

The Effectiveness of the Engine Room Simulator Training

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ABSTRACT

The paper presents the results of the research on the engine room simulator training effectiveness. The multiple trainees attending the graduate and post-graduate marine engineering courses have evaluated the different engine room simulator types. The different simulator types have been taken into consideration. The trainee opinion has been compared with the objective assessment results and the multiple conclusions have been drawn. The paper shows also the relation between the observed training effectiveness and the time spent at sea by a trainee, the owned maritime certificate and his personal experience with other simulator types.

Keyword: Engine Room Simulators, STCW, Marine Simulator Training

INTRODUCTION

The main purpose of this research is to establish the relation between the different simulator type, the trainee personal profile and the effectiveness of the engine room simulator training.

The research has been conducted in Gdynia Maritime University (Poland) including the following groups of trainees:

- the regulars students of the bachelor level courses in maritime engineering,
- the regulars students of the master level courses in maritime engineering,
- the participants of the qualification courses preparing candidates to the examination before the state examination board for the next, higher officer's rank,
- the participants of the courses updating professional knowledge of officers holding the chief engineer and second engineer certificate.

Totally 78 trainees took a part in this research.

Three types of the engine room simulators, all installed in Gdynia Maritime University have been compared in this research:

- UNITEST Virtual Engine Room 4.8 (VER 4.8) and Engine Room Console 4.8 (ERC 4.8) is a software simulator with the 2D visualization of the ship's engine room (see Fig. 1 and 2). Additionally this simulator has many unique training features like the integrated checklists and the integrated assessment.



Fig. 1 Virtual Engine Room 4.8 - panel obsługi silnika głównego.

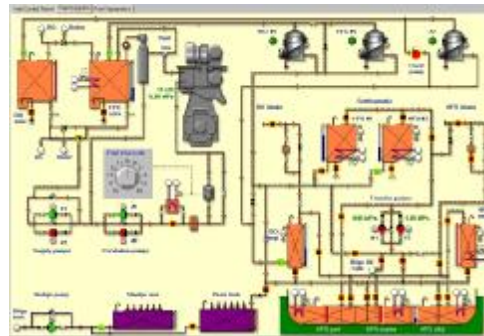


Fig. 2. VER 4.8 - schemat systemu paliwowego.

- UNITEST Medium Speed Engine Room 3D (MED3D) is a software simulator with the sophisticated 3D visualization of the engine room space (Fig. 3).

