IDENTIFYING SKILL GAPS IN THE KNOWLEDGE AND TEACHING OF COLREGS

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ABSTRACT

The term "navigation" implies actions undertaken to enable the vessel to sail safely from the port of departure to the port of arrival in a defined period of time. The navigation of the vessel is exposed to many dangers and accidents which can occur and may have far reaching consequences on people, society, property and marine environment. By analysing maritime accidents in the past, vessel collisions were identified as one of the most frequent type of accidents. Furthermore, it is known that human error and wrong interpretation of the Rules are the most frequent reasons for vessels collisions. Recognizing that issue, the European Union approved the project "Avoiding Collisions at Sea" (ACTs) funded by the European programme "Leonardo da Vinci". The purpose of this research is to identify skill gaps in the knowledge and teaching of COLREGs (*International Regulations for Preventing Collisions at Sea 1972 - Rules*) for nautical engineering students and maritime professionals and non-professionals. The research results obtained have clearly showed skill gaps in the understanding of some parts of COLREGs due to wrong interpretation and application of the Rules. The only way to change this in the future is to improve learning methods of COLREGs inter alia using these research results.

Key words: COLREGs misunderstanding, skill gaps, training needs, improving teaching methodology.

1   INTRODUCTION

The Faculty of Maritime Studies in Rijeka is the leader of the European Union project "Avoiding Collisions at Sea" (ACTs). Other partners on the project are maritime training institutions coming from Great Britain[1], Spain[2], Slovenia[3], Bulgaria[4] and Turkey[5]. The project started on November 2013 and is planned to be completed by November 2015.

The most frequent reason for collision between vessels is disregarding COLREGs[1,2,3,4]. Accidents analysis in the paper [5] shows that 85% of all accidents are either directly initiated by human error or are associated with human error by means of inappropriate human response. Analysis note that mistakes are usually made not because of deficient or inadequate regulations, but because the regulations and standards that do exist are often ignored. The

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IMO MSC clearly indicates that the causes of many of the accidents at sea are due to deficiencies in maritime education and training of seafarers or disregard for current standards and regulations.

MAIB (Marine Accidents Investigation Branch) safety study [6] analyses accidents from 1994 to 2003, where 55% of all accidents were collisions. Study also notes that 19% of the vessels involved in collision were completely unaware of the other vessel until collision, 24% of them were aware too late and 57% of them were aware of the other vessel.

Safety report [7] conducted by the EMSA (European Maritime Safety Agency) analysed accidents from 2007 to 2010. The report shows that total number of all accidents including collisions is falling, however if number of collisions is compared with other types of accidents it can be seen that collisions constitute 40% of all accidents.

By using a questionnaire, the authors have studied the knowledge and understanding of COLREGs by nautical students and maritime professionals and non-professionals. The questionnaire has been designed in such a way as to test the understanding of the Rules in order to see what parts of the Rules are misunderstood. The questionnaire [9], in a paper form and on-line, has been distributed within the EU and all over the word. In that way all the various methods of learning the Rules in different countries have been included into the research.

Regardless of the learning methods, the results of the questionnaire have confirmed skill gaps by nautical students and experienced maritime professionals and non-professionals from all over the world. After identifying skill gaps, based on the research results, a proper learning methodology can be developed.

2 INDENTIFICATION OF THE TRAINING NEEDS

In order to achieve the project goals, COLREGs questionnaire has been prepared and distributed among nautical students, maritime professionals and non-professionals. Preparation of COLREGs questionnaire, distribution of questionnaire and participant profile are described in following subchapters.

2.1 Research instrument

The questions have been designed to determine which rules are difficult to understand and which rules are most often broken in practice. Such questions are more difficult than the questions which simply check the knowledge. In a technical sense, the questionnaire has been prepared according to the instructions of the professors from the Faculty of the Humanities and Social Sciences in Rijeka who are dealing with teaching and assessment methods. Preparing questions for testing the Rules understanding has been a very difficult task, only 4 questions from the total of 372 from the MCA COLREGs test have been taken.

In accordance with the suggestions given by colleagues from the Faculty of the Humanities and Social Sciences in Rijeka, some graphical scenarios have been prepared and used in the questionnaire. This type of questions has been the right choice as there have been many positive comments on. Some comments have referred to the language used in the questionnaire as being an archaic one, but this has been agreed upon between Partners to use words and phrases as much as possible from COLREG (IMO) [8].-

As the aim has been to examine the understanding of certain Rules, the scenarios with only two vessels has been used. In practice, multi-encounters scenarios are very often used, but they have not been used in this questionnaire.

