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Traineeship students and risk prevention on board merchant ships: risk factors and effects on their health.

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ABSTRACT

The question of occupational hazards in the maritime field is of vital importance, especially for those starting their externships on board. This paper focuses on this issue and aims to analyse the occupational risks faced by students during their external placements at sea, identify the main hazards and risks to which they are exposed and propose prevention and control measures to minimise them.
It is important that students starting their external placements on board receive adequate training on the occupational risks associated with the maritime environment and the prevention and control measures necessary to minimise them. It is also necessary that shipping companies and those responsible for safety on board provide adequate personal protective equipment and ensure that all necessary safety measures are complied with to guarantee a safe working environment on board.
By conducting surveys and interviews, mainly with students, but also with recently graduated officers, we can get an insight into the daily situation of hundreds of bridge and engine students doing their academic and professional internships on ships of different types.
Analysing occupational risks, identifying hazards and proposing appropriate prevention and control measures can help to minimise accidents at work and protect the life and health of maritime workers.
Inadequate conditions in the workplace can lead to the development of risks that compromise the health of the worker.

1. Introduction.

As defined by the World Health Organisation (WHO)" [1], health is: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

The worker seeks to cover his or her needs when carrying out a job, this has positive effects such as obtaining money and feeling fulfilled as a person, however, work can also have negative effects on health if it is not carried out in the right conditions to maintain physical, psychological and social wellbeing. For this reason, two very important concepts must be taken into account: occupational risk and working conditions. According to the Law 31/1995, of 8 November, on the prevention of occupational hazards, in article 4 it defines:

1. "Occupational risk" means the possibility that a worker may suffer a particular harm arising from work. In order to classify a risk from the point of view of its seriousness, the probability of the injury occurring and the severity of the injury shall be considered together".

2. "Working condition" means any characteristic of the work which may have a significant influence on the generation of risks to the safety and health of the worker. Specifically included in this definition are

(a) The general characteristics of the premises, installations, equipment, products and other tools existing in the workplace.

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(b) The nature of the physical, chemical and biological agents present in the working environment and their corresponding intensities, concentrations or levels of presence.

(c) The procedures for the use of the aforementioned agents which influence the generation of the aforementioned risks.

(d) All other characteristics of the work, including those relating to its organisation and organisation, which influence the magnitude of the risks to which the worker is exposed". [2].

Therefore, in order to complete this work, surveys and interviews have been carried out with all the students who are doing their curricular and extracurricular internships, in order to find out what the most common occupational risk factors are.

2. Objetives.

When performing our study, we set out to develop the following objectives:

- To identify the most common risks to which trainees could be exposed during their stay on board merchant ships.
- To identify the different occupational risk factors affecting trainees on board merchant ships.
- Recognise the most unfavourable conditions for trainees on a merchant ship.

3. Background.

Before getting into the subject, it is important to mention that article 41 of the Spanish Constitution states that "the public authorities shall maintain a public social security system for all citizens, which guarantees sufficient social assistance and benefits in situations of need" [3].

This health insurance is compulsory, financed by workers' and employers' contributions, and covers a wide range of benefits such as assistance in the event of illness, retirement, unemployment, temporary or permanent incapacity for work.

The Instituto Social de la Marina (ISM) is a public business entity in Spain that is responsible for providing social protection and health care services to maritime workers and their families. It was created in 1911 and reports to the Ministry of Transport, Mobility and Urban Agenda.

The services offered by the ISM include medical, dental, psychological and social assistance, as well as training and education programmes for maritime workers and their families. It is also responsible for the management of pensions and social benefits for maritime workers, as well as their protection and social security.

The Social Marine Institute has a network of medical and welfare centres throughout Spain, as well as a fleet of maritime ambulances for emergency care at sea. It also offers training and education programmes for workers in the maritime sector, with the aim of improving their quality of life and social welfare.

In short, the Instituto Social de la Marina is a public entity whose main objective is to provide social protection and health care to maritime workers in Spain and their families.

Fom the above analysis, it can be concluded that despite the huge efforts made by previous studies to point out the seaport efficiency determinants, the relationship between some factors and technical efficiency is still regarded as unclear and require further investigations.

3.1. Occupational risk prevention.

Occupational Risk Prevention (ORP) in the maritime field is of vital importance due to the nature of the work carried out in this sector, which may involve risks to the safety and health of workers.

Occupational hazards in the maritime sector can range from injuries due to sudden movements of the ship, falls into the sea, accidents due to handling heavy loads, to risks arising from the operation of machinery and navigation equipment.

To prevent these risks, appropriate safety and prevention measures are necessary. These include inspections and preventive maintenance of equipment and machinery, the implementation of safety protocols for loading and unloading manoeuvres, the use of individual and collective protection equipment, training in safety and prevention of occupational hazards, among others.

In addition, it is important that maritime workers have access to adequate medical and health care services in the event of suffering any type of work-related injury or illness.

In the case of Spain, the company's duties include compliance with Law 31/1995, of 8 November, on the prevention of occupational hazards [2] and paying for the minimum health and safety measures for its workers, whether material or sanitary.

But not only companies have duties, workers have to comply with certain health and safety measures that the corresponding company has complied with according to the regulations so that there is no fraud on the part of its workers.

3.2. Trainees on merchant ships.

In order to obtain the Second-Class Merchant Navy Pilot professional card, in addition to having a degree in Nautical and Maritime Transport and being 18 years of age, a 12-month period of embarkation as a deck and bridge student must be completed in order to be able to take the professional suitability test. On the other hand, students of the Marine Technologies degree must meet the same requirements, completing a combination of 12 months of training, consisting of a 9-month period of embarkation as an engine student; on ships with a power equal to or greater than 750kw, and a period of on-the-job training in a workshop of 3 months to obtain the title of Second-Class Engine Officer of the Merchant Navy.

Article 56. Content, development and conclusion of the tests. R.D. 269/2022, of 12 April, [4] regulating Merchant Navy professional certificates and certificates of competency, mentions that "The suitability tests will assess the degree of participation and use shown by the candidate during their periods of embarkation, in the performance of the functions of the professional certificate and card for which they are applying, as well as the acquisition of the competencies attributed to said certificate in the corresponding sections of the STCW code [4].

According to R.D. 269/2022, of 12 April, [4] which regulates the professional qualifications and competence of the Merchant Navy, in article 44. Nature of the position of student "Students shall be considered as officers and shall appear as such on the crew list, with the designation of "Bridge and deck student officer", "Engine student officer" ...". [4]. This article mentions that trainees shall not form part of the minimum safe manning.

The trainees who are to carry out their training on board a merchant ship must fulfil certain conditions which require:

"to be in possession of a certificate of proficiency in basic safety training, to have a valid medical certificate of physical fitness, to have obtained one of the student certificates issued by the university teaching centre certifying academic training on all subjects and competences of the corresponding sections of the STCW code. In addition, the seafarer's identity document and the maritime navigation book must be available, the student must be covered by accident insurance in the contract policy, which must specifically state the shipowner as the policyholder and the student as the insured, and the duration of the contract per embarkation period" [4].

All of the above is reflected in article 42: Conditions for the embarkation of students of the present R.D. 269/2022, of 12 April, [4] which regulates the professional qualifications and competence of the Merchant Navy.

Considering the requirements and documentation necessary for the embarkation of students, the following is a detailed explanation of the factors and potential occupational risks that students may suffer during their work experience on a merchant ship.

3.3. Occupational risk factors on merchant vessels.

There are different risk factors that may appear in an accident at work, which may arise as a one-off occurrence or as an occupational disease that is gradually generated as a result of the constant and daily performance of work duties. Although accidents at work can be found in all areas of work, the merchant navy is one of the professions that entails the greatest risk, due to its inclement weather, work in the engine room, holds or work on decks.