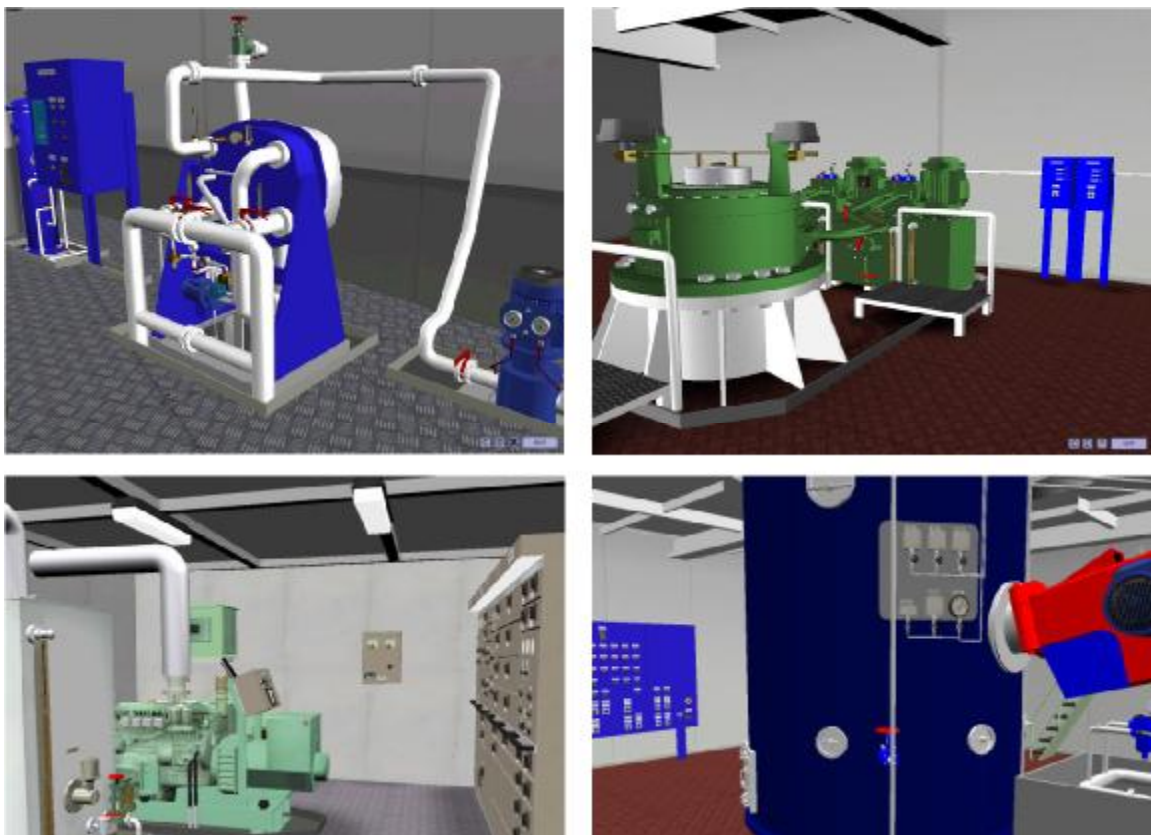


Fig. 3. MED3D - trójwymiarowa wizualizacja siłowni okrętowej.

- UNITEST Medium Speed Engine Room 3D Hardware Version (MED3Dh) is a full hardware simulator with sophisticated 3D visualization of the engine room space and the realistic hardware replica of the control console and the main switchboard.



Fig. 4. MED3Dh - konsola sterowania silnikiem głównym.



Fig. 5. MED3Dh - Główna tablica rozdzielcza energii elektrycznej.

The methodology of this research has been based upon the works [5,6]. The special questionnaire (Fig. 6) has been developed in order collect the information about the trainee education, sea experience, certificates, opinion about the simulators and what is most important about the simulator assessment results. The assessment results have

been implemented as final note according the following scale (typical for the Polish education system):

- 2.0 - failed (worst)
- 2.5 - failed
- 3.0 - passed
- 3.5 - passed
- 4.0 - passed
- 4.5 - passed
- 5.0 - passed (best)

RESEARCH RESULTS

The influence of the Certificate of Competency (any level) possession or a lack of it, on the simulator assessment result (presented as a final note) has been presented at Fig. 7. As it was expected, the trainees who already have possessed Certificate of Competency have achieved the better results than the other group however the difference between mean values has no statistical significance at α -level 0.05.

SIMULATOR ASSESSMENT QUESTIONNAIRE

This part of the form should be completed by a student BEFORE the assessment begin at the simulator.
(Ta część formularza powinna być wypełniona przez studenta przed rozpoczęciem testu na symulatorze).

A. STUDENT ANONYMUS IDENTITY (anonimowa identyfikacja studenta)

1	<input type="text"/>	First character of your first name (pierwsza litera imienia)
2	<input type="text"/>	First character of your last name (pierwsza litera nazwiska)
3	<input type="text"/>	Two last digits of the year of your birth (dwie ostatnie cyfry roku urodzenia)
4	<input type="text"/>	Month of your birth as a two digit number (miesiąc urodz. napisany dwiema cyframi)

*This data is necessary only in order to assign the assessment result (score) to the specific report.
(Te dane są potrzebne tylko aby przypisać ocenę końcową z testu do konkretnego formularza)*