Once the final version of the questionnaire in the English language has been prepared, partners from Croatia, Slovenia, Turkey and Spain have translated the questionnaire into their proper languages.

The Slovenian Partner has been in charge of a non-professional questionnaire. It has been decided that the questionnaire will be the same, with only the general questions section being a different one.

The questionnaire has been made up of four groups of questions:

- General questions for identifying the target group of respondents (12 questions).
- Questions that have had an answer in COLREGs (34 questions).
- Questions for testing the opinion and actions of seafarers (12 questions). This type of questions has been intentionally left to students in order to check if the professors have explained them some situations and what they will do when appointed junior officers.
- Optional questions for teachers and lecturers at maritime colleges (4 questions).

General questions aimed at enabling the analysis and extraction of desired characteristic groups of participants in order to obtain quality conclusions and comparisons among groups.

Group of questions that have an answer in COLREGs are the most important group of the questions for determining which Rules are hard to understand (Figure 1). On these groups of questions we have received some remarks because we have offered multiple-choice answers. That has been expected because of the misunderstanding of the Rules.

22. A power-driven vessel, vessel A, LOA = 187 meters, is proceeding in a traffic separation scheme lane. From her starboard side, a RO-RO passenger vessel, vessel B, LOA = 150 meters is crossing the traffic separation scheme.
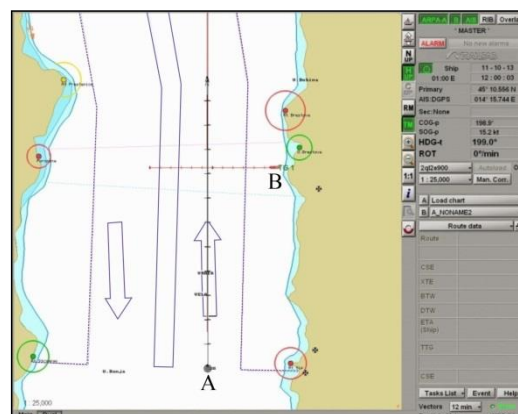
If a risk of collision exists which vessel is the stand-on vessel?

a) Vessel A

b) Vessel B

Figure 1: Example of a question that have had an answer in COLREGs

In questions used for testing the opinion and actions of seafarers or students we have not defined the answer (Figure 2). In this group of questions, we have just wanted to see how respondents think. The questions of this group, with or without scenario, have been quite precise, so that, if everyone thinks in the same way, the answers would be the same or similar. However, the results have showed great differences.

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39. In your opinion what is the "safe passing distance" between two power-driven vessels
    LOA = 200 meters when meeting on the high seas?
    The safe passing distance (CPA) in this case is _____

Figure 2: Example of a question testing the opinion and actions of seafarers or students

The last group of questions have been questions for professors who teach the rules. This group of questions has been put to see the experience and the opinion of persons teaching COLREGs.

2.2 Data collection

The questionnaire was distributed from January to the end of March 2014 through Lime survey and in a printed form. The results from the printed form have been inserted in the Lime survey. The questionnaire has been distributed to all maritime schools and colleges, seafarers on board merchant ships, teachers and lecturers at maritime institutions, VTS operators, employees of the port authorities, pilots as well as to masters of fishing boats and yachts.

The Partners have contacted crew managers who have sent questionnaires to all vessels and to seafarers ashore as well. They have also asked some seafarers to fulfil the questionnaire in their offices. High school and faculty students have fulfilled the questionnaire in their classrooms. The questionnaire has been announced and the persons questioned have been allowed to use books when filling in the questionnaire. The time for filling in the questionnaire has not been limited. In that way, we have managed to test the understanding of the Rules because they have been allowed to use all possible literature with no time limit. The respondents have taken 30-40 minutes to complete the questionnaire. By using such type of testing, we have avoided stress which is usually present on board a vessel. By the end of March 2014, the questionnaire was fulfilled by 1280 participants (professional seafarers, maritime high school and faculty students) and 285 holders of licenses for various types of ships/boats (pleasure craft and small fishing vessels). By January 2015, the questionnaire was fulfilled by 1498 seafarers and 288 non-professionals.