These accidents or occupational diseases can occur either in safety conditions or in workplaces and/or work equipment. When we refer to workplaces, we mean spaces, installations or ladders and when we refer to work equipment, we mean machines, tools, transport equipment, etc. On a ship there are many places where an accident at work can occur, e.g. in enclosed spaces. In order to enter an enclosed space, measures must be taken to avoid the loss of human life due to the atmosphere that can occur in these enclosed spaces. The IMO in Resolution A.1050 (27) adopted on 30 November 2011, [5] sets out Recommendations concerning entry into enclosed spaces on board ships.

In terms of environmental conditions, the damage associated with an occupational hazard could be derived from:

Physical agents; such as noise, radiation, vibrations, temperature, lighting. An example of an occupational hazard caused by physical agents could be hypoacusis or deafness caused by noise. This is an occupational disease established in Royal Decree 1299/2006, of 10 November, [6] which approves the table of occupational diseases in the Social Security system and establishes criteria for their notification and registration.

As far as chemical agents are concerned, an example could be poisoning, which is quite dangerous as serious poisoning could cause immediate death. In oil tankers we find pressure and vacuum valves, these valves allow the escape of toxic vapours and for this they must be placed at a stipulated height during construction.

And finally, biological agents. An example of an occupational hazard caused by such an agent is the famous case of Covid-19. R.D. 463/2020, of 14 March, declaring a state of alarm for the management of the health crisis situation caused by COVID-19 and the measures contained therein, as well as those established in the successive royal decrees extending the state of alarm, have constituted the basic regulatory framework of the regulations adopted to deal with the emergency caused by the pandemic. COVID-19, a disease caused by infection with the SARS-CoV-2 virus, is an urgent notifiable disease, in accordance with the provisions of Royal Decree 2210/1995 of 28 December [7] creating the national epidemiological surveillance network.

Ergonomic conditions are both physical and mental. Therefore, occupational ergonomics tries to improve and facilitate the employee's work so that he/she is less likely to suffer a physical accident such as incorrect posture when handling a load or to develop a mental problem such as stress or anxiety due to having too much workload, information or responsibility. "The Maritime Labour Convention, 2006 ("MLC, 2006") sets minimum standards of work and living conditions applicable to all seafarers working on ships flying the flags of countries that have ratified it" [8]. Real examples of physical ergonomic hazards are cargo handling. In the maritime fishing sector, serious risks can be observed from awkward postures, pushing and pulling with the application of forces and pressure neuropathies.

Due to the National Institute for Safety and Health at Work (INSST), several Technical Prevention Notes (NTP) have been elaborated, but more studies and research should be carried out on the prevention of the risks that may occur to a worker.

Psychosocial conditions are conditions that can be found in a work situation, in this case in the maritime field, and are directly related to the organisation of the work, its social environment, the performance of the task and have the capacity to affect the development of the work and the health of the employee. There is a certain similarity with ergonomic conditions in the mental factor. A more current and famous example is the psychosocial risk caused by stress, which may be related to working conditions or the quality of the work, apart from the fact that the crew member or student had some previous expectations about their position and did not meet their expectations. In the professional environment they are those that affect the ideology and principles of the company.

4. Methodology.

The method of analysis to detect which is the most common risk factor among trainees is the mixed research method, since the survey collects quantifiable data, but also collects the experiences of the respondents, which also provides qualitative information.

This survey was conducted online via the Google Forms survey platform (see Annex I), with completely voluntary and anonymous participation, using media such as social networks. In addition, we have tried as far as possible to be as inclusive as possible when addressing both the male and female gender, being sufficiently objective in the elaboration of this work.

The idea was not only to have the testimony of the students but also that of other crew members, for which the survey is accessible to any public in the maritime field (seamen, officers, etc.) as a way of obtaining data that will allow us to get even closer to the daily reality of life on board.

An analysis has been carried out by means of computer tools in which all the cases of the four risk factors are compiled in order to have a total of each occupational risk condition, and then to analyse and verify from the data obtained which is the most predominant.

5. Results and Discussion.

A total of 80 people took part in the survey of trainees on board merchant ships at Spanish universities, of whom 22.5% were female and 77.5% male. As we can see, men make up three times the number of women on board, although this is something that in recent decades can be considered a real achievement, given that until very recently the number of female officers on board merchant ships, at least of Spanish origin, was very small, if not practically non-existent. The first female officers would arrive mainly from the 1980s onwards, after the voting of the Spanish Constitution in 1978. After this, the nautical schools, which depended on the Ministry of Transport, would become dependent on the universities at the beginning of the 90s, turning these courses into higher degrees, necessary to be able to opt for professional merchant navy qualifications. Since they became university degrees, the number of women joining nautical studies (bridge or engine sections) has continued to grow, and it has become increasingly common to find not only female trainees but also female officers on merchant ships.

With these results obtained from our survey, data has been collected from the Universidad de La Laguna on graduates and it has been observed that from the academic year 2016 to 2019 there has been a constant growth on the part of the male gender and increasing and decreasing intervals for the female gender. In general, an average of 70% of men and 30% of women tend to finish their nautical studies, although this ratio decreases slightly when it comes to obtaining an internship on board in the case of women, so it is necessary to continue working in this direction in order to achieve a greater labour insertion of women in the maritime field.

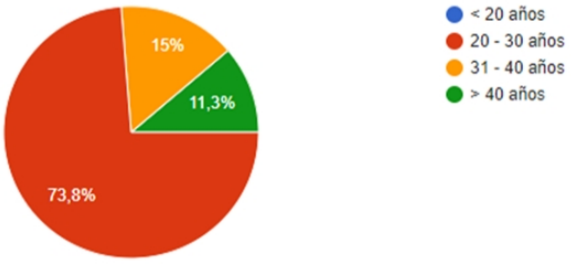
Table 1: Students Graduated by Academic Year.

	Hombres		Mujeres		Total
Año de Egreso	n	%	n	%	n
2013/14	18	69,2%	8	30,8%	26
2014/15	31	67,4%	15	32,6%	46
2015/16	32	80,0%	8	20,0%	40
2016/17	26	72,2%	10	27,8%	36
2017/18	36	63,2%	21	36,8%	57
2018/19	50	79,4%	13	20,6%	63
Total general	193	72,0%	75	28,0%	268

Source: Fundación General de la Universidad de la Laguna.

In addition to the participants there was an age range with the highest participation between 20-30 years old with a percentage of 73.8%. This is due to the fact that some of the respondents had previously completed a higher level training cycle in the maritime-fishing field, so when it comes to accessing the internships they are usually older than the students who go directly to university from the secondary school. It should also be mentioned that we usually find the case of students coming from Vocational Training, who already have a background as skippers and, in order to improve their professional opportunities, they join these degrees "late", which means that their external placements are carried out at an older age than those graduates coming from the secondary school.

Figure 1: Age group.



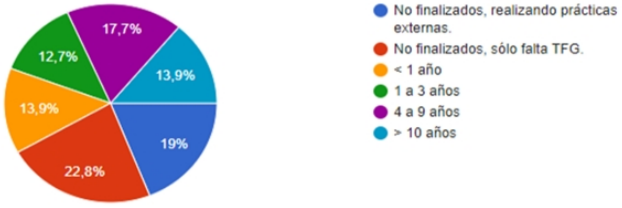
Source: Authors.

It is important to emphasise that almost 75% of the students doing external placements are between 20 and 30 years of age, if we take into account that the desirable age to finish the degree is 22 - 23 years, most of the students on placements are in the average, if we take into account that those in vocational training tend to be older, at least two years older than those in baccalaureate when accessing the degree.

