INTERNATIONAL MARITIME ORGANIZATION

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SUB-COMMITTEE ON STANDARDS OF TRAINING AND WATCHKEEPING
43rd session
Agenda item 3

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VALIDATION OF MODEL TRAINING COURSES

Model Course – Train the Simulator Trainer and Assessor

Note by the Secretariat

SUMMARY

Executive summary:	This document provides a new draft model course on Train the simulator trainer and assessor
Strategic direction:	5.2
High-level action:	5.2.2
Planned output:	5.2.2.5
Action to be taken:	Paragraph 3
Related document:	STW 40/14

1 Attached in the annex is a new draft model course on Train the simulator trainer and assessor.

2 The preliminary new draft of this model course was forwarded to members of the validation panel for their comments. Relevant comments on the draft course have been received from the validation panel and incorporated, as appropriate.

Action requested of the Sub-Committee

3 The Sub-Committee is invited to consider the above information and take action as appropriate.

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ANNEX

DRAFT IMO MODEL COURSE ON TRAIN THE SIMULATOR TRAINER AND ASSESSOR

MODEL COURSE 6.09A

TRAIN THE SIMULATOR TRAINER AND ASSESSOR

Contents

INTRODUCTION

Purpose of the model course

The primary principle behind the IMO model course is to help maritime training institutes and their teaching staff, to organize the development of simulator training courses at the micro level in a way to give integrated simulator training to mariners. The model course will also assist the training institutes to enhance their existing capabilities so that the final outcome adds value to the skills of the mariner for its application on board a ship in a real working environment.

The model course can at best be described as a guideline, which when used with discretion can bring about uniformity in the world of maritime training. However, the intention of this model course is not to provide a package that is to be applied blindly. In any training mechanism, the presence of a trained instructor can never be underestimated or substituted. The knowledge, experience, skills and sincerity will always act as the lynchpin in transferring knowledge as the primary part of training. The quality of the instructor is thus the key to efficacy of transfer of knowledge to the trainees. They not only need to be qualified but be able to have a sound understanding of the working environment on board a ship. The sensitivity on part of the instructor will be an important factor to link the material for training (be it on a simulator or in the classroom) with the psychology of a seafarer in order to create as close a real life scenario as is possible. Only then can the post-training implementation be hoped for.

Education systems around the world are a function of cultural backgrounds. And these vary considerably from region to region. The success of this model course will therefore rest on the fact that it can guide the application universally. It has been drawn using a large canvass to identify the basic requirements and stipulations of IMO conventions and related recommendations related to maritime simulator training.

Use of the modular course

For an effective use of the model course, the instructor will need to appraise the course plan and the detailed syllabus. The appraisal will require information of actual knowledge and skills and prior technical education of the trainees. Furthermore, any difficulties arising due to differences between the actual trainee entry level and that assumed by the course designer will need to be identified.

For the course to be successful, as desired under this model course, considerable attention will need to be paid resources such as:

- Qualification and experience of simulator instructors
- Additional staff to execute the simulator training function
- Infrastructure – for simulation, lectures and discussions
- Equipment
- Resource material

Thorough preparation is the key to successful implementation of the course. IMO has produced a booklet entitled *"Guidance on the implementation of IMO model courses"*, which deals with this aspect in greater detail and has been referred to for the preparation of the modular course.

Part A: Course Framework

Scope

The course includes technical aspects of teaching that have a direct relation with the maritime simulator world. Without delving into the details at this stage, it is however emphasized that the simulator pedagogy, as well as psychology of learning forms an important element of the course.

The topics that have been covered in this modular course have been chosen in such a way as to provide a valuable introduction for those who have little experience in teaching and also as a very useful refresher for experienced instructors. In addition, those whose teaching experience has been limited to lecturing will gain considerable exposure, as they will explore the world of maritime simulation along with a variety of teaching techniques.

The course deals with the relevance of simulator in maritime training and the simulator pedagogy associated with the use of training on a maritime simulator. The basic aspects of learning process, purpose of training, setting of training objectives and basic principles of course design and the psychology of learning is also been touched upon, however it does not form the main thrust of the course. It is assumed that course participants would have received formal training in these aspects prior completing this programme.

The course involves conventional teaching and training methods, participative training techniques (such as task solving, both individually and in groups), simulation exercises involving ‘role playing’. While "ideal" solutions are sought in this part of the course, the practical constraints which simulator instructors face are taken into account. Adaptation to local circumstances is an important part of the course and should be demonstrated when appropriate.

