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COMPARATIVE ANALYSIS FOR STATE-OF-THE-ART SIMULATION TRAINING SYSTEMS THOSE INFLUENCE ONTO THE FUTURE ENGINEERS' KNOWLEDGE AND SKILLS

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Methodology Volunteer engine room cadets of the first year of study were taking part in an experiment. To choose and divide experiment participants into groups a questionnaire and the Bennett Mechanical Comprehension Test (BMCT) were held. Thus, according to the questionnaire results participants were divided into 3 groups marked with A, B, C letters. Group A consisted of cadets who have EDG theoretical base Group B consisted of cadets who possess theoretical knowledge, have worked with EDG simulator, and/or have started the EDG. Group C consisted of those who have never worked with the EDG simulator, have never started the EDG, and are not theoretically prepared. Each group in turn was separated into 3 subgroups according to the level of engineering thinking estimated with the BMCT test. As a result, these subgroups were distinguished: - high level – A1, B1, C1 - medium level – A2, B2, C2 - lower that medium level – A3, B3, C3 Total number of participants was 24.

After completed questionnaire and Bennett's test 4 cadets did exercises on the engine room simulator. Exercises comprises preparing for start and starting EDG according to few procedures (for instance one of them depicted in Table in this poster) installed on Ro-Pax ferry and tanker LCC. Then all of them and 5 more cadets went to the EDG starting procedure in IVR condition by using HMD. Only one cadet went directly to engine room laboratory with real diesel generator. **Experimental equipment** The Engine Room Simulator Wartsila ERS 5000 TechSim (Fig.1) with 2 ship models Ro-Pax ferry and tanker LCC. For IVR condition were using HMD HTC VIVE with hand controllers and Optimum Maritime Solutions Ltd(OMS-VR) software (Fig. 2), specifically EDG module. As a real emergency generator was used laboratory one GenSet Д246.4 60 kW power, 1500 RPM, 450 V AC, 60 Hz (Fig. 3).

Tanker LCC emergency generator starting procedure	
No.	Item
Battery Start	
1	Check battery voltage
2	On the Emergency Generator Auto Start/Stop Panel: - Set the Operation Switch to position MAN; - Press the START button on the controller; watch the engine state gauges at the top of the panel.
3	Push the STOP button to stop the EDG
4	Put back Operation Switch to position AUTO



Figure 1. Participant in the non IVR engine room simulator preparing Ro-Pax ferry EmGen to the start



Figure 2. Participants engaged in the IVR conditions using HMD simulator training facility. The screens in the background display a projection of the participants' view



Figure 3. Participant in the real conditions preparing to start and start emergency diesel generator in the academic engine room laboratory

Results and discussion In the Fig. 4 depicted chart of cognitive test score comparison for groups with EDG theoretical knowledge and different operational skills. From the Fig. 4 it could be understood that Group 1 has better results than Group 2. Seven members of Group 1 have demonstrated an average level of knowledge, and four members – high level. In the Group 2 no one has demonstrated a high level of knowledge. Fig. 5 indicates that average grades of Group 1 participants that have trained with ERS and IVR is twice higher that grades of Group 2 (only partial theoretical knowledge).