B. STUDENT PROFESSIONAL EXPERIENCE AT SEA (doświadczenie zawodowe studenta na morzu)

5	<input type="text"/>	Approx. how many months experience at sea totally (w przybliżeniu ile miesięcy pracy na morzu łącznie)
6	<input type="text"/>	Current seafarer certificate (obecny dyplom morski) 0 – none (żaden), 1 – operational level (poziom operacyjny), 2 – management level (poziom zarządzania)
7	<input type="text"/>	Highest rank at ship ever (najwyższe kiedykolwiek sprawowane stanowisko na statku) 0 – none (żadne), 1 – cadet (praktykant), 2 – motorman (motorzysta), 3 – watch keeping engineer (mechanik wachtowy), 4 – chief/second engineer (starszy/drugi mechanik)
8	<input type="text"/>	Highest academic degree (najwyższy posiadany stopień akademicki) 0 – none (żaden), 1 – bachelor, chartered engineer (licencjat, inżynier), 2 – master of science (magister)

C. OPINION ABOUT SIMULATOR (opinia o symulatorze)

9	<input type="text"/>	Simulator type used for this assessment (typ symulatora podczas tego testu kompetencji), 0 – VER/ERC, 1 – TD, 2 – SER, 3 – GTS, 4 – MED3D, 5 – MED3Dh, 6 – ER3D, 7 – MER3D, 8 – PSV3D, 9 – DE3D, 10 – CBT
10	<input type="text"/>	Ease of use (łatwość użytkowania), 0 – very difficult (bardzo trudny), 1 – difficult (trudny), 2 – easy (łatwy), 3 – very easy (bardzo łatwy).
11	<input type="text"/>	Learning “How it works?” (uczenie się “Jak to działa?”), 0 – not useful, (nieprzydatny), 1 – little useful (mało przydatny), 2 – useful (przydatny), 3 – very useful (bardzo przydatny)
12	<input type="text"/>	Learning “How to operate it?” (uczenie się “Jak to obsługiwać?”), 0 – not useful, (nieprzydatny), 1 – little useful (mało przydatny), 2 – useful (przydatny), 3 – very useful (bardzo przydatny)
13	<input type="text"/>	Learning “What is wrong?” (uczenie się “Co jest zepsute?”). 0 – not useful, (nieprzydatny), 1 – little useful (mało przydatny), 2 – useful (przydatny), 3 – very useful (bardzo przydatny)

D. Date:(day)(month)year

This part of the form should be completed by an instructor AFTER the assessment end at the simulator. (Ta część formularza powinna być wypełniona przez instruktora po zakończeniu testu na symulatorze).

14	<input type="text"/>	Note (ocena) 2–worst..... 5–best with 0.5 step (od 2 do 5 z krokiem 0,5)
15	<input type="text"/>	Score in % (wynik w %)
16	<input type="text"/>	Signature (podpis)

Elaborated by / Opracowany przez: Dr. Stefan Kluj

Fig. 6. Kwestionariusz użyty w badaniu.

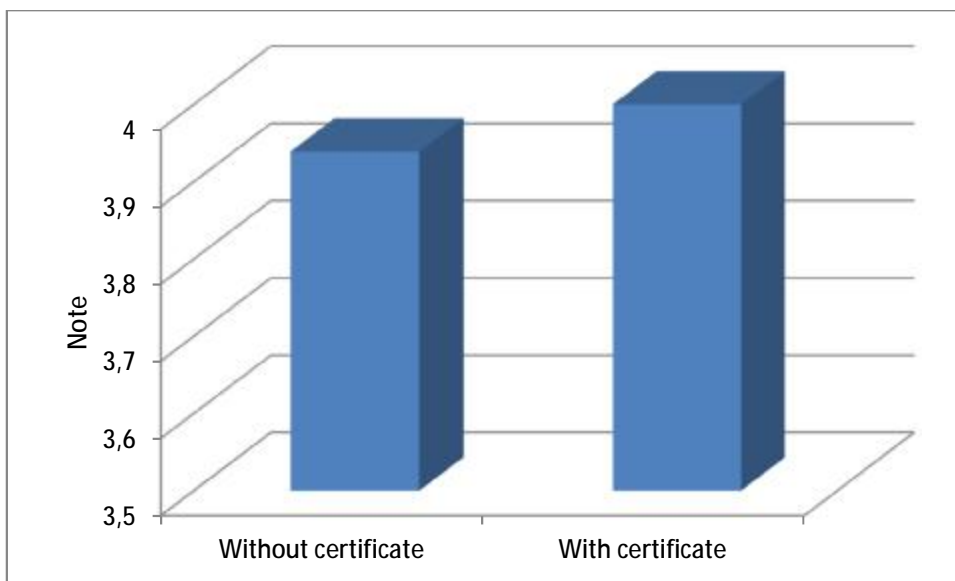


Fig. 7. Porównanie ocen uzyskiwanych podczas testu symulatorze w zależności od posiadanego świadectwa morskiego.

