime Academy", Izmail, Ukraine*

**ABSTRACT:** In multilingual crews of seagoing vessels, English functions as a lingua franca, and the security of communication depends to a large extent on the use of standardized IMO SMCPs. However, communicative failures occur not only due to insufficient language competence but also due to psycholinguistic limitations of speech processing under conditions of navigational load, attention switching, and stress. The purpose of the study is to identify psycholinguistic mechanisms that increase the risk of professional communication disorders on the bridge. The study has an integrated analytical design and is based on a secondary analysis of empirical data: the results of surveys of seafarers on the use of SMCPs and on hull-based studies of ship-based radio communications. To interpret the discrepancies between the normative model of communication and actual practice, a psycholinguistic model is applied, considering three key factors: processing load, attention switching between communication channels, and stress-induced interference. The analysis showed that the regulatory status of SMCPs is perceived differently by seafarers depending on the communicative context: they are more often considered mandatory in external communication, while they are seen as recommended in internal one. Corpus data show uneven use of protocol elements: the phonetic alphabet is almost always used, while message and exchange termination structural markers are much less used. This indicates the degradation of metacommunicative elements under the influence of operational load. The study confirms that communicative failures in mixed crews are due not only to language competence but also to psycholinguistic limitations of speech activity. A model of professional language competence of seafarers is proposed, combining language repertoire, protocol-procedural competence, and cognitive control.

## 1 INTRODUCTION

Language training, which is defined as a combination of lexical and grammatical knowledge, reading and speaking skills, and the uniformity of phrases within the framework of the Standard Marine Communication Phrases (hereinafter – SMCPs) developed by International Maritime Organization (hereinafter – IMO), is typically used to describe the issue of professional communication in the maritime domain. Simultaneously, the logic of maritime safety turns communication into an operational risk

management mechanism rather than an extra competency. In addition to transmitting information, messages on the bridge, in VHF (Very High Frequency) communication, or when interacting with a pilot also initiate and coordinate actions that have financial, temporal, and potentially critical ramifications. In mixed crews with members who speak different native languages, English serves as a lingua franca. However, consistent cognitive circumstances for perception, reaction planning, and real-time message accuracy monitoring are not guaranteed when using it as a working language. In a psycholinguistic context, the

distinction between language as knowledge and language as operational action under load is pivotal, as speech depends on constrained working memory, attention, and cognitive control resources, and is particularly affected by stress and multitasking (Canımoğlu & Yıldırım, 2023).

The IMO rules or Standards of Training, Certification and Watchkeeping (hereinafter – STCW) say that people must speak English at work and stress the need for standardizing safe phraseology for message exchange. In maritime education, this frequently manifests as an ESP-oriented (Enhanced Survey Program) Maritime English course, wherein the SMCP is portrayed as a universal solution: by standardizing the phrase repertoire, errors will be eradicated. However, survey data on how seafarers actually see and use the SMCP show that there is a lot of variation in how they understand their status and level of obligation. In particular, Farjami's (2024) findings indicate differences in the perceived status of the SMCP in external communication and onboard communication (optional, recommended, or mandatory). Öztürk et al. (2024) also note seafarers interpret requirements differently, even within a standardized system, and therefore develop their communicative strategies differently in situations where the cost of error is high.

Even more indicative is the gap between the normative repertoire and the actual use of protocol elements observed in quantitative corpus analyses and field research on routine communication. In the aggregated data set used in this study as a secondary empirical basis, a full closed loop sequence (repetition plus confirmation) is observed in only a portion of radio messages during icebreaker operations (Boström, 2021). In a pilot corpus analysis of ship–shore and VHF communication, a closed loop is observed in 58.9% of cases, while certain message-structuring markers (message markers and prowords) appear at rates of 5.8% and 3.6% respectively, despite the 100% use of the phonetic alphabet (Jurković, 2022). These findings suggest that the issue lies not in the presence of standardized phrases as training material but in the psycholinguistic conditions under which they are selected and used. The question, therefore, is which protocol elements remain stable under workload, which are the first to disappear, and why this occurs (Pauksztat, 2021).