As we can see in the following graph, to the question: How long ago did you finish your Bachelor's degree studies, almost 40% of those surveyed are doing an external work placement or are only completing their TFG before finishing their studies. Another almost 25% have completed their studies in the last three years, so the data obtained will give us a good idea of the recent experience of these students.

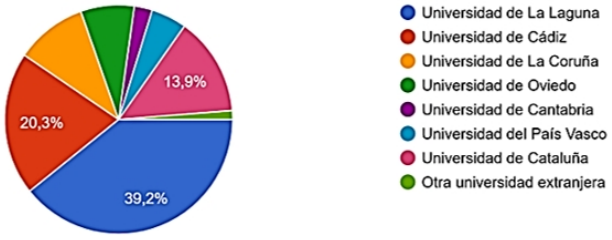
When asked if they had any other additional formal education or training, the majority, almost 70%, came from the baccalaureate. The number of students coming from Vocational

Figure 2: Degree finalization.



Source: Authors.

Figure 4: University of origin.

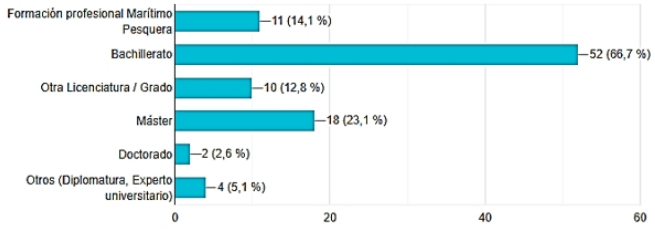


Source: Authors.

Training barely reaches 15%, but in recent years, the number of students coming from these studies has grown, above all due to the limitations that they often encounter when carrying out their professional work, limitations in GT or in kW of the vessels that they can steer with their original qualification. There is a significant number, more than 10% of respondents who have another higher qualification, which is also often the case, when students who do not find a job (at least satisfactory), often opt for one of the nautical qualifications. Almost 25% already have a master's degree, which is necessary to continue their professional career as captains or chief engineers. This is due to the fact that they normally enter the shipping companies with undergraduate degrees or the old diplomas and after many years in these companies, when it is time to promote them, as they do not have the academic qualifications to do so, they remain "stagnant" in their positions, often being overtaken by professionals with less experience who do have a master's degree. On many occasions, the shipping companies "force" these more experienced graduates to obtain a Master's degree.

It is striking that some of them even have a postgraduate degree, which is not easy to see and is often done with the future objective of seeking a position ashore in university teaching or to improve their CV.

Figure 3: Previous education of the students.



Source: Authors.

We have sent our survey to all the students that we could who are sailing, although students from the seven nautical university schools in the country have participated, most of the participants in order correspond to the Universidad de La Laguna.

Of the total number of participants, more than 70% are either trainees or already working for the shipping company on board, almost 10% have opted for shore-based jobs and almost 20% report being unemployed, which can be due to multiple factors.

For example, it is becoming more and more difficult to find a student placement, at least in Spain. The Asociación de Navieros Españoles (ANAVE) subsidises shipping companies to enrol student trainees through agreements with universities; previously this was not the case and the shipping company had to cover the costs of "training in practice" for student officers, which made it very difficult to find a ship. With ANAVE's encouragement, more shipping companies are now taking on board students with agreements (for this to happen, the student must have some kind of relationship with the university), although other shipping companies still maintain a policy of only hiring trainees who have graduated. The fear on occasions of not being able to find a placement once the academic degree has been obtained, in order to meet the requirements for obtaining the professional qualification, means that many students delay the end of their studies in order to maintain the link with the university and, therefore, be eligible for an internship agreement that will allow them to complete the mandatory period of embarkation in order to obtain the professional qualification.

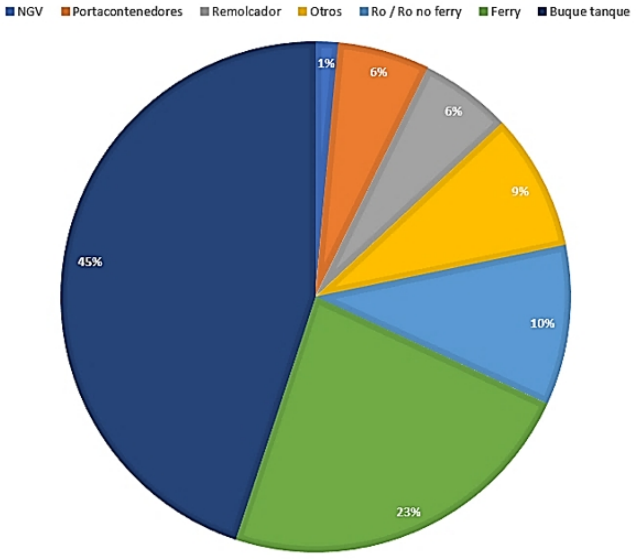
The majority of those surveyed belong to the bridge section with almost 90% and the rest belong to the engine section, this is a reflection of the reality that is experienced in the study centres, where the number of students who opt for the bridge degree is higher and much lower for the engine section; However, we do not really know why this is the case, as when it comes to professional opportunities, shipping companies, due to the shortage of engineers, demand this type of graduate, and it is not difficult for them to be offered a job where they have done their internships. At the moment, to give us an idea, shipping companies in general are looking for engine students and there are not enough students to cover this demand.

5.1. Working environment analysis.

In this part of the survey, we would first like to see what the working environment is like for the respondents. First of all, we have asked about the type of ships where they have done their internships. The types of vessels on which the trainees have been working with the highest percentage are tankers (45%), followed by ferries (23%) and Ro/Ro (10%). As we can see, the majority of students do their work experience on ships that pose a greater risk to human life, at least potentially, although the safety measures and protocols tend to be greater on these ships (at least in theory).

In the following graph "Type of work experience contract", it can be seen that 51.1% have direct work experience contracts with the company, 31.1% have a curricular agreement through

Figure 5: Type of ship.



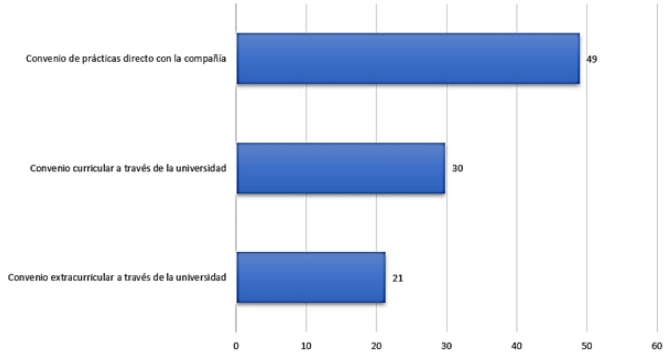
Source: Authors.

the university and lastly, 22.2% of students have an extracurricular agreement through the university. Therefore, the number of students on internships with and without an agreement through the universities is practically 50% in each case.

In R.D. 882/2020, of 6 October, which regulates the direct granting of subsidies to the Asociación de Navieros Españoles (ANAVE), to provide traineeships for Merchant Navy students during the 2020 budget year. [10] Article 1 states that "The purpose of this Royal Decree is to regulate the granting of direct subsidies, on an exceptional basis and for reasons of public, social and economic interest, aimed at supporting, in the 2020 budget year, the completion by merchant navy bridge or engine trainees of the mandatory embarkation periods for the awarding of second merchant navy pilot and second engine officer certificates.

The beneficiaries of these subsidies will be the Asociación de Navieros Españoles (ANAVE) and the shipping companies belonging to it that provide the ships and the means necessary for the students' embarkation to take place" [10].

Figure 6: Contract Type.