The similar results can be observed when comparing the final notes for the groups with different position at a ship (Fig. 8). In this case the difference between mean values has no statistical significance at α -level 0.05 as well.

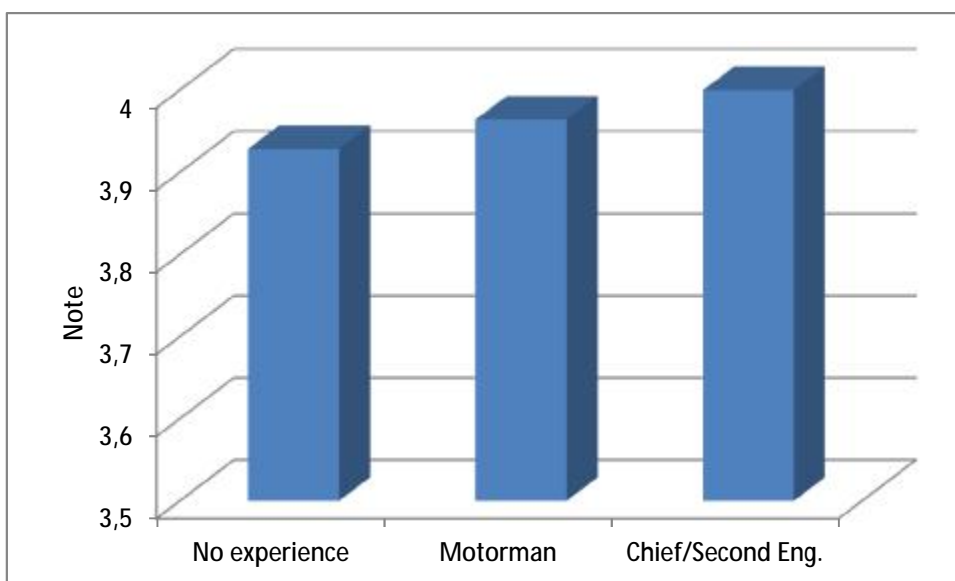


Fig. 8. Porównanie ocen uzyskiwanych podczas testu symulatorze w zależności od stanowiska sprawowanego na statku.

The influence of the previous education level on the simulator training has been presented on Fig. 9. The diagram shows that MSc gives much better preparation for the sea duties than BSc. This is an important observation because the dominating trend worldwide is the provide the maritime education in accordance with STCW but without any emphasis on the academic education.