Within the scope of this article, the research hypothesis is formulated as follows. Communicative failures in multilingual crews are caused not only by insufficient English proficiency but primarily by psycholinguistic constraints of speech processing, including processing load, attention switching, and stress-induced interference. These factors are not sufficiently accounted for in current ESP and SMCP-oriented approaches and therefore remain poorly trained as operational skills. This theory does not disprove the need for language competency but shifts the emphasis to the lack of performance conditions. The same individual may demonstrate that they are proficient in English enough to succeed in the classroom. However, the chance of making a mistake goes up a lot on the bridge, where incoming signals have to be processed, several situational parameters have to be kept in working memory, communication

channels have to be watched, and decisions have to be made all at once.

To elucidate the research gap, it is essential to underscore that the SMCP as a document is neither “deficient” nor “inadequate.” The challenge arises from the tendency of normative and instructional design to regard the SMCP as the primary focus of training, whereas the psycholinguistic conditions influencing communicative actions during stress, workload, and concurrent process monitoring are seldom represented as training tasks (Farjami, 2024). Consequently, the overarching suggestion to “enhance English teaching” is methodologically deficient. It doesn't say which risk mechanism is being talked about, which training tool is being used, what the conditions are, or what the effectiveness indicator is.

## 2 MATERIALS AND METHODS

The research design of this study is integrated and comprises two interrelated components. The first line is analytical and focuses on comparing the normative layer (IMO and STCW requirements and the SMCP logic of “standardization”) with empirical indicators of how SMCP and protocol elements are actually used in practice. The second line is psycholinguistic and aims to operationalize mechanisms of workload, attention switching, and interference as explanatory variables for the empirical gaps identified.

The empirical data set includes the following components: quantitative results of a survey study on the use of SMCP in external and onboard communication, showing the distribution of responses across the categories optional, recommended, required, and mandatory. It also includes summary statistics from corpus and field research measuring the implementation of specific protocol elements in routine communication, including the frequency of closed-loop sequences as well as markers of message completion and structuring (Boström, 2020; Jurković, 2022). A controversial section of the analysis addresses the SMCP's status as an official IMO training manual. SMCPs are typically included in maritime communication training due to their regulatory position and the lack of formal alternatives, which influences the impression of accountability for the use of Parts A and B.

The study investigates psycholinguistic risk factors using a model that combines cognitive processes and real communicative activity. Each risk is defined by four components: the speech processing mechanism, the operational parameters under which it occurs (such as load or navigation context), the manifestation as a communication error, and the measurable indicator (Turna & Öztürk, 2024; Liu et al., 2025). This strategy allows you to move from broad concepts regarding language obstacles to particular ways to teach them.

Psycholinguistic risk factors are examined here as observable mechanisms reflected in communication behavior rather than as abstract cognitive constructs. The first factor, processing load, arises when speech is integrated with radio communication and navigational control. Communication is simplified in these situations: full closed-loop sequences are utilized less frequently, protocol pieces are eliminated, or

incomplete confirmations take place. Attention switching between different communication channels (VHF, internal communication, pilot instructions, navigation monitoring) is the second factor. This can lead to response delays, errors in repeating numerical data, or the loss of part of the message after interruptions. The third factor is stress-induced interference. When time is of the essence, there is a greater chance of merging linguistic patterns, cutting messages short without finishing them, and deviating from the SMCP structure.

The regulatory status of SMCP is perceived differently by seafarers, according to research; they are frequently seen as required in external communications (ship-to-shore, ship-to-ship), while they are seen as advised in internal communications. Therefore, the research examines both the protocol's structure and the psycholinguistic elements that influence speakers' decisions to adhere to or simplify standardized communications.