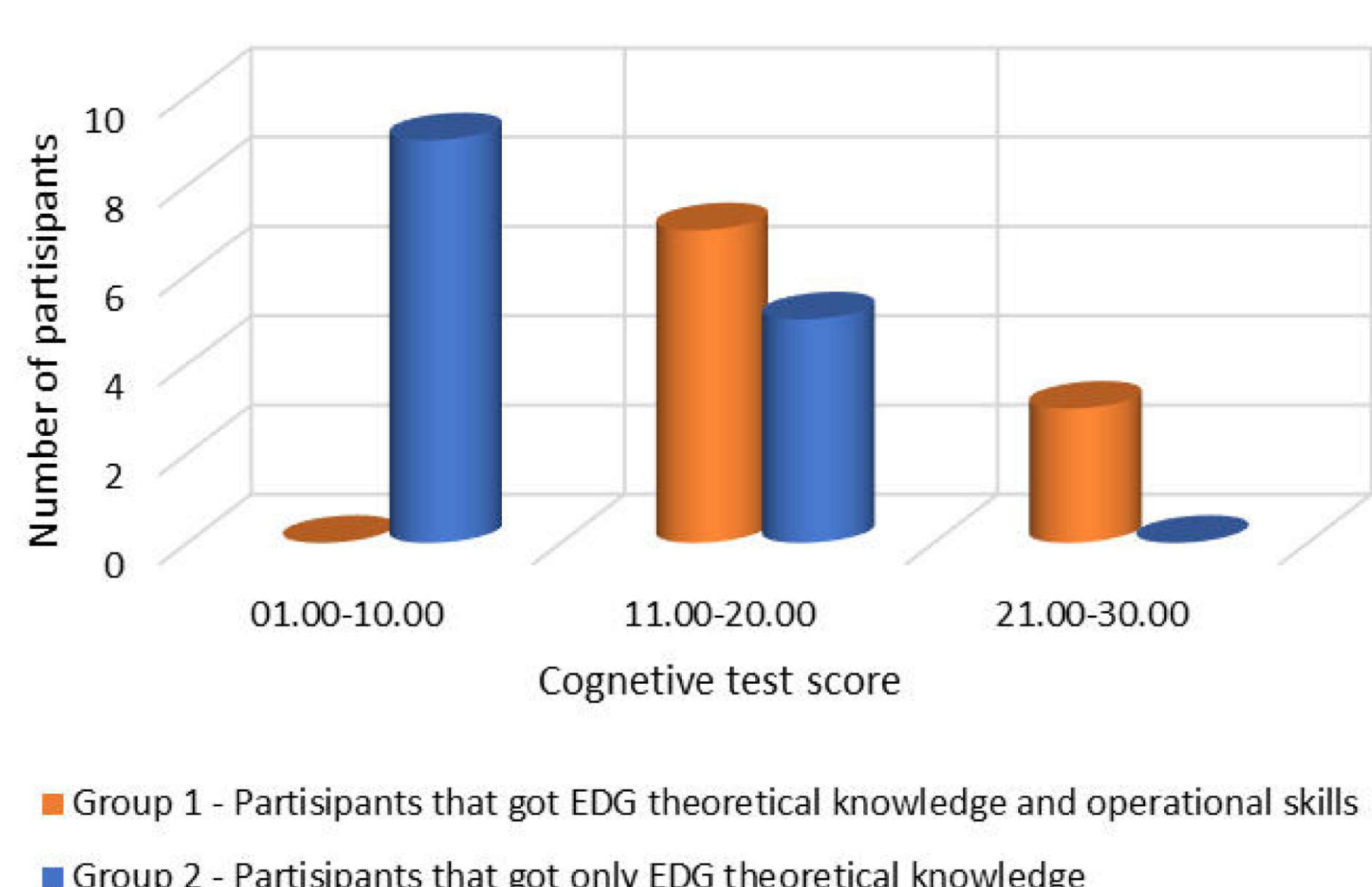


Figure 4. Chart illustration cognitive test score comparison for groups with EDG theoretical knowledge and different operational skills