The course has a large practical component in which the participants implement the theoretical guidelines by planning, creating, executing and evaluating their own simulation exercises. The experiential nature of the course being conducted largely using simulators provides the participants the opportunity to hone the necessary skills required to be an effective simulator instructor.

Hence the scope is to:

- Establish a reliable simulator training programme for the instructor to impart comprehensive simulator training to the seafarer that will include the amalgamation of:
  - Classroom teaching
  - Simulation training
  - Special working environment on board a ship and the human element
  - Psychology of learning
- Foster sustainable training skills to the instructor within the changing maritime environment
- Acquire simulator training skills that includes the psychology of learning

To sensitize the future simulator instructor to simulation technology, the simulation exercises will be controlled by an instructor and, initially, allow the trainees to become familiar with the equipment, the controls and the instrumentation provided by the simulator. The equipment and environment fidelity will be discussed with the trainees.

During exercises, trainees are expected to make use of effective bridge/engine-room/cargo procedures, and varying the environment. The trainees will also be made to comply with applicable Regulations and to observe the principles of various shipboard operations as set out in the relevant parts of the STCW 2010 Convention. Each exercise will be preceded by a session for briefing and planning and be followed by a debriefing.

Objective

The objective is to develop a sensitive instructor who fully understands the personality of a seafarer, the importance of simulation in maritime training, and pedagogy skill in order to impart sound and practical training to the seafaring fraternity. On completion of the course, the future maritime instructors should be able to contribute in formulating a training policy both at the macro, as well as the micro level. Finally, the future instructors should have a basis for evaluating the whole process of training. The crucial aim is to develop individual simulator instructor traits.

Thus, the thrust of the course is directed at promoting the knowledge, skills and attitudes, which the "ideal" instructor should possess by:

Acquiring training awareness where:

- There is a process of identifying training needs
- S/he has an understanding of the end result of training
- The potential benefits of training are clear and conveyed to the trainees, and
- The relationship of training to the real world scenario onboard ships is always kept at the forefront

Acquiring training skills related to:

- The process of adult learning
- Psychology of learning
- Parameters of course design
- Methodology of teaching techniques
- Instructor-trainee relationship and presentation proficiency
- Assessment of trainees
- Evaluation of course

Acquiring managerial skills and aptitudes relating to:

- Planning
- Organizing
- Identifying and providing resources
- Leadership
- Interpersonal relationships
- Communication skills

Expected end-of-training situation

It is envisaged that the trainees will have achieved a conceptual understanding of the importance of maritime education and simulator training with a view of the human element in shipping and special working environment on board a ship. In addition, this course would also assist in giving the prospective simulator instructors an understanding into the psychology of learning in order to design and conduct simulator-based training programmes, including exercises and detailed briefing and debriefing. The course will require the participants to actually plan a programme, set up exercises and conduct them in a manner in which the simulator is used to its maximum potential to enhance the professional development of seafarers. Also discussion on use of simulator for evaluation and assessment is included.

Entry standards

In addition to having basic knowledge of computer systems and IMO Regulations, trainees should have also complied with section A-I/6.4.1-2 of the STCW Code.

The qualification and experience of the instructor will play an important role just as its application to any course. Although, it is not only understood but implied as well, a seafaring background is a must. However, a seafaring background alone cannot be considered sufficient. What is necessary is an aptitude for maritime simulator training – an aptitude to pass on the knowledge. If one sees the level of maritime courses, i.e. courses for seagoing staff (short/specialized), seagoing staff (advanced), maritime safety/pollution prevention (administration), shipping company staff, long courses or STCW certificate courses, one would appreciate that the potential instructor will have to amalgamate his/her practical seafaring background with knowledge of pedagogy to be in a position to transfer knowledge.

Ideally, those entering the course will have had some experience in training, although those who are about to enter the profession would also be suitable. The balance of new entrants to experienced participants will affect the nature of the course and the instructor should be made aware of this aspect well in advance. It is also preferred that the trainee has completed IMO Model Course 6.09 – Training Course for Instructors or a similar programme in which the underlying concepts and the principles of the pedagogical processes are dealt with.