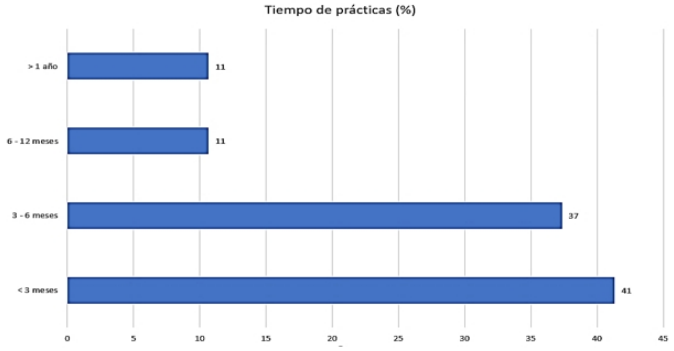


Source: Authors.

In the following graph, 80% of these students have not completed more than 6 months on board, 41% have done less than three months of work experience; 37% have done three to six months of work experience; the remaining 20% have done more than 6 months of work experience. This is interesting, above all because of the information that can be provided by these students who have just started, in many cases for the first time, a "job" in an environment that poses a high risk to human life.

It should be noted that Real Decreto 269/2022, of 12 April, [4] which regulates the professional qualifications and competence of the Merchant Navy in Article 39 stipulates that "No more than 2 continuous months in which the vessel has been berthed, anchored, dry docked, in a shipyard or in any other circumstance in which it has not sailed" [4] will be admitted as a period of embarkation; This is of great importance in order for students to be able to complete the period of embarkation required to obtain their professional qualification as soon as possible.

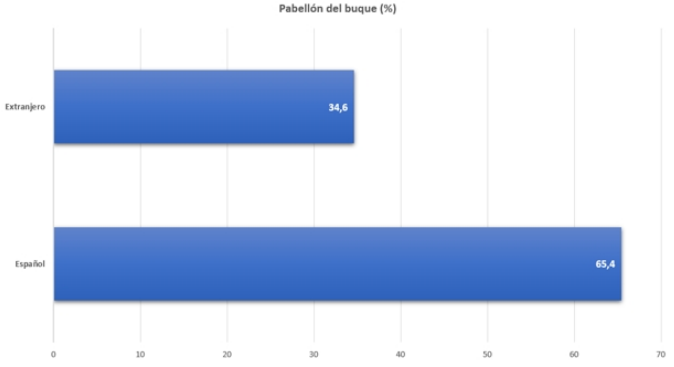
Figure 7: On-board practice time.



Source: Authors.

The following graph shows the type of flag of the vessels on which the students do their internships, almost 2/3 of the students do their internships on Spanish flag vessels while only 1/3 of the students do their internships on foreign vessels.

Figure 8: Students sailing on a foreign-flagged vessels.



Source: Authors.

The next graph we have tried to see if there is any difference between the different schools in terms of whether their students do their internships on Spanish or foreign flag vessels. We can

see that, by schools, there are two clearly differentiated groups, the first being Cadiz, Coruña and Cataluña, where almost half of the students who do work experience do so on foreign-flagged ships, and the other half being the rest of the schools, where this percentage is practically half. We would not know why this trend is due to this, although it is true that it would be desirable for students to do more work experience on foreign ships, as these are courses with a marked international character.

Figure 9: Students sailing on a foreign-flagged vessels according to university of origin.

Source: Authors.

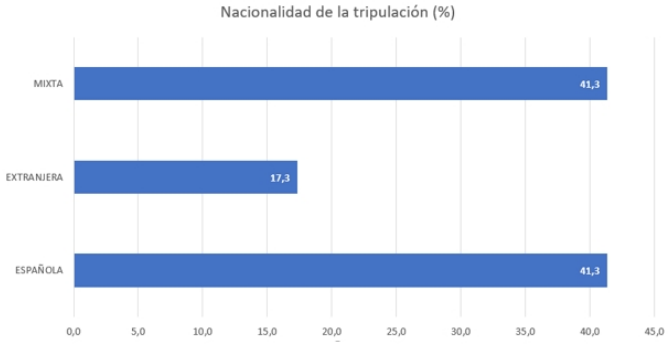
In this sense, practically all the ships where the students carry out training courses fly a flag of convenience, mainly Cyprus, which accounts for more than 50% of the cases, followed by Malta, Manila, etc... with the only exception of Portuguese-flagged ships, but this does not even reach 10%. Article 38. Periods of embarkation on foreign flag vessels, of Royal Decree 269/2022, of 12 April, [4] which regulates the professional qualifications and competence of the Merchant Navy, stipulates that "Periods of embarkation may be carried out on merchant vessels flying the flag of any State party to the STCW Convention, which comply with the conditions of gross tonnage, power and type of navigation required for each allocation of the corresponding professional card" [4].

One of the most important handicaps that Spanish students tend to have when "going out into the world" is their lack of command of languages, mainly English, which is the usual working language on board ships, especially in the case of mixed crews (a particular nationality mixed with others). The students surveyed encountered ships with crews of either entirely Spanish nationality or mixed nationality (in the case not in question, Spaniards with any other nationality), with just over 40% of each type of crew encountered by those surveyed. The number of students who have sailed on vessels with a totally foreign crew is reduced to 17.3%.

Following on from the previous question, we also asked about the language normally used on board. Most of the respondents said that they had done internships where the main language was Spanish in 68% of the cases and 28% spoke English, which they used regularly during their working days.

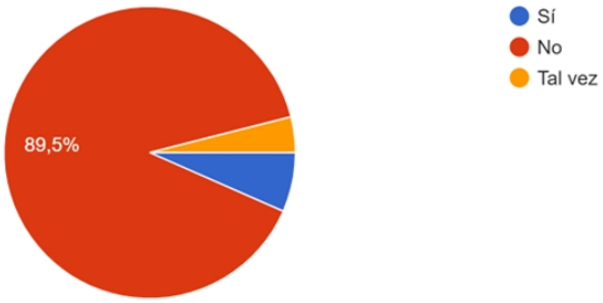
It is worth mentioning that Royal Decree 269/2022, of 12 April [4], which regulates professional qualifications and competence in the Merchant Navy, in Article 87, point 4, establishes that: "Every member of the crew of a Spanish ship must be able to communicate effectively in the working language on board". Article 88 of the same Royal Decree, in point 1, states that "The working language on Spanish ships is Spanish. However, English may be declared as the working language for the purposes of Chapter V of the SOLAS Convention. When the working language is English, all plans, documents and checklists to be completed shall include translations into English" [4]

Figure 10: Crew origin.



Source: Authors.

Figure 11: Problems with the language at work.



Source: Authors.

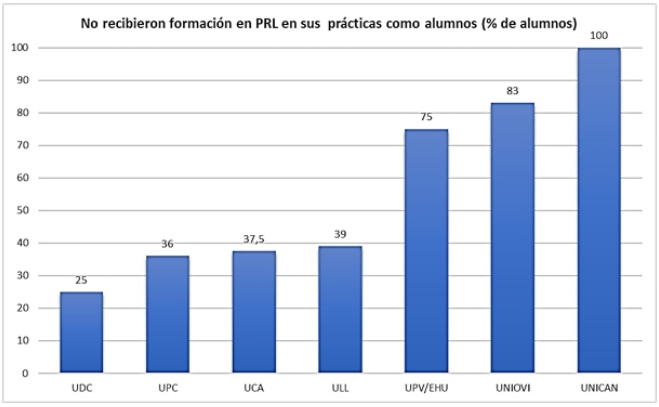
As can be seen in the graph below, 89.5% have not had any communication problems with the crew due to language, which means that the stipulations of articles 87 and 88 of Royal Decree 269/2022, of 12 April, regulating the professional qualifications and competence of the Merchant Navy are fulfilled, while 6.6% have had problems and 3.9% have sometimes had communication problems due to language on board.