Most of the participants were maritime faculty students, ships officers and masters. Age of participants is from 19 to more than 63 years and the most of them were from Croatia, Turkey, Spain and UK. Participants in average have over 5 years of sea going experience and most of them navigate on liquid cargo vessels, container vessels and bulk carriers. Also 9% of participants were involved in collision and most of those collisions occurred in coastal waters and harbour areas and visibility was over 6 miles. Only 34% of all participants attended some additional COLREG training course.

3 ANALYSIS OF THE QUESTIONNAIRE RESULTS

The questionnaire results analysis for the understanding of the Rules has shown that maritime education and training lecturers have had the best results, followed by seafarers with sea experience who have on the average 15% better results than participants with no sea experience. The results obtained are shown in Figure 3.
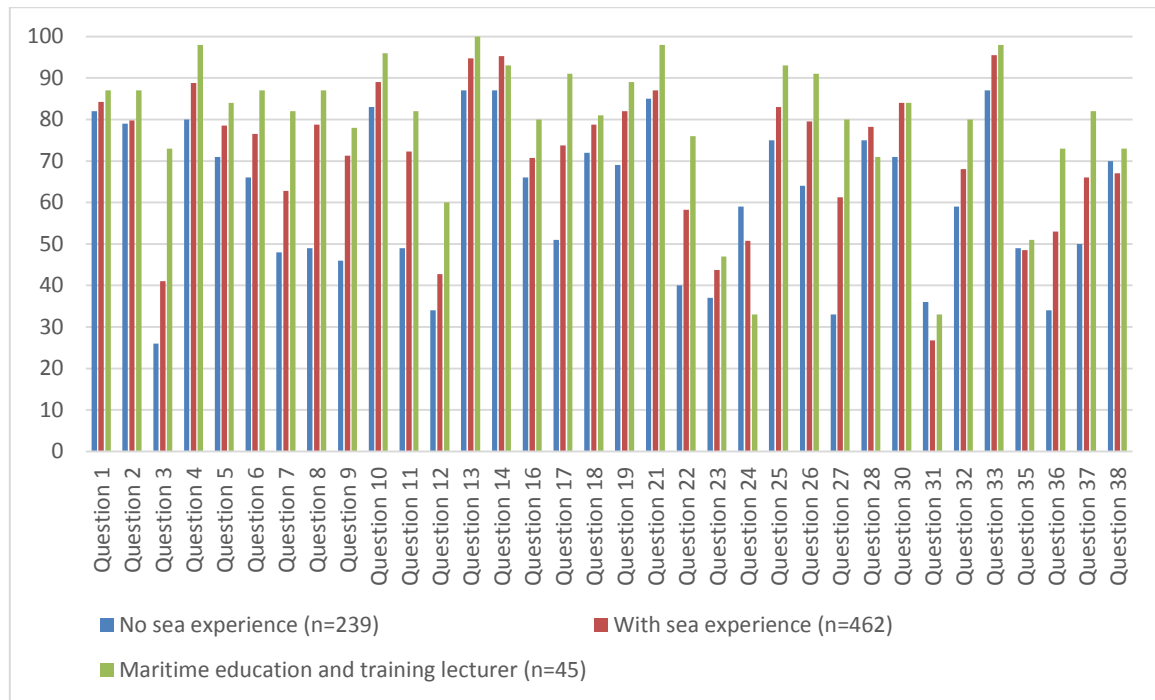

Figure 3: Percentage of correct answers by participant without and with sea experience and by maritime education and training lecturers

However, in questions regarding Rule 10 (TSS), participants with no sea experience have more correct answers and in questions regarding Rule 17 (Action by Stand-on Vessel) and Rule 18 (Responsibilities between Vessels) the results obtained from all participants are similar. Moreover, the results obtained from high school and maritime faculty participants have shown no difference in understanding the Rules.