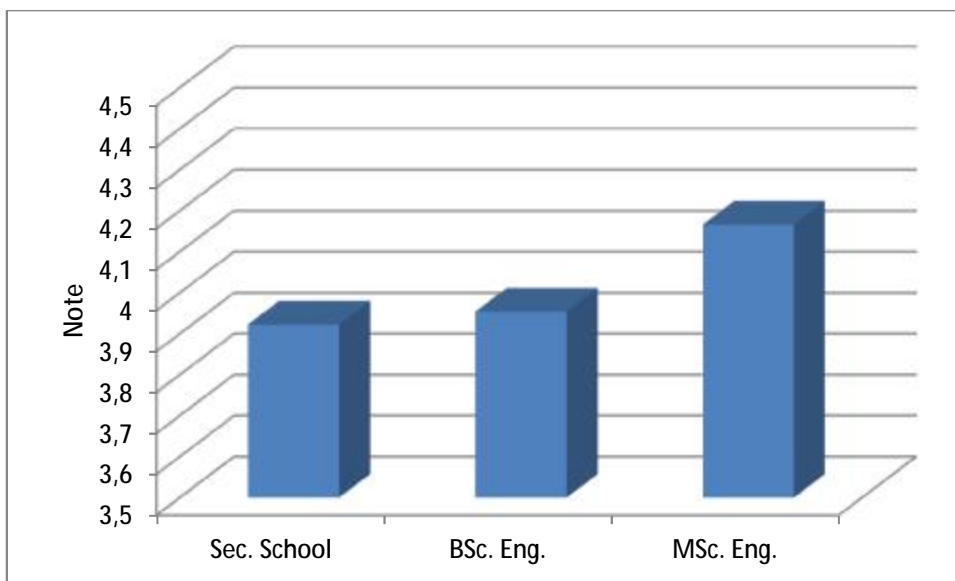


Fig. 9. Porównanie ocen uzyskiwanych podczas testu symulatorze w zależności od posiadanego wykształcenia.

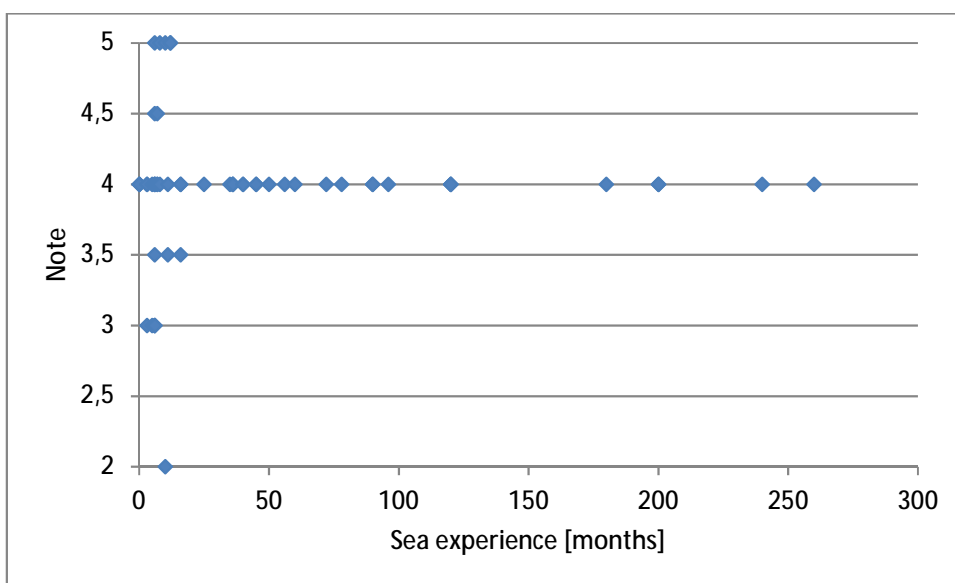
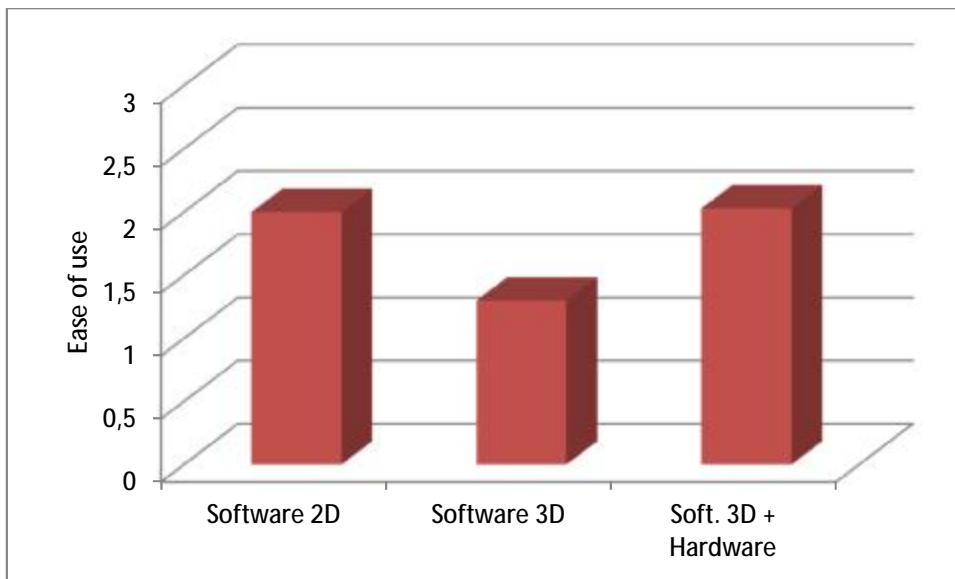
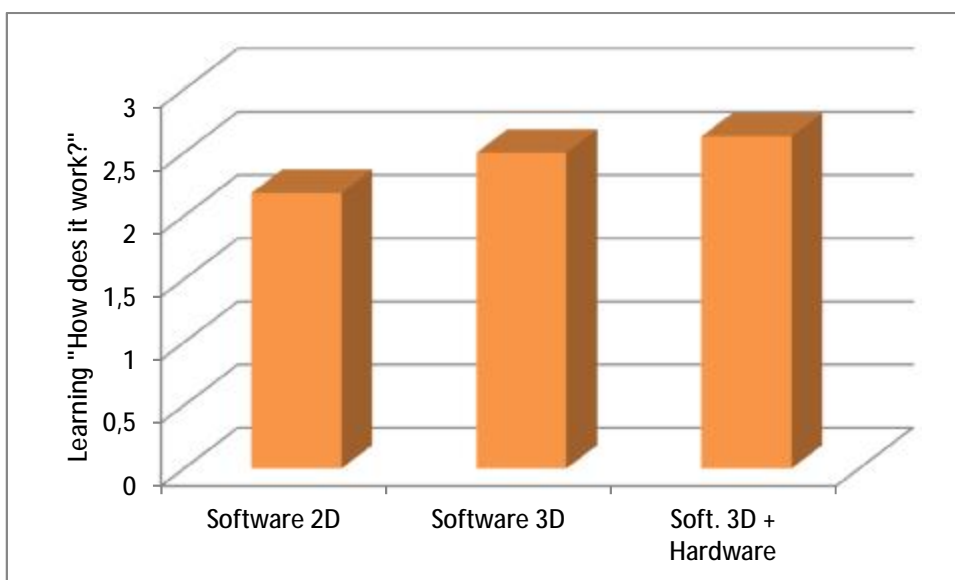