### 3 RESULTS

Survey results show that depending on the communication situation, SMCP's perceived normative status varies. SMCP is necessary for contact with individuals outside the ship (ship-shore and ship-ship), according to 65% of respondents. Responses on communication on board, however, are more diverse. For many sailors, SMCP is not necessarily necessary, but rather advised or elective. This distribution shows that different operational contexts have different perceptions of the need to follow conventional phraseology. The corpus and field data demonstrate that certain aspects of the protocol are not consistently applied in regular communication (Declerck & Koch, 2022). Certain elements, such as the phonetic alphabet, appear frequently, whereas others, such as prowords, explicit closure markers, and message markers, appear considerably less frequently. Closed-loop communication is also observed only in part of the exchanges reported in the analyzed datasets.

Figure 1 illustrates the distribution of responses regarding the perceived status of SMCP in external communication. The results indicate that a notable proportion of seafarers do not regard standardized phraseology as strictly mandatory, suggesting variation in how the normative force of the protocol is interpreted in practice.

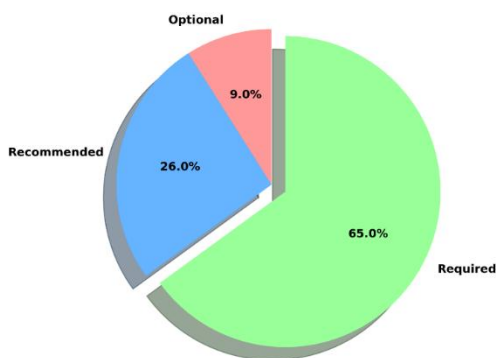


Figure 1. SMCP's status in external communications

Psycholinguistic analysis is particularly interested in onboard communication since it concentrates some of the most difficult speech production settings. These include maneuvering under time pressure, coordinating among bridge team members, switching between several information channels, and carrying out navigational tasks simultaneously. Participants in external communication typically have a certain distance from one another, which slows down engagement and permits more thoughtful message construction. However, real-time interaction and a significantly higher exchange density occur on the bridge. Processing load may reach critical levels in such circumstances, and any more codified speech requirements may be viewed as additional workload. The distribution of answers regarding the state of SMCP in onboard communication helps to demonstrate if the standard becomes a theoretical norm that is frequently disregarded in practice or whether it continues to be an operational instrument under the most difficult psycholinguistic circumstances (Figure 2).

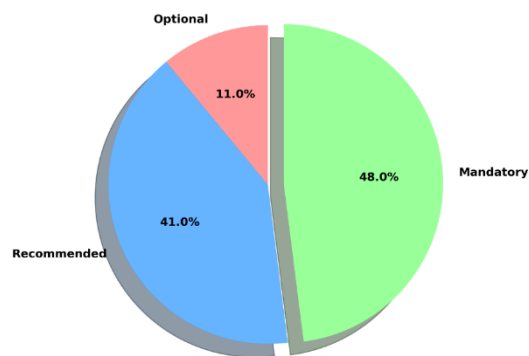


Figure 2. SMCP's status in onboard communications

The diagram demonstrates that the SMCP status is even less evident in onboard communication than it is in external communication. Nearly 10% of respondents think the standard is optional, even on the bridge, and the percentage of responses indicating mandatory (48%) barely surpasses suggested (41%). According to this distribution, seafarers may favor operational efficiency above strict adherence to defined communication structures, making protocol usage easier when multitasking.

The second empirical focus is on how certain aspects of protocolization are implemented in regular ship-to-shore and VHF communication. According to corpus research, individual protocol markers are substantially less common than closed-loop communication, which happens in 58.9% of cases. While the phonetic alphabet is regularly employed at a rate of 100%, the marker over appears in 8.9% of cases, message markers in 5.8%, and prowords in 3.6% of cases (Jurković, 2022). There is an obvious asymmetry in this design. Spelling and the phonetic alphabet are examples of elements that are rarely lost since they are simple to automate and clearly serve to prevent phonetic errors. On the other hand, components like markers, prowords, and over that call for disciplined turn closure and meta-communicative control of message structure tend to disappear more frequently.