Questions for testing the opinion of seafarers, like a minimum CPA, parallel course overtaking, and distance for start avoiding collision have received different answers because there are no correct answers in the Rules, but a difference between participants with and without sea experience has been noticed as is shown in Figure 4.
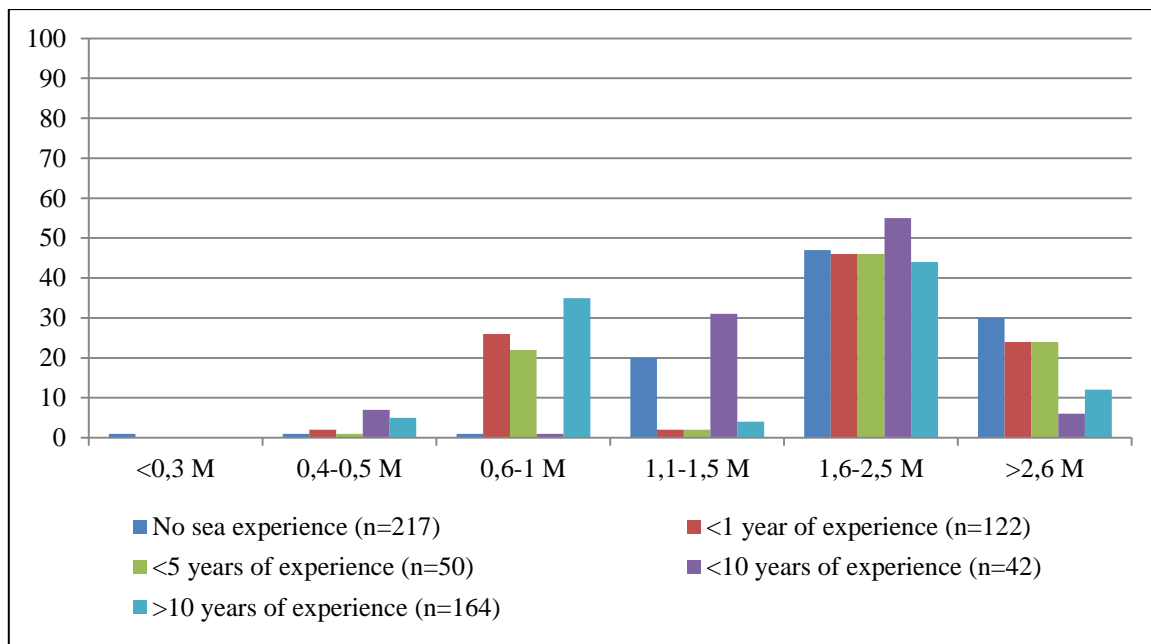
Figure 4: Percentage of answers for a minimum CPA opinion testing by different respondent groups

Rules which are hard to understand according to all participants are Rule 6 (Safe Speed), Rule 8 (Action to Avoid Collision), Rule 9 (Narrow Channel), Rule 10 (Traffic Separation Scheme), Rule 13 (Overtaking), Rule 18 (Responsibilities between Vessels) and Rule 19 (Conduct of the Vessels in Restricted Visibility). The results are showed in Figure 5.
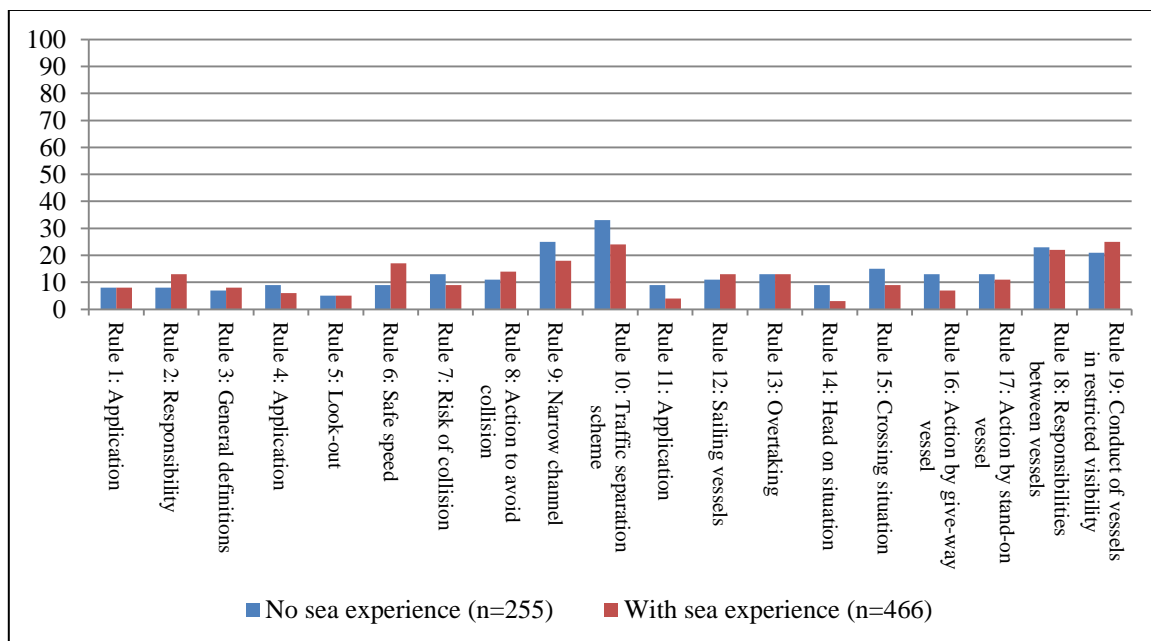