Given that we are interested in knowing the occupational risks faced by students during their embarkation period, the first question asked in the survey seems obvious and it is whether they have received training prior to embarkation on Occupational Risk Prevention? 56.4% of respondents have received pre-boarding training on Occupational Risk Prevention while 43.6% have not received any pre-boarding training. On reviewing the answers, we see that, in the same university, there are students who indicate that they have received such training, while others indicate the opposite, and this is also the case

in all schools, so it is more likely that the students are referring to the company where they are doing or have done their work experience; especially because the curricula currently in force ensure specific training in occupational risk prevention on board. Therefore, we could be faced with the very important issue of OHS training, which is regulated by law and which is apparently not being carried out in a high percentage of cases.

If we analyse these data according to schools, we can find the following graph.

Figure 12: OHS training for students when they start their internships.



Source: Authors.

We can see that there are very disparate differences in this respect, but it is worrying that, with the exception of the UDC, such a large number of students do not receive OHS training from the shipping company when they start their work experience on board. In some cases, for example, students have told us that when they start their work experience they have to sign a document stating that they have received training in Occupational Risk Prevention, but this training does not become effective until several weeks or months later, although new students, in order to keep their position as students on board, sign this document knowing that they must have received the training beforehand.

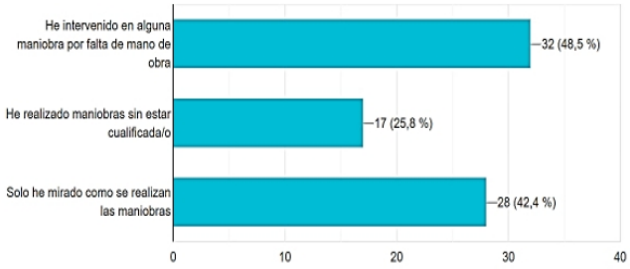
5.2. Occupational Risks on Board Ship.

We will now show the results obtained from our survey related to the questions we asked the participants in reference to the existence of risk situations on board ships that may affect them directly as learners.

5.2.1. Risk due to psychosocial conditions.

These conditions are very important as they are closely linked to the mental well-being of the crew member. One of the questions in our survey refers to the trainees' duties in their traineeship, where they are asked whether they have carried out manoeuvres or operations on board due to a lack of manpower. Although the trainee officer is not there to replace the work of any member of the ship's crew, almost half of the respondents stated that they had taken part in manoeuvres and operations

Figure 13: Intervention of trainees in manoeuvres due to lack of sufficient manpower or crew.



Source: Authors.

because there was insufficient manning on the ship, as shown in the graph below.

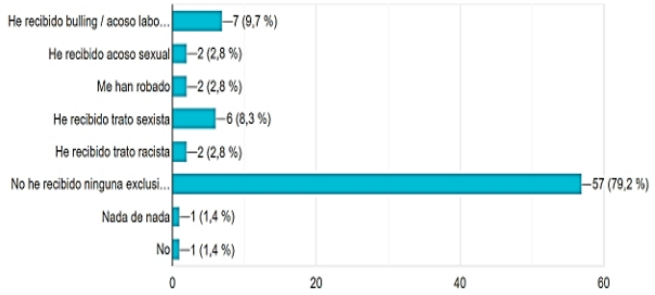
Perhaps the most worrying aspect of all this is that a quarter of students feel that they are not qualified for operations of this type, which puts at risk not only the safety of the students themselves, but also that of the people around them.

It should be mentioned that in R.D. 269/2022, of 12 April, which regulates the professional qualifications and competence of the Merchant Navy, [4] in Article 44. Nature of the student's position, in point 2, "students shall not form part of the minimum safe manning" [4] however, many shipping companies do not take this into account and think that the student is just another worker, when in reality they have conditions that do not make them comparable to the contracted personnel of the manning. At the other extreme, 42.4% of trainees state that they do not actively participate in the manoeuvres and operations, acting as mere observers, which is not desirable in order to develop the competences established by the IMO STCW convention.

In the area of interpersonal relations with other crew members, when asked if they "have had major problems with other crew members", it is noteworthy that almost 80% of the students have not had any major problems with other crew members, which could be classified as mistreatment, exclusion, etc.... almost 10% reported having had problems of harassment at work, a value similar to those who reported having suffered sexist treatment by other crew members; which are values that can be considered important, as the incorporation of women as officers on ships has become more and more normalised in recent decades, which undoubtedly must have favoured these results. Fortunately, treatment that can be considered more serious, such as sexual harassment, theft by another crew member or racist treatment, each account for almost 3%, which added together implies almost 10% of significant problems of trainees with the crew. This all depends on multiple factors, which if we wanted to study in depth could become almost endless.

Analysing the data obtained, sexist treatment has always been suffered by women and 75% of the time on foreign-flagged ships with foreign or mixed crews. With regard to harassment at work, it is suffered more by men than women, and not only by students, but also when they have reached higher positions in the hierarchy, with contracts as first or second officers. In some cases, respondents do not only suffer from one of these isolated

Figure 14: Report of problems with the crew.



Source: Authors.

episodes, but harassment at work may be accompanied by other behaviour such as sexual harassment, sexist treatment or racist treatment. This occurs mostly on foreign-flagged vessels with foreign or mixed crews, although there are cases, the fewest, on Spanish-flagged vessels with national crews.

Preparing this survey, questions were left open-ended so that participants could share their experiences during their shipment related to any of these occupational risk factors. One of the conditions they were most affected by was psychosocial conditions.

All those who experienced some form of mistreatment or psychological harassment by other crew members were asked if they reported it, of which 63.6% did not report it because many felt that it was not necessary or that these acts were serious enough, which can go against the student and can lead to these behaviours escalating if they are not dealt with in time. In general, students are the weaker party, and it is important for traineeship supervisors to be aware that such situations may arise, feeling threatened and intimidated by the bully, which is a fairly common mistake as it goes against the trainee's own health, apart from the fact that silence is quite a dangerous factor as it may end in something much more important. tragedy. Finally, 36.4% did notify their superiors or company managers.

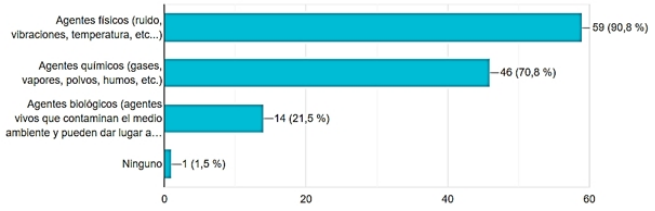
An important question is whether, once these incidents were reported, the managers took any kind of action. Of the 36.4% of participants who had a problem and decided to report it, we can see in the graph below that only almost 30% of the cases did the superiors take the corresponding corrective measures, although in 70% of the cases the officer in charge or the person responsible did nothing and let it pass, which is a tremendous negligence on the part of these people. It is vitally important that action is taken in these cases by the shipping companies and that this type of behaviour by crew members is prevented.

5.2.2. Risk due to environmental conditions.

Another type of risk that can be encountered on board are those related to environmental conditions. Firstly, we find ourselves in a hostile environment and secondly, we may be transporting, storing or simply in contact with substances, materials or in environments that may pose a risk to our departure.

As can be seen in the graph below, we have grouped the risks arising from environmental factors into physical, chemical or biological agents. We asked the respondents to what type of risks derived from environmental factors they may have been exposed to. The majority of those surveyed, more than 90%, reported having been exposed to physical risks (vibrations, temperatures, noise, etc.), second place went to risks associated with chemical agents, with just over 70% of cases (vapours, dust, smoke, etc.) and in last place were risks due to biological agents, which affected just over 20% of students. In short, we can affirm that to a greater or lesser extent, these types of factors are the ones that pose the greatest risk to trainees, and not only to them, but also to the rest of the crew.