The data on the actual use of individual protocol elements helps determine which components of standardized communication remain stable under

operational workload and which are the first to deteriorate, if disparities in how SMCP status is perceived indicate a problem with the standard's internalization. From a psycholinguistic perspective, this issue is central to understanding the mechanism of communicative breakdowns. The question is whether the problem lies in a lack of knowledge of protocol phrases or in the fact that some protocol elements require a level of cognitive control that cannot be maintained under conditions of parallel tasks. The quantitative profile of how these elements appear in real VHF communication makes it possible to examine whether a systematic asymmetry exists between automated components that are easily integrated into speech and metacommunicative components that require conscious monitoring of message structure (Figure 3).



Figure 3. Implementation of protocol elements in routine ship-shore and VHF communication

The visualization reveals a clear asymmetry in the performance profile. The phonetic alphabet is employed 100% of the time, while elements that govern the exchange's meta-communicative structure, such as message markers and over, only occur in 5.8% and 8.9% of cases, respectively. Nearly half of interactions lack full meaning verification since only 58.9% of exchanges employ closed-loop communication, a critical safety feature.

This imbalance reflects variations in the cognitive demands of protocol parts. The phonetic alphabet may be easily automated by letter-word substitution and is a local talent that doesn't need monitoring the entire message structure. Conversely, markers and over- or closed-loop communication require keeping track of turn completion, storing crucial parameters in working memory, and upholding the communicative objective at the message level. Due to competition for limited working-memory and attentional resources, these processes are more likely to worsen as processing load rises. Since most seafarers speak English as a second language, additional language-processing demands may make this risk worse in multilingual teams.

The pattern can be understood as an interaction between two levels of control from a psycholinguistic standpoint. The first level includes linguistic tasks such as vocabulary formation, pronunciation, and accurate name and number representation. The second level is procedural and includes confirmation loop closure, turn completion monitoring, communicative intent marking, and message structure maintenance. Because it depends on central control mechanisms and the coordination of several working-memory constraints,

this level is more susceptible to degradation under increased cognitive load.

This increases the risk that two participants believe they have reached agreement while in fact only part of the parameters has been aligned. In multilingual crews, this risk becomes even greater because additional effort is required for language processing. This is especially evident in communication under ELF, where the speed of decoding and the accuracy of meaning integration depend on accent, speech rate, familiarity with certain syntactic patterns and the frequency of language switching in practice.

Overall, a measurable difference emerges between how the standard is institutionally defined and how it is internalized and carried out as a behavioral protocol. Indicators of SMCP status (optional, recommended, required, mandatory) point to differences in how the normative force of the standard is perceived. The performance profile of protocol elements in routine communication shows a resource-related loss of metacommunicative components. Rather than focusing only on criticism of ESP or SMCP, it becomes necessary to propose a training framework in which SMCP are treated as a tool for reducing cognitive entropy, while psycholinguistic mechanisms required for their stable execution under workload are also trained.

## 4 DISCUSSION

### 4.1 Psycholinguistic constraints on the implementation of standardized maritime communication

The regulatory logic of maritime communication is based on reducing ambiguity. Standard phrases are intended to limit variation in wording and thereby lower the risk of misinterpretation. In training practice this principle is often simplified into the assumption that stable reproduction of SMCP automatically ensures safe interaction. At the same time, the standards define mainly the objective and the basic framework of communication rather than the psycholinguistic conditions under which it takes place. In the STCW competency description, adequate knowledge of the English language relates to the capacity to comprehend communications and information pertaining to ship operations and safety as well as to effectively communicate with other ships or shore stations (International Maritime Organization, 2025). The purpose of communication and the situations in which it is employed are described in this description, but it does not address how stable speech performance should be maintained under navigational workload, where communication is no longer an isolated language exercise but rather one task among several concurrent activities (De Bruin et al., 2025).