Course intake limitations

As guidance, the intake of participants will depend on the extent of simulation facilities available, since the course is largely practical and experiential in nature, each course participant must be able to have adequate hands on training on the simulator. Group sizes larger than six per simulator would potentially affect the reinforcement of learning and is not recommended. However, this is only a suggestive baseline. An institute can develop its own policy with regard to number of students in each batch based on these guidelines.

Staff requirements

The conduct of the course will require a minimum of two experienced instructors, who should have an adequate background and knowledge of maritime simulator practices. At least one, who would normally be the chief instructor, should be competent in the field of simulator training and instructor development. Also a point worthy of note is that this modular course includes simulator training on shipboard operations. Therefore, the instructors should have worked on maritime simulators for their personal experience in this regard will be well suited.

Participants may seek answers to local problems and opinions on a wide range of issues, which affect them. While such matters may not be included in the planned course, it would be of considerable advantage if the instructors should be well informed and have had a sufficiently wide experience to handle such matters.

Teaching facilities and equipment

The modular course relies on practical exercises conducted on a simulator to equip the prospective instructor on the various shipboard operations. Therefore, the participants must have access to a range of simulation technology and this will form an essential part of the facilities for this course. As a minimum requirement either a full mission ship handling / engine-room simulator; or part task of the alternative such as bridge/engine-room to be made available. However it is preferable that some form of LCHS (desk top or full mission) is also made available. Along with the simulator room, a briefing and debriefing room will assist in the exercises on the simulator. The infrastructure associated with classroom will be required. It is suggested that the ambiance provided for the entire course should be such that can promote interactive sessions rather than a monotonous environment of a regular classroom.

To augment the familiarization of various types of simulators, Demonstration CD 1 provides an introduction to different types of marine simulators and Demonstration CD 2 provides a brief exposure to the basic and critical controls and functions of a bridge, cargo handling and engine-room simulator. These demos are not meant to replace the simulator, but to provide additional awareness of different simulation technology available today.

Teaching aids

- Instructor Manual
- Demonstration CD 1 (enclosed) – An overview of various types of simulators available for maritime training
- Demonstration CD 2 (enclosed) – An interactive CD catering to specific instructions to operate the Bridge, engine-room and LCHS simulators
- IMO Booklet *"IMO – What it is, what it does, how it works"*
- IMO booklet *"Guidance on the Implementation of IMO Model Courses"*
- IMO catalogue – Model Course Programme
- OHP – Overhead Projector; LCD projector
- Simulators – Bridge, Engine-room and Liquid Cargo Handling simulators available at, but not limited to:

    1. ARI Simulation
    2. Kongsberg
    3. Poseidon
    4. STN Atlas
    5. Transas

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Part B: Course Outline and Timetable

The course outline is only a suggestive indication of what should be the time allocation. However, the ingenuity of the instructor should never be underestimated. S/he will have to adjust the time allocation into classroom study, problem solving exercises and training on the simulator – either individual or group.

The syllabus has been outlined as a list of learning objectives. The learning objectives have further been grouped together in a logical format. The instructor can use his/her professional judgement to set the type and duration to achieve the given objective. By type it is meant whether the simulator, classroom or problem solving will be chosen to achieve the particular learning objective within the broad framework of the course. It is to be noted however, the choice should not be made at random but after considerable planning, for, the relevant subject material will have to prepared in advance accordingly. This may be a useful approach when confronted with groups that may have different qualifications or require less comprehensive training than that envisaged.

The inputs that are required to achieve the learning objectives need not necessarily be constant, but depend on the different circumstances each time the course is conducted. As a consequence, the course outline, and particularly the time allocations and timetable, should be treated as a guide only. The experience of the participants, the simulation equipment available and the number of participants will all have an important bearing on the conduct of the course. It is left to the expertise of the individual instructor to mould a suitable training programme to achieve the set objectives.