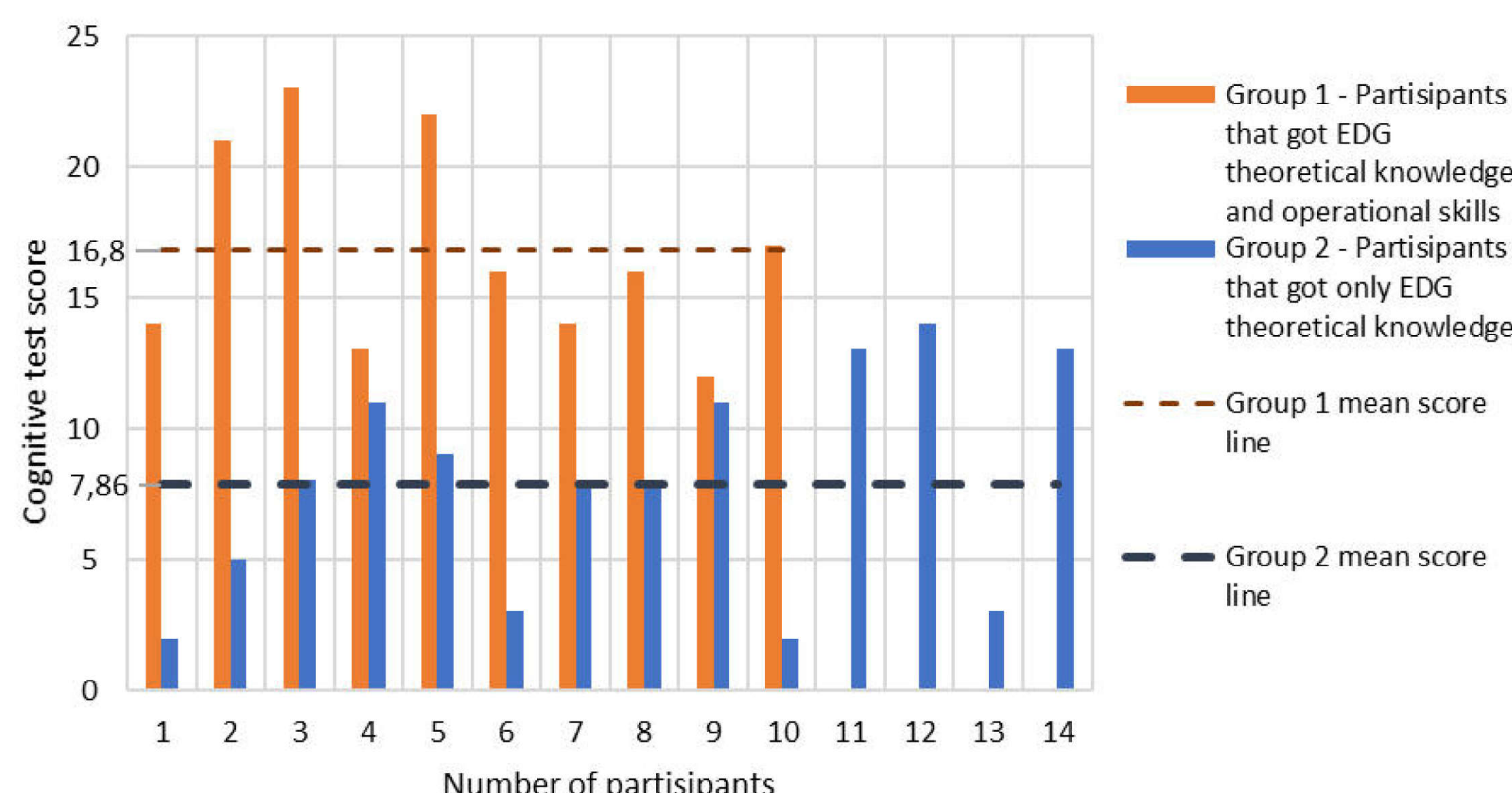


Figure 5. Chart of cognitive test mean score comparison for groups with EDG theoretical knowledge and different operational skills

Conclusion New MET technologies have been tested. The comparison of new technologies carried out, and had shown, that the IVR will increase the knowledge and EDG operational skills in particular procedures for checking fuel oil and lube oil levels, preparation of the EDG before starting and start. Experimentally, behind the aid of laboratory EDG, the efficiency of state-of-the-art simulator training technologies is confirmed. It is also a matter of focused that such a kind of education and academic training is most relevant for cadets when preparing to the first shipboard training. The obtained results showed that the combination of simulator training technologies gives the maximum effect for cadets and in comparison, with subgroups that are partially acquainted with the theoretical information about requirements and technical operation of EDG have almost twice higher score, i.e. more competent. The greatest efficiency can be achieved with mentoring preparation, to explain the material in detail, with an emphasis on respect for the main things, given the recommendation, assessment and evaluation control, the correctness of the cadet's action.