Different protocol components exhibit uneven stability in actual interaction, according to empirical evidence from corpus data. Elements that are easily routinized exhibit high levels of compliance in ordinary ship-shore communication, while elements that necessitate control over the message's arrangement are far less common. While closed loop confirmation only occurs in roughly half of the documented examples, the phonetic alphabet serves as a very constant component, and markers used to

indicate completion or organize the exchange occur even less frequently (Bailey et al., 2025). Speech production tends to become more cost-effective under operational pressure. Procedures that require speakers to preserve the communication plan in working memory and keep an eye on the order of protocol stages emerge considerably less frequently than forms that aid in preventing phonetic misinterpretation.

At this stage, the psycholinguistic dimension emerges as a crucial element of explanation. Central control, content preservation and updating, and information integration in the “episodic buffer” all function under constrained resources that must be divided among conflicting activities, according to recent evaluations of the multicomponent model of working memory (Hitch et al., 2025). The burden increases dramatically rather than gradually when regular operating chores on the bridge are coupled with the requirement to decode ELF speech with accent variations in real time and then create a response. Instead than focusing on the message’s procedural manifestation, some of the available resources are used to preserve the communication context and keep an eye out for potential mistakes.

Frequent switching between languages, registers, and communication channels is another source of workload for mixed crews. According to neurophysiological study, language switching enhances the need for top-down control and is linked to stronger brain components connected with control and error monitoring, as well as what researchers refer to as “switching cost” (Cui et al., 2024). Bridge officers frequently perform multiple tasks simultaneously, including receiving instructions, monitoring navigational data, and producing standardized communication. These activities compete for limited cognitive resources and become even more demanding under accident or collision risk, when communication, which represents one of the most vulnerable elements of the safety system, may deteriorate. Research by Yin et al. (2024) and Riyanto et al. (2023), who frequently discovered human factors in assessments of marine occurrences, is in line with this.

When taken together, the findings suggest that poor English competence is not the sole factor leading to communication problems at sea. Instead, they represent psycholinguistic limits that arise when the operational demand mandates standardized communication. The SMCP’s effectiveness is determined by seafarers’ capacity to retain procedural control over message structure amid multitasking, attention switching, and stressful operating situations, despite the fact that it provides an organized repertory designed to eliminate ambiguity. Confirmation loops and message architecture, two protocol components that require greater cognitive control, are more likely to fail in such scenarios. This conclusion suggests that the safety function of standardized phraseology is determined by both the cognitive context in which the phrases are employed and the phrases’ understanding.

#### 4.2 A psycholinguistic model of professional language competence for seafarers in mixed crews

The proposed concept defines professional language competence in multilingual crews as the ability to

perform communication activities safely within stressful, multitasking, and ELF interaction settings. This technique emphasizes the consistency of speech performance in operational circumstances, as opposed to traditional training, which emphasizes vocabulary, syntax, and the reproduction of standard phrases. The model includes three components that are affected by workload and stress: language repertoire, procedural-protocol competence, and cognitive control resources such as switching, inhibition, and mistake detection. This approach helps to explain why persons who have significant English ability in classroom settings may perform inconsistently in real-world navigational circumstances. The model’s components are connected to observable indicators that can be used as criteria during simulator-based training for educational purposes. The model’s structure and instances of indicators that can be used to gauge learning progress are displayed in Table 1.