Figure 5: Rules which are most difficult to understand for participants without and with sea experience

Questions about using VHF in collision avoidance have shown that participants with sea experience less than 10 years use more VHF in collision avoidance than participants over 10 years of sea experience. Moreover, only 40 % of the participants with sea experience use

more VHF communication after AIS equipment become mandatory, and 70% believe that VHF contact can be useful for preventing collisions at sea.

Questions for maritime education and training lecturers have shown that over 63% of students have problems in interpreting the Rules.

According to maritime education and training lecturers, Rules which are most difficult for students to understand are Rule 19 (Conduct of the Vessels in Restricted Visibility), Rule 18 (Responsibilities between Vessels), Rule 10 (Traffic Separation Scheme), Rule 6 (Safe Speed) and Rule 7 (Risk of Collision), and those answers are very similar to the answers given by other participants. The results are shown in Figure 6.
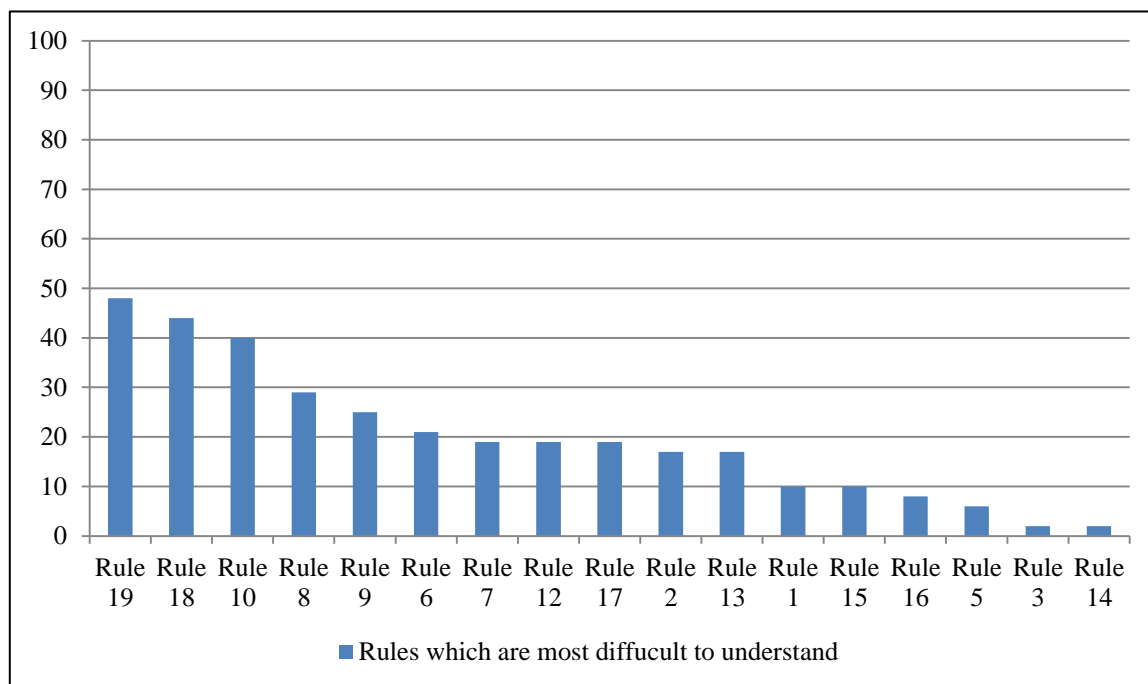

Figure 6: Rules which are most difficult for students to understand – answered by lecturers

4   VALIDATION OF THE QUESTIONNAIRE RESULTS

In order to validate the results of the questionnaire, workshops have been organized in all of the partners' countries and the research results obtained have been presented. The workshops aimed at presenting the results of the research, at validating the obtained results through discussions, at conducting discussion on the methods of learning the Rules and at determining the best way to use the results of the project for long-life learning.