Course Outline

	Subject Area	**Number of Hours**	**Simulation / Exercises**
	Class room lectures / discussions / demonstrations / presentations / exercises		
1	Introduction: What is Simulation and the Importance of Simulation Training in the Maritime Industry	1.5	-
2	Basic Simulator Design and Types of Simulators	1.5	-
3	The Scope of Simulation Training	1.5	-
4	The Simulator Instructor	1.5	-
5	Conceptualizing a Simulator Training Programme	3.0	-
6	Effective Interpersonal and Communication Skills	1.5	-
7	Conducting a Simulation Exercise	3.0	-
8	Assessment and Evaluation	3.0	-
	Exercises on a simulator		
1	Simulator familiarization	-	1.5
2	Simulation exercise creation	-	3.0
3	Simulation exercise 1	-	3.0
4	Simulation exercise 2	-	3.0
5	Simulation exercise 3		3.0
	Total	16.5	13.5
	Total for the entire course	**30.0 hours**	

Course Timetable

	1ST PERIOD (1.5 HOURS) (0900 – 1030 HRS)	2ND PERIOD (1.5 HOURS) (1030 – 1200 HRS)		3RD PERIOD (1.5 HOURS) (1300 – 1430 HRS)	4TH PERIOD (1.5 HOURS) (1430 – 1600 HRS)
DAY 1	Icebreaking activity, Introduction, What is simulation? The Importance of Simulation Training – THEORY	Types of Simulators, Classification, Design and Configuration THEORY & DEMO 1	**MEAL BREAK (1200 – 1300 hrs)**	The scope of simulation training, STCW 2010 & simulation training – THEORY & TASK 1	Simulator familiarization – PRACTICAL TASK 2
DAY 2	Conceptualizing and Planning a Simulation Programme – THEORY	Conceptualizing and Planning a Simulation Programme – THEORY & PRACTICAL TASK 3		Creation of a Simulation Exercise TASK 4 – DEMO 2 & PRACTICAL	Simulation Exercise Planning TASK 5
DAY 3	The Simulator Instructor – THEORY	Conducting a simulation exercise – THEORY		Conduct Simulation Exercises – PRACTICAL TASK 6	Conduct Simulation Exercises – PRACTICAL TASK 6
DAY 4	Effective Interpersonal and Communication Skills THEORY	Simulation Exercise Planning TASK 5		Conduct Simulation Exercises – PRACTICAL TASK 6	Conduct Simulation Exercises – PRACTICAL TASK 6
DAY 5	Assessment, Evaluation and Verification – THEORY & PRACTICAL TASK 7	Conduct Simulation Exercises – PRACTICAL TASK 6		Conduct Simulation Exercises – PRACTICAL TASK 6	Discussion, Summary and Course Evaluation – THEORY

Part C: Detailed Teaching Syllabus

The detailed teaching syllabus indicates the contents of the course and appropriate references and teaching aids.

- **Learning objectives**

The detailed teaching syllabus has been written in learning objective format in which the objective describes what the trainee must do to demonstrate that knowledge has been transferred. This format is an appropriate teaching and assessment tool to express:

The depth of understanding of a subject and the degree of familiarization with a subject on the part of the trainee, what capabilities the trainee should really have and be able to demonstrate.

Every instructor is encouraged to teach learning in an "objective-related" way instead "material-related". In this context, all objectives are understood to be prefixed by the words, "The expected learning outcome is that the trainee is able to ...".

To indicate the degree of learning outcome of this course, the learning objectives for the Detailed Teaching Syllabus can be classified in three 'dimensions':
C (cognitive)
A (affective)
P (psycho-motor)

Within a dimension, they are hierarchized by increasing complexity (C1 to C6, A1 to A5, and P1 to P5) where the complexity (depth, familiarization) is expressed (following B. Bloom and others) by a typical verb as follows:

Cognitive dimension of learning objectives:

C1	Knowledge	describe, outline
C2	Comprehension	explain
C3	Application	apply, perform, operate
C4	Analysis	analyse
C5	Synthesis	synthesize, construct, plan
C6	Evaluation	assess

Affective dimension of learning objectives:

A1	Reception; notice	recognize
A2	Response	respond
A3	Value	value
A4	Organization	organize
A5	Value characterization	accept, appreciate

Psycho-motor dimension of learning objectives:

P1	Imitation	imitate
P2	Manipulation	manipulate
P3	Precision	move, mark
P4	Coordination	coordinate (operations, menus)
P5	Naturalization	automate, internalize

- **Note**

Throughout the course, safe working practices are to be clearly defined and emphasized with reference to current international requirements and regulations. It is expected that the institution implementing the course will insert references to national and/or regional requirements and regulations as necessary.