Table 1. Elements of the psycholinguistic model of operational indicators and professional language proficiency

Model component	Psycholinguistic content	Operational indicators in simulation and training
Linguistic Repertoire (ELF or Maritime English)	Decoding speed, accuracy of meaning interpretation and stability of key terminology	Reduction of clarification requests, accuracy in repeating numbers, courses and distances, and a decrease in semantic shifts in message relay
Procedural-Protocol Competence (SMCP, closed-loop communication)	Automated message structuring, intent marking, turn completion, and meaning verification	Proportion of closed-loop communication in messages; stability of structural markers; compliance with protocol steps under time pressure
Cognitive Control Resource (switching, inhibition, monitoring)	Ability to maintain communicative goals during task switching, conflict control, error monitoring	Decreased error rates under switching situations, stable accuracy during extra navigational tasks, fewer protocol failures, and shorter response times during channel switching.
Stress-Induced Modulation (interference)	Impact of stress on attentional allocation, utterance planning and error monitoring	Maintaining message structure under time constraints; less condensed responses without confirmation; protocol stability in collision risk circumstances.

Table 1 shows that SMCP competency is redefined rather than abandoned in this approach. Although the standardized repertoire is thought to be a strategy for lowering cognitive entropy, it only works when trained control is present under workload. The focus of schooling changes as a result. The goal is now to replicate sentences as action with a specified structure, temporal profile, and quantifiable safety criterion rather than as text.

Instead of being offered as a substitute for current standards, the application of this approach in maritime academies should be connected to current courses and competency criteria. A convenient starting point for integrating a psycholinguistic viewpoint into lesson design is provided by the fact that IMO Model Course 3.17 already included simulation of VHF

communication for distress and urgency signals among the anticipated training activities (International Maritime Organization, 2015). Programs can modify the training approach while still adhering to current standards thanks to this integration. In addition to language output, simulation should be used to develop the stability of protocol performance under cognitive stress, including attention switching, situational parameter maintenance in working memory, and error monitoring.

### 4.3 Training implications of psycholinguistic model

Multilingual crews and the possibility of misunderstandings with possibly hazardous outcomes are the reasons for the need for standardization (International Maritime Organization, 2001). Secondary study of empirical data reveals that certain protocol aspects are more stable in normal ship-shore interactions, while others are less common. According to corpus research, the phonetic alphabet is constantly used in ship communication, however message markers are used extremely infrequently (Jurković, 2022). These findings suggest that training should not be framed simply as vocabulary expansion but as the development of stable procedures for performing communicative actions under navigational workload, when attention and control resources are limited.

IMO Model Course 3.17 includes VHF communication simulations as part of training in message comprehension, accurate recording of critical details and correct reporting of messages at different levels of complexity (International Maritime Organization, 2015). This element of the course makes it possible to introduce psycholinguistic components into a standard ESP and SMCP program without changing the regulatory framework, while shifting the internal logic of training. The phrase is no longer practiced as a piece of text to be reproduced but as an action carried out under time pressure, with switching between communication channels and with the closed loop maintained as a safety mechanism.

Table 2 presents a generalized training framework that can be integrated into simulator-based sessions or classroom activities with VHF role-play scenarios when a simulator is not available. Each module indicates which psycholinguistic mechanism is being trained, which protocol-related outcome is expected, and how it can be quantitatively recorded in the assessment.

The proposed framework does not challenge the SMCP and does not place psycholinguistics outside the existing standards. On the contrary, it considers standardization a tool for reducing cognitive entropy. At the same time, it introduces what is often missing from typical ESP/SMCP courses: systematic training of cognitive control under load expressed through measurable procedural indicators. For this reason, assessment within this approach becomes meaningful not when a student merely “knows the phrase”, but when they are able to perform the protocol consistently in situations of attention switching without losing critical message parameters.