Figure 15: Environmental factors.



Source: Authors.

Recently, during the Covid-19 pandemic, clearly a biological agent, global containment and quarantine measures were also extended to shipping companies and ships. Much of the fleet, especially those engaged in passenger transport, had to stop and crews were mostly sent home. Other ships were unable to change crews on a regular basis and the campaigns became longer, also for the trainees on board. As time went on, some basic supplies and goods became scarce on board the ships (we have testimonies of female trainees who had problems getting intimate hygiene products, as they calculated the supplies for the campaign and the campaign took too long, others for example report that thanks to using products such as menstrual cups they did not have so many problems in this regard). Most of the trainees who were relatively close to home were sent home, others who sailed with international companies had their return delayed. All in all, the measures taken by the shipping companies and the isolation of the crews meant that only 4% of the trainees were infected with Covid on board the ships, which is very positive as the shipping companies have taken safety measures and 96.1% were not infected during their on-board training.

In the last year, shipping companies have again increased the demand for trainees, which was drastically reduced as mentioned above during the confinement, while maintaining protective measures to prevent trainees returning from their holidays from infecting the rest of the crew.

5.2.3. Risk due to ergonomic conditions.

In the following section we assess the risks to which trainees may be exposed due to ergonomic conditions. The following graph shows that 41.4% of those surveyed answered that they have worked more hours on duty than those stipulated in the MLC 2006 Agreement.

It should be remembered that in Royal Decree 269/2022, of 12 April, which regulates the professional qualifications and

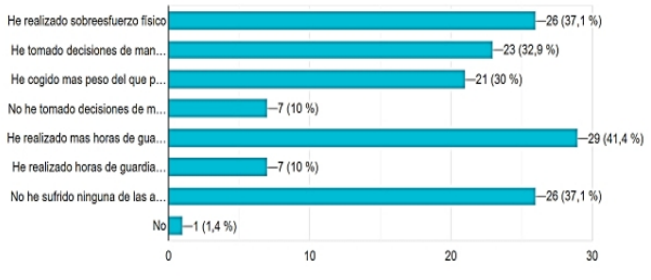
competence of the Merchant Navy, Article 47. Periods spent on board performing navigational and bridge watchkeeping duties in port, engine and radio-electronic watchkeeping, paragraph 1, [4] states that "navigational and bridge watchkeeping in port shall mean the time spent by the deck and deck officer in charge of the watch at sea or in port for at least eight hours out of every twenty-four hours; engine watch shall mean the time served as engineer officer in charge of a watch at sea or in port on a ship with or without a continuously manned engine room for at least eight hours in any twenty-four hours; and radio watch shall mean the time served as radio officer in charge of a watch with duties in connection with the radio communications service for at least eight hours in any twenty-four hours" [4].

As a result of non-compliance with Real Decreto 285/2002, of 22 March, [11] amending Real Decreto 1561/1995, of 21 September, [2] on special working days, with regard to work at sea, Article 17. Rest between working days, in point 2, section a) indicates that "between the end of one working day and the beginning of the next, workers shall be entitled to a minimum rest of eight hours. This rest shall be twelve hours when the ship is in port, this being understood as the time when the personnel remain ashore or on board of their own free will, except in the case of the need to carry out loading and unloading operations during short stopovers or work for the safety and maintenance of the ship, when it may be reduced to a minimum, except in cases of force majeure, of eight hours" [2].

This is undoubtedly a very relevant factor because in addition to not complying with the regulations, it is damaging the physical and mental state of both the student and the officer in charge of the ship's watch.

Of these risk factors derived from ergonomic conditions, 37.1% have been physically overexerted, 37.1% have suffered none of the above, 32.9% have made decisions quickly and effectively under pressure, 30% have taken on more weight than they can carry, 10% have not made decisions quickly and effectively under pressure and finally 10% have worked unsupervised on-call hours.

Figure 16: Risk factors in ergonomic condition.



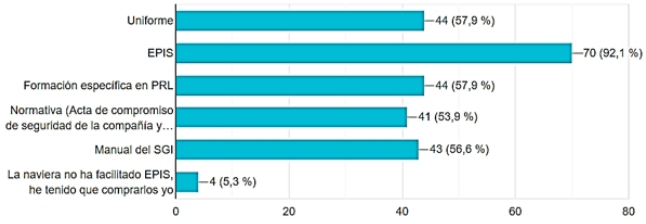
Source: Authors.

5.2.4. Safety conditions.

Safety is one of the most important issues to be safeguarded on any ship, not only for the trainees, but for the entire crew and passengers. Safety measures on board are regulated at international level, mainly through the provisions of the IMO SOLAS (Safety of Life at Sea Convention). Within the individual safety measures, the employer is obliged to provide his employees with Personal Protective Equipment, they must also receive a minimum training in occupational hazards and familiarise themselves with the workplace area, inform them about the regulations and provide them with the company's Integrated Management System Manual (IMS).

In the survey carried out regarding the risk factors of safety conditions, 92.1% answered that the shipping company provided Personal Protective Equipment (PPE), 57.9% provided them with uniforms and another 57.9% provided them with training in occupational risk prevention, 56.6% provided them with the manual (SGI), 53.9% provided them with the regulations (Act of commitment to safety in the company and MIT) and, finally, 5.3% did not provide them with the equipment. 6% provided them with the manual (SGI), 53.9% provided them with the regulations (company safety commitment act and MIT) and, finally, 5.3% did not provide them with personal protective equipment and they were forced to buy it by their own means.

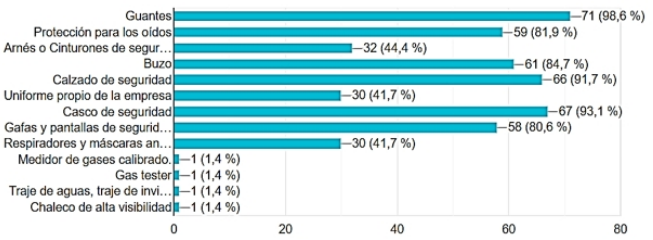
Figure 17: Equipment provided by the shipping company.



Source: Authors.

We also wanted to ask what type of PPE is provided by the company to the trainees. The following graph shows the personal protective equipment provided by the company to the trainees during their on-boarding. The materials provided are mainly: gloves, followed by safety helmets, safety shoes, a diver, ear protection material, safety goggles and screens, safety harnesses or belts, the company's own uniform, and finally respirators and masks to prevent inhalation of dust and gases.

Figure 18: EPIS provided by the shipping company.



Source: Authors.

The 86.7% of those surveyed agreed that the company had provided them with safety materials in accordance with the position they occupy and equivalent to the activity assigned to them, while 6.7% stated that they were not satisfied with the PPE provided by the company because they were not in accordance with the position and the activity they carry out, and

finally 6.7% doubted whether or not the materials provided by the company were correct or not.

They also stated that the Personal Protective Equipment (PPE) was mainly provided by the 1st Bridge / Machinery Officer in 77.3% of the cases, 14.7% were provided by the 2nd Bridge / Machinery Officer, and finally 8% were provided by HR.

When asked who is the person responsible for safety on the ship where they are doing their training, we can see that in almost 65% of cases the person responsible for the safety of the ship is the first officer, 40.8% say it is the captain, and 10.5% say it is the second officer, which does not make much sense to offload this responsibility onto a second officer, although it depends on many factors. It is true that safety on board is the responsibility of the entire crew, to a greater or lesser extent, although it is these officers who are responsible for its coordination.