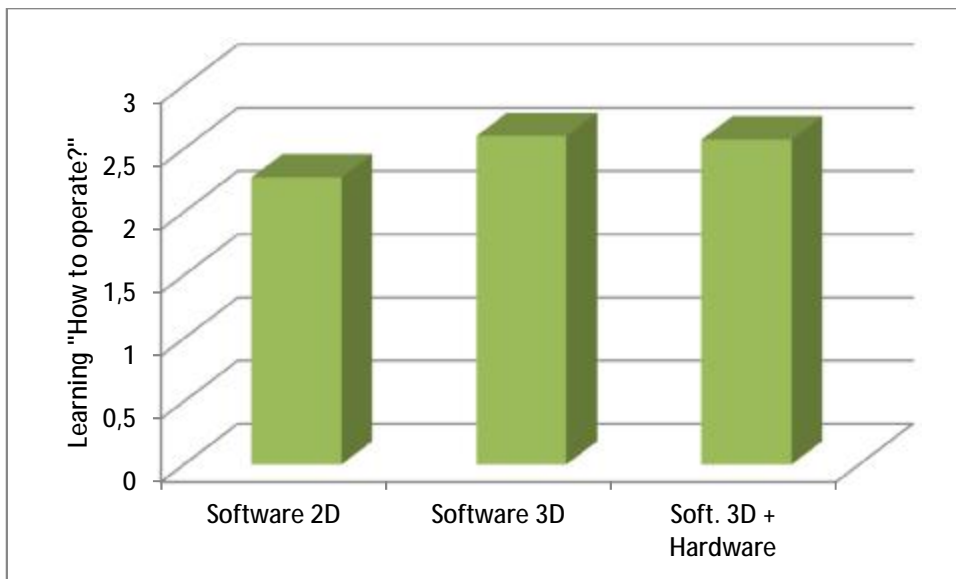
Fig. 10. Porównanie ocen uzyskiwanych podczas testu symulatorze w zależności od stażu morskiego.