Table 2. Psycholinguistically Oriented Training Framework (connection between SMCP and control mechanisms under operational load)

Training module	Psycholinguistic objective	Operational training task	Quantitative outcome criterion	Regulatory reference
1. SMCP as a “safety procedure” rather than a “text”	Reduction of processing load through structural standardization	Practicing standard VHF exchanges using fixed steps: contact → working channel → message → confirmation → closing	Proportion of complete exchange cycles; proportion of correct closings	SMCP: requirements for accuracy and clarity (International Maritime Organization, 2001)
2. Closed-Working loop as a core safety mechanism	memory support for retaining message parameters and error monitoring	Repeating key parameters (course, distance, time) with explicit confirmation by the addressee	Proportion of complete closed-loop; proportion of correct readbacks	Empirical vulnerability of the protocol: uneven use of elements in routine SSC (Jurković, 2022)
3. Attention switching between channels (bridge, VHF, pilot)	Training attention switching without loss of meaning	Scenario with controlled interruptions: channel change, new instruction, parallel task	Response delay; number of meaning losses; proportion of omitted protocol steps	STCW: ability to understand and communicate safety-related information in English during operations (International Maritime Organization, 2015)
4. Stress and time pressure	Prevention of stress-induced interference	Short “emergency windows” in the scenario (collision risk / time pressure) requiring protocol compliance	Change in the proportion of closed-loop exchanges under pressure; increase/decrease in missed confirmations	Human factor in maritime incidents (Hatlas-Sowinska & Wielgosz, 2022; Nævestad et al., 2023)
5. ELF variability (accent and speech rate)	Reducing interference through training of cognitive control and monitoring	VHF audio segments with variable accents; tasks for accurate recording and reproduction of parameters	Accuracy of recording numbers/coordinates; number of clarification requests; proportion of errors in critical parameters	SMCP as a shared code for multilingual crews (International Maritime Organization, 2001)

According to Hatlas-Sowinska and Wielgosz (2022), the percentage of marine events related to human error varied significantly between 2019 and 2022. This variability supports the notion that safety depends on both performance circumstances and knowledge. As a result, it's critical to examine SMCP usage and protocol

elements in light of operational communication concerns. Communication failures that might directly result in problems or delay timely corrective action include inaccurate parameter transfer and missed confirmations. Longitudinal trends in human-error statistics provide an essential measure of safety stability in operating environments characterized by workload, stress, and time restrictions (Gabadava & Hu, 2025; Yin et al., 2025).

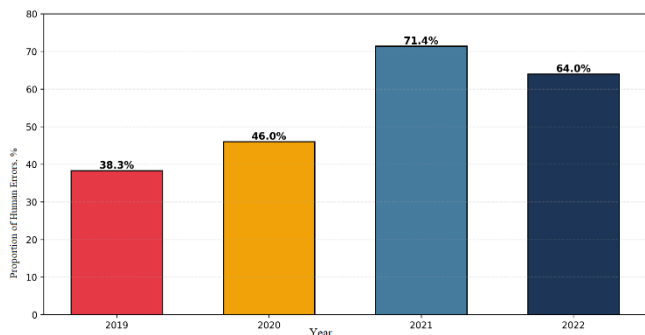


Figure 4. Human errors as the causes of maritime incidents

Figure 4 shows that, although its percentage varies, human error continues to be a significant contributing factor in maritime accidents. This variance suggests that, in addition to training, the operational conditions under which activities are carried out influence safety outcomes. Increased operating strain and uncertainty may have contributed to the very high level seen in 2021 (71.4%). Cognitive resources are depleted more quickly in instances of increased workload, unpredictable schedules, reduced personnel availability, or external interruptions, increasing the probability of errors in a variety of operational areas, including communication.

These findings indicate that language education cannot be limited to steady classroom environments. The capacity to maintain protocol performance despite time limits, stress, and task switching should be considered when evaluating competency. As a result, training components dealing with stress exposure and attention switching should be seen as essential rather than optional components of professional development. As a result, enhancing communication safety requires more than simply improving English proficiency; it also requires integrating language training with cognitive training that considers communication as an operational activity with limited cognitive resources (Zhou & Jiang, 2023). The risk typology presented in Table 3 reflects this approach by linking psycholinguistic mechanisms with observable communication failures.