One of the first actions to be taken by students when they board the ship for the first time has to do with familiarising them with the safety measures, so the officer in charge must accompany them on a "safety walk". 90.9% of those surveyed said that they had done the safety briefing immediately after boarding, which is very positive, but 9.1% did not do it. It should be stressed that "All crew members are familiar with their specific duties and with the devices, installations, equipment, procedures and characteristics of the ship that are relevant to perform such duties in normal and emergency situations" [4], this paragraph is found in Article 80. Obligations of the shipowner and master in point 1.e) of R.D. 269/2022, of 12 April, [4] regulating the professional qualifications and competence of the Merchant Navy.

Respondents were also asked whether they participate in the inspections of the ship's safety elements. The results obtained show that 92.2% participate in the ship's safety inspections, while 7.8% do not participate, although we must consider that in general this is a task that is entrusted to deck personnel and not to engine personnel.

The respondents were asked if they had the feeling of being in a risky situation the first time they did their internship. The results obtained show that 26% stated that they did not feel safe in a risky situation, while 74% did feel safe when boarding. It is very striking that a quarter experienced this feeling of being exposed to risk. It is true that lack of experience is often a determining factor in this sense, and it is only after a few weeks that students have become sufficiently familiar with the ship, which may have a significant influence on their response.

Out of curiosity, and given that this is going to be their responsibility in the future, we asked the respondents if during these inspections they had found any type of defect, deficiency or non-conformity in the ship's safety equipment. The results obtained show that in 50% of the cases deficiencies were found in the ship's safety elements, which is quite a significant number of non-conformities, but we must bear in mind that the amount of equipment and materials is so large that it is normal that many times they present a fault, due to their location, for example in the open air, or due to inadequate handling. Ideally, this information should be passed on to the company so that appropriate measures can be taken. However, there are cases such as those reported in a testimony, where the extinguishers did not comply with the regulations despite having been inspected by an external company, and it seems that this was due to the fact that the captain and this company had some kind of agreement underhand, which was lucrative for both, being precisely highlighted by a student, who would experience situations of harassment at work because of this.

Of the participants in this survey, 51.2% stated that the emergency signs and symbols were deficient. Both fire extinguishers and fire hydrants (BIE) 26.8% indicated that they were defective. Lifebuoys and lifeboats have 22%. Self-contained breathing apparatus (SCBA) with 17.1%. Survival suits with 14.6%. Public address systems with 12.1%. Alarms and life jackets with 9.8%. Fire detection equipment and Liferafts with 7.3%.

In R.De. 1215/1997 of 18 July 1997, establishing the minimum health and safety requirements for the use of work equipment by workers, Article 3. [12] General obligations of the employer in paragraph 1 mentions that "The employer shall take the necessary measures to ensure that the work equipment made available to workers is suitable for the work to be carried out and suitably adapted to it, in such a way as to guarantee the safety and health of workers when using such work equipment.

Where the safety and health of workers cannot be fully ensured in this way during the use of work equipment, the employer shall take appropriate measures to reduce such risks to a minimum.

In any case, the employer shall use only equipment which complies with:

(a) Any legal or regulatory provisions applicable to them.

b) The general conditions laid down in Annex I of this Royal Decree".

Paragraphs 4 and 5 should also be highlighted:

"The use of work equipment shall comply with the general conditions laid down in Annex II of this Royal Decree.

When, in order to avoid or control a specific risk to the safety or health of workers, the use of work equipment must be carried out under specific conditions or in specific ways, which require particular knowledge on the part of the workers, the employer shall adopt the necessary measures to ensure that the use of such equipment is reserved for the workers designated for this purpose".

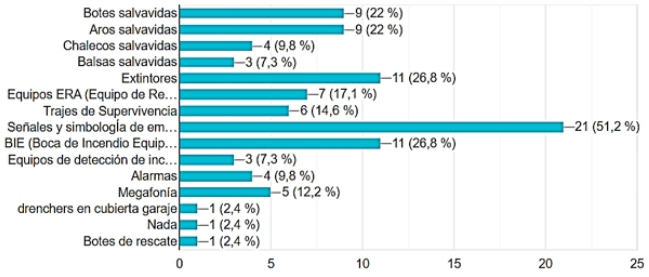
The employer shall take the measures necessary to ensure that, by means of appropriate maintenance, work equipment is maintained throughout its period of use in such a condition as to satisfy the provisions of the second subparagraph of paragraph 1. Such maintenance shall be carried out taking into account the manufacturer's instructions or, failing this, the characteristics of the equipment, its conditions of use and any other normal or exceptional circumstances likely to affect its deterioration or maladjustment.

Maintenance, repair or conversion operations on work equipment involving a specific risk for workers may only be carried out by specially trained personnel. [12]"

In the event of an accident, if there is, for example, a fire, and the reflective signs indicating the emergency exit are defective, the crew member may become lost and disorientated by the smoke, or even suffocate and end in tragedy. Real Decreto

485/1997, of 14 April, [12] on minimum provisions for health and safety signs at work, in ANNEX I Minimum general provisions for health and safety signs in the workplace, in point 4, states that "The signalling means and devices must be, depending on the case, cleaned, maintained and checked regularly, and repaired or replaced when necessary, so that they maintain their intrinsic and functional qualities at all times. Signalling devices which require a power supply shall be provided with an emergency power supply to ensure their operation in the event of a power failure, unless the risk disappears when the power supply is cut off" [12].

Figure 19: Defective emergency materials.



Source: Authors.

On a scale of 0 to 10 with 10 being the highest level, 32.5% rate the level of compliance with regard to checking safety equipment as 9. In general, safety measures on board are rated quite high, reflecting the fact that safety measures are implemented in accordance with the regulations on most ships and that despite being a high-risk environment for human life, efforts are made to keep these risks at bay by keeping equipment in the best possible condition.

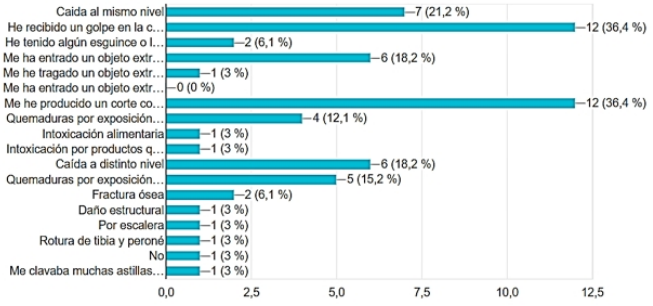
5.3. Accidentability and the effects of work on students.

Next, we will analyse the effects on students' health that may have occurred during their work placement. The graph below shows the results of the question asked to those surveyed as to whether they have suffered any type of accident. The results obtained show that 62.3% of those surveyed have not suffered any type of accident on board, while 37.7% have had a mishap or accident at work on board.

In the following graph, respondents are asked what type of mishap or accident they have suffered. Of the 37.7% who, if they have suffered any type of mishap or accident on board the previous graph, 36.4% say they have suffered physical injuries, 36.4% have been cut by an object, 36.4% have received a blow to the head or another area of the body, 21.1% have suffered falls at the same level, 18. 2% had a foreign object in their eye, 18.2% had fallen from a different level, 15.2% had been burned by chemical agents, 12.1% had been burned by exposure to the sun, 6.1% had suffered a bone fracture and another 6.1% had suffered a dislocation, and finally, the remaining accidents were suffered by 3% of those surveyed.

This is very important since the company has the obligation to provide and ensure that all employees and students have the corresponding safety measures, otherwise it would be infringing a right of the worker as contemplated in Law 31/1995, of 8 November, on the Prevention of Occupational Risks and a duty as an employer.[2]

Figure 20: Type of accident.



Source: Authors.

To the question, Have you communicated it to the person in charge? This is the question in the following graph, in which it can be seen that 66.7% of those surveyed answered that they had reported the accident or mishap to the person in charge, while 33.3% had not reported the accident or mishap to the person in charge.