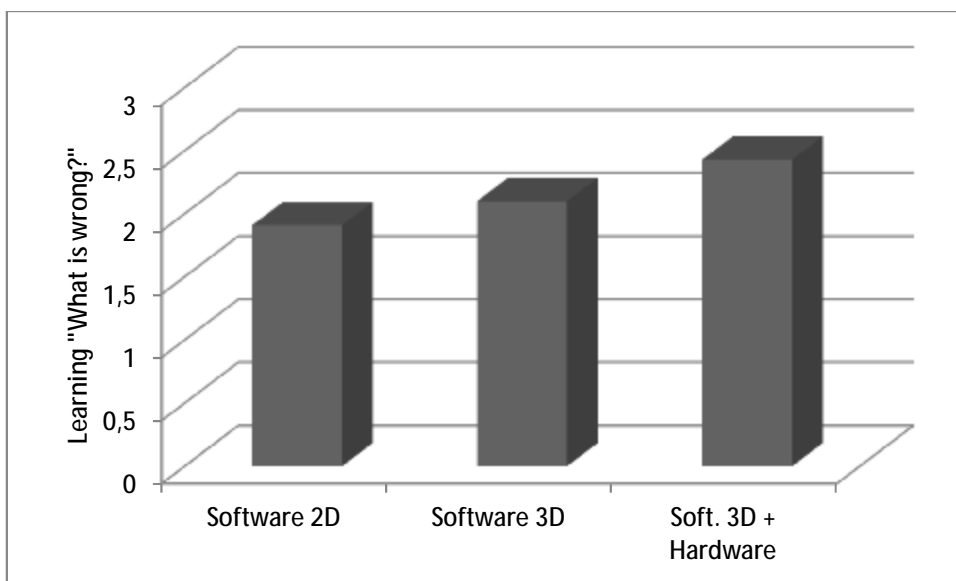
Rys. 3. Subiektywnie postrzegana łatwość użytkowania poszczególnych typów symulatorów.



Rys. 4. Subiektywnie postrzegana przydatność poszczególnych typów symulatorów do uczenia się sposobu działania systemów.



Rys. 5. Subiektywnie postrzegana przydatność poszczególnych typów symulatorów do uczenia się sposobu obsługi systemów.



Rys. 6. Subiektywnie postrzegana przydatność poszczególnych typów symulatorów do uczenia się sposobu wykrywania niesprawności.

CONCLUSIONS

The research results show that the 2D simulators may be very effective as a teaching tool for the students in the early stage of their education because they give the idea about the operating principle of complete engine room systems and about their interdependencies. This simulator type can be also effective for the planning of the operational procedures during the resource management courses and the management level education in general. The another possible application of this simulator kind is the familiarization with another power plant type especially when comparing the rules of the operation of the diesel engine propulsion with the steam turbine and the diesel-electric system. In spite all the mentioned advantages many trainees consider them as a very abstract model of the reality, which sometimes is not taken quite seriously. This abstractness can be considered as an advantage by those experienced engineers who have seen already the several different engine rooms and know that the layout can be very different even for the same propulsion type.

The 3D simulators on the other hand are usually considered as very realistic and because of that they are taken very seriously by the most of the trainees. Especially those who have already some experience at sea are impressed by the simulator realistic look and feel, and because of that they trust that the mathematical model has the similar level of creditability. This high level of the realism is especially important in the case of the customized 3D simulators, developed for specific, actual (not generic) engine room models where the trainee should learn not only the principles, but also the detailed operation of the given machinery. This is mostly requested for the highly complicated modern engine room types like the passenger ships, LNG tankers or the platform supply vessels.

Keyword: *Engine Room Simulators, STCW, Marine Simulator Training*

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