In all partners' countries, workshops have been attended by 102 participants: teachers and professors at maritime colleges and faculties, seafarers, representatives of government authorities and maritime companies, pilots and members of various professional associations related to maritime shipping.

It has been concluded, on the workshops, that the results obtained have been in accordance with the workshop participants´ opinions and that there has been a strong need for the implementation of new methods of learning and teaching of COLREGs.

The questionnaire results and the conclusions from workshop discussions have clearly confirmed that there are significant differences in the understanding and application of the Rules.

5   FINDINGS OF THE RESEARCH

Taking into account all the facts stated above, the following conclusions can be drawn:

1. Need for the change or review of the COLREGs. The rules would have to have some minor changes or updates in accordance with evolving technology, and some drastic changes that are unlikely to expect. And what is more important is that the existing rules have to be interpreted precisely, so that they can be understood in the same way by everyone.
2. Necessity to determine the relationships and the hierarchy of the Rules. Rules that have priority over the other ones have to be clearly determined and navigation officers should be able to apply them without having any difficulty. A flow chart showing the priority of the rules is suggested. This would also lead to developing a sequence for learning/teaching the rules.
3. Establishing common understanding of the Rules – COLREGs guidelines. Establishing a common understanding of an individual rule through some kind of Guidelines is needed and standardizing the education, training and assessment of COLREGs through the COLREGs Model Course. COLREGs model course should be an integral part of the STCW. It is interesting that professional seafarers think that Rules and literature for learning Rules should be clarified, and non-professionals are satisfied with the learning materials. This has to be born in mind when preparing the COLREGs Model Course.
4. Need for a further clarifications of some Rules. At each workshop, it was pointed out that certain rules should be clarified. In some rules, certain definition should be added in order to clarify the rules. While explaining the rules, manoeuvring characteristics of the vessel should be included in order to make correct decisions on taking appropriate actions to avoid collision.
5. Establishing a brief COLREGs course and develop a COLREGs e-course. The COLREGs course should be easy to use by simple means of the information technology, rather than by expensive simulators.
6. Considering the results of the ACTs questionnaire and the analysis of the actual collisions, the conclusion is that the Rules are not easy to understand or apply in certain cases.
7. In order to improve the Rules learning methodologies for students and seafarers it is suggested as follows:
   – To use the case study scenarios to cover each individual rule
   – To include as many as possible scenarios as real life may pose within COLREGs training case studies
   – Radar view together with the bridge view should be included in the case studies
   – Use of Court decisions for the interpretation of case studies
   – Use of as much as possible visual images to make teaching COLREGs more effective
   – Training methodologies: use of images, simulators, CADs and visuals
   – Use of former accidents scenarios in an animated form

- Using of 3D dynamic animations, day and night, when cases and examples are used to support rules explanations
- Use of multi-ship situation scenario
- Use of materials such as animated scenarios or gamification of the Rules so that cadets can see the Rules in action and role play as vessels, to see the results of their decisions
- Scenarios must always be based on impartial reports e.g. MAIB reports or similar ones to ensure impartiality in the decision and report findings used for the scenarios
- Use of e-learning solution, software, mobile app to let students run short COLREGs

8. Need for official translation of COLREGs. Official translation of COLREGs in multiple languages could be made, but even more important are the explanations of the Rules.

9. COLREGs test should be prepared in the mother tongue language and in English as well.

6   CONCLUSION

The questionnaire results and conclusions of workshops discussions have clearly indicated problems in the understanding and application of COLREGs by nautical students and maritime professionals and non-professionals. As the research has been conducted in the EU and worldwide, the obtained results are relevant because different learning methods have been included into the survey and all those methods have shown same deficiencies. This gives clear results that it is necessary to improve the learning methods of COLREGs in the future.

The ongoing work on the ACTs project includes the development of a new learning methodology which will take into consideration the research results and will try to improve the learning method by using scenarios created for each Rule. It is possible to achieve decrement of collisions at sea by a better understanding and by applying the Rules by professional and non-professional seafarers, and it is believed that this new teaching methodology of the Rules will contribute to that goal. Further progress of the ACTs project can be followed on the web page: www.ecolregs.com.

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