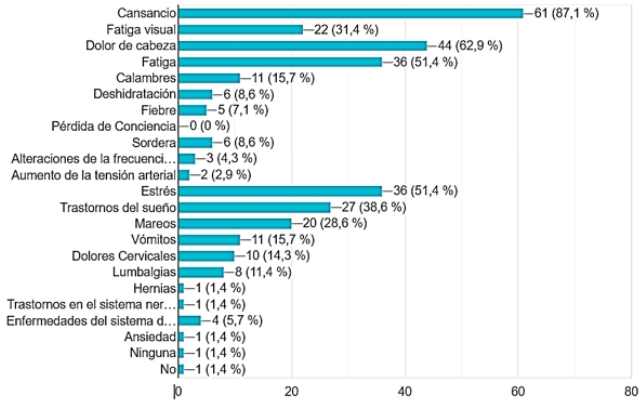
The most common risk among the participants in this survey was ailments associated with ergonomic conditions, with nearly 90% reporting fatigue, 62.9% suffering from headaches, followed by fatigue in 51.4% of cases, 31.4% reporting eyestrain, 15.7% suffering from cramps, 14.3% from neck pain, 11.4% from lumbago, 1.4% from hernias and finally 1.4% from disorders of the nervous system.

As for risk factors in environmental conditions, 28.6% reported dizziness, 15.7% vomiting, 8.6% dehydration, 8.6% deafness, 7.1% fever, 5.7% digestive system diseases, 4.3% heart rate disturbances and 2.9% increased blood pressure.

However, in terms of psychological conditions, the majority of those surveyed suffered from stress (51.4%), followed by sleep disorders (38.6%), and finally, 1.4% suffered from anxiety. This is normally due to the workload and the fact that the students are under constant stress as they find themselves in a new environment that they do not control and must automatically be in a state of alertness, as everything is new and they are assailed by multiple doubts. The crew and the way they deal with them is decisive in these cases to improve this situation.

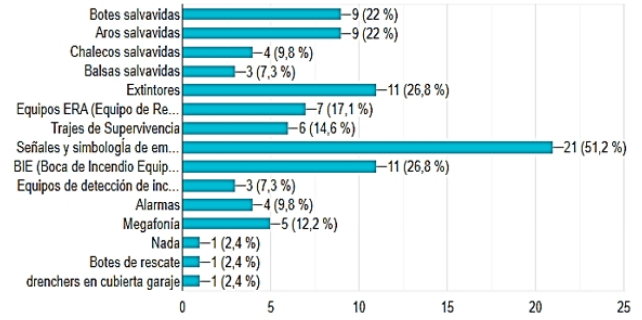
Here the participants responded that the ship's safety or emergency equipment was NOT in good condition. 51.2% of the respondents stated that the emergency signs and symbols were defective or defective in some way, 26.8% stated that the fire extinguishers were not in good condition and another 26.8% stated that the fire hydrants were defective, 22% said that the lifeboats and life rings were defective, 17. 1% of the self-contained breathing apparatus, 14.6% of survival suits, 12.2% of public address systems were not in good condition, 9.8% of life jackets and 9.8% of alarms, 7.3% of life rafts and fire detection equipment, 2.4% of rescue boats, and finally, 2.4% of drenchers on deck/garage were defective.

Figure 21: Major diseases and illnesses on board.



Source: Authors.

Figure 22: Emergency equipment in poor condition.



Source: Authors.

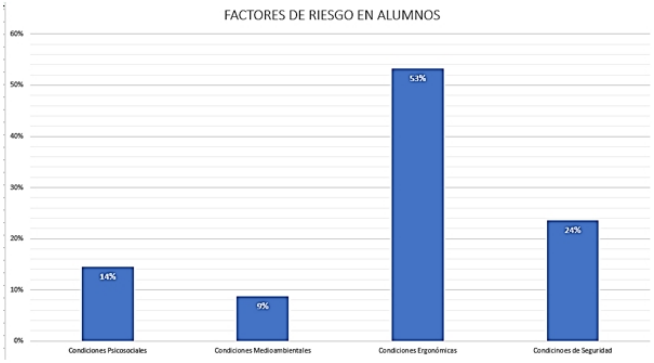
It is relevant that the symbology, which does not involve a great expense compared to the rest of the equipment, is the most affected, when it would be the least expensive thing to replace, but it is also usually one of the things that are most affected, for example if they are in places exposed to the elements.

It is important to know whether this could also be related to a lack of inspection by the crew when making safety rounds. We received an answer to this question below. The following graph shows that 96.1% say that the corresponding checks are carried out on emergency materials and 5.2% say that they are not, so we can affirm that there are only a few cases in which improvements should be made in this regard.

The graph below shows that of the total results, the ergonomic risk factor was the predominant one, followed by the risk factors due to safety conditions; the last two factors being psychosocial followed by environmental.

Ergonomic conditions being the most predominant risk factor in the survey carried out, we wanted to investigate the latest maritime accidents and confirm that this risk factor is evidently more present in occupational accidents. Next, an accident investigated by the Commission for the Investigation of Maritime Accidents and Incidents (CIAIM), has published a report on 21/2021 which refers to the collision between the vessels PESCA VAQUEIRO and ZHONG YUAN YU in the South Atlantic Ocean, on 15 February 2019, whose report findings in-

Figure 23: Risk factors.



Source: Authors.

dicate that the main cause of the accident has been attributed to risk factors in ergonomic conditions, i.e. "the cause of the collision between the vessels PESCA VAQUEIRO and ZHONG YUAN YU 11, was human error resulting from the failure to maintain effective navigational watchkeeping on the bridge of both vessels. " "In view of the organisation of the navigational watches on the PESCA VAQUEIRO, it cannot be ruled out that fatigue may have played a role in this accident." [13](See Annex III) for the full report.

Finally, we asked the participants if they would like to work in the same company where they did their internships, and the results obtained indicate that in just over half of the cases they would be interested in continuing, another quarter would think about it and finally 20% would not opt for that company, which is a fairly high result that implies that measures should be taken by the administrations and shipping companies as well, for not being able in these cases to promote the team feeling that is essential for a job of these characteristics.

Conclusions.

The maritime environment is a work environment that presents specific and particular occupational hazards that need to be considered and managed to ensure the safety and health of workers on board, including trainees on ships.

In this research work it can be seen that the most predominant risk factor is ergonomic conditions, within these conditions most of the respondents have suffered from fatigue, headache, eyestrain, stress, sleep disorders and have also worked more hours on duty than they are entitled to. This is probably due to the long hours and workload, which causes all these effects on students' health.

The next most common risk factor among our respondents is security conditions. What is very striking is that almost all of the respondents say that the corresponding checks of emergency materials are carried out. But at the same time, 50% of the respondents say that they found the ship's emergency equipment to be deficient or in poor condition. This is a clear contradiction. We therefore ask ourselves: What is happening with the 50% who do carry out the corresponding inspections of the ship's safety equipment but find deficiencies in it, how long

does it take to sail with these damaged safety equipment, how long does it take to inform the company to replace the safety equipment, how long does it take the company to send the new safety equipment, etc.? These are quite important questions to consider. It is clear that there are some ships where the emergency equipment is in poor condition or deficient in some way, despite the fact that the corresponding inspections are carried out by the crew.

On the other hand, from the data obtained, the lowest percentage is occupied by psychosocial risk factors, it has been observed that the participants have suffered some kind of discriminatory treatment, although this is not the predominant trend.

To minimise these occupational risks, it is important to have good planning prior to the work placement, to ensure that trainees receive adequate training in occupational risk prevention, and to have personal protective equipment to ensure the safety of workers on board.

In short, occupational risk prevention is essential to ensure the safety and health of workers on board, including trainees on ships. Training, planning and the use of safety measures are key to minimising these occupational risks and ensuring a safe and healthy working environment.

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