Risk in mixed crews frequently results from circumstances when communication must function as a procedure under workload, rather than only from a lack of English. Because of this, SMCP cannot be viewed as a one-size-fits-all solution that eliminates communication errors. Evidence from a review research demonstrates that depending on the situation, practitioners' perceptions of the standard's status also differ. This variation raises the possibility of interference and meaning-related errors and has an impact on how consistently the protocol is followed (Farjami, 2024).

Table 3. Typology of psycholinguistic risks in bridge team communication in mixed crews

Risk type	Psycholinguistic mechanism	Typical communicative manifestation	Empirical indicator in the data	Training countermeasure
R1. Protocol erosion under load	Processing load and task competition	Omission of structure markers; shortened responses without turn completion	Low proportion of message markers in ship communication (Jurković, 2022)	Automation of the VHF exchange structure as a procedure; training of a "minimal safety step set"
R2. Closed-loop breakdown	Working memory limitations and reduced monitoring	Repetition without confirmation or confirmation without accurate repetition	Uneven distribution of closed-loop across message types (Jurković, 2022); low proportion of the ideal cycle in ship-to-ship communication (Boström, 2020)	Training readback as a core safety mechanism; assessment of the proportion of complete cycles
R3. Channel switching with loss of meaning	attention switching and switching of cost	Response delays; addressee shift; errors in parameter reconstruction	Increased need for top-down control during errors or switching (Cui et al., 2024)	Scenarios for top-with controlled interruptions; training retention of key parameters
R4. Stress-induced interference	stress-induced interference	Mixing of templates; increased ambiguity; omission of protocol closing	Context of the high contribution of the human factor to incident causes (Hatlas-Sowinska & Wielgosz, 2022)	Short "stress windows" in the simulation; monitoring protocol stability under pressure
R5. ELF variability and mutual interference	L1/L2 competition and conflict control	Increase in clarification requests; errors in numbers/coordinates; ambiguous formulations	Different status of the SMCP among practitioners as an indicator of uneven internalization of the standard (Farjami, 2024)	Training accurate decoding of critical parameters with different accents; standardization of "critical slots" in the message

## 5 CONCLUSION

The article demonstrates that even in situations where English serves as the primary working language, professional communication safety in mixed crews cannot be reduced to the general level of English competence. Secondary investigation of empirical data

reveals that actual ship-shore communication protocol components are executed in an unequal manner. While parts that call for metacommunicative control of message structure are far less common, some components stay largely unchanged. Additionally, the data demonstrates that practitioners understand the standard's status differently even within an SMCP-oriented approach. The consistency with which the protocol is applied in practice is affected by this variation. All things considered, the results validate the hypothesis. In addition to lexical or grammatical limits, psycholinguistic constraints of speech processing under workload, attention switching, and stress-induced interference are the main causes of communicative failures in mixed crews.

The study creates a psycholinguistic model of the professional language proficiency of seafarers. According to this concept, competence is defined as the combination of language repertoire, procedural-protocol competence, and cognitive control influenced by workload and stress. A training structure that can be included into maritime education without deviating from current norms is also suggested in the article. The SMCP is still the standard communication code, but in accordance with the tools outlined in IMO Model Course 3.17, training is extended to cover attention management, control procedures, and the stability of protocol performance during VHF communication simulations. This strategy also complies with the STCW's mandate that officers communicate safely and navigatively in English.

There are a number of limitations to this study. The empirical material is secondary and depends on information gathered using various techniques and in different circumstances. Because of this, more testing in a simulator-based quasi-experiment carried out within a particular maritime education institution is necessary for the suggested model and training framework. Time pressure, channel switching, and task variety might all be controlled with such a setup. Additionally, it would enable the recording of closed-loop performance, the accuracy of crucial message parameters, and the use of message markers. However, there is methodological justification for this article's initial use of secondary data. It facilitates the establishment of operational metrics that may subsequently be investigated in primary experimental research and aids in connecting the normative design of communication standards to the real behavior of speakers.

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