Knowledge, Understanding and Proficiency	Course Compendium Ref.	Other Reference
1. Introduction: What is Simulation and the Importance of Simulation Training in the Maritime Industry	1.0	Demo 1
1.1 explain the concept of simulation		
1.2 explain the effectiveness of simulation training		
1.3 describe the benefits of simulation training		
1.4 discuss the need to supplement what is learned on the course with practical experience in developing course programme, Simulator exercises and in conducting assessment		
1.5 discuss that the course draws on the practices of several IMO Member States as examples of how competence-based assessment and examination systems may be conducted using simulators and emphasizes the common fundamentals and principles		
2. Basic Simulator Design and Types of Simulators		None
2.1 Define Simulator equipment	2.1	
2.2 State the basic Elements of simulation	2.1	
2.3 Describe the simulator systems classified based on level of performance of tasks	2.1	
2.4 Lists different types of simulators based on functions	2.1	
2.5 Describe the software components of Simulators	2.1	
2.6 Describe the configuration of Part Task simulator	2.1	
2.7 Describe the configuration of Multi-task Simulators	2.1	
2.8 Explain the layout of full Mission simulators	2.1	None
2.9 State that the simulators used for mandatory simulator based training shall: – be suitable for the selected objectives and training tasks; – be capable of simulating the operating capabilities of shipboard equipment concerned, to a level of physical realism appropriate to training objectives, and include the capabilities, limitations and possible errors of such equipment; – have sufficient behavioural realism to allow a trainee to acquire the skills appropriate to the training objectives; – provide a controlled operating environment, capable of producing a variety of conditions, which may include emergency, hazardous or unusual situations relevant to the training objectives; – provide an interface through which a trainee can interact with the equipment, the simulated environment and, as appropriate, the instructor; and	2.2	

Knowledge, Understanding and Proficiency	Course Compendium Ref.	Other Reference
– permit an instructor to control, monitor and record exercises for the effective debriefing of trainees.		
2.10 State that the simulator used for the assessment of competence required under the Convention or for any demonstration of continued proficiency so required shall: – be capable of satisfying the specified assessment objectives; – be capable of simulating the operational capabilities of the shipboard equipment concerned to a level of physical realism appropriate to the assessment objectives, and include the capabilities, limitations and possible errors of such equipment; – have sufficient behavioural realism to allow a candidate to exhibit the skills appropriate to the assessment objectives; – provide an interface through which a candidate can interact with the equipment and simulated environment; – provide a controlled operating environment, capable of producing a variety of conditions, which may include emergency, hazardous or unusual situations relevant to assessment objectives; and – permit an assessor to control, monitor and record exercises for the effective assessment of the performance of candidates.	2.2, 2.4 2.2, 2.4	None None
2.11 Prepare a checklist for inspecting an engine-room simulation equipment capable of simulating a main and auxiliary machinery system operation	2.3	None
2.12 Write down the specifications of Ship Handling Simulator	2.3, 2.4	
2.13 Define fidelity	2.5	
2.14 Explain fidelity requirements set out in STCW code for RADAR Simulator		
2.15 Explain different components of Fidelity		
2.16 State that fidelity varies with type of simulators		
2.17 Differentiate between Physical Fidelity and Cognitive fidelity		
2.18 State that high fidelity does not necessarily leads to better learning and task performance		
2.19 Define validation	2.6	
2.20 State that flag administration may regulate validation and approval of simulators		
2.21 State that there are no international standard validation regulations for simulators		
2.22 State that DNV has classified simulators and validates simulators		

Knowledge, Understanding and Proficiency	Course Compendium Ref.	Other Reference
3. The Scope of Simulation Training	3.1, 3.2, 3.3,3.4, 3.5, 3.6, 3.7, 3.8	None
3.1 Identify and map the competencies from STCW with regard to simulation training		
3.2 Explain the relationship between the simulator instructor and simulation in relation to STCW		
3.3 State the seven standards of competence as laid down in the STCW		
3.4 Discuss the STCW 2010 requirements with relation to simulators and simulation		
3.5 Discuss the non-mandatory simulators as per STCW		
3.6 Explain the levels of responsibility stated under the STCW Code		
3.7 Describe in detail the simulator class for bridge operations as an example		
3.8 Discuss in detail the competency matrix as required by the STCW Convention for the various parameters of bridge simulation		
3.9 For the bridge simulators, discuss the STCW reference, the competency required, as well as the level of simulation required		
4. The Simulator Instructor		
4.1 Identify change in role from sole voice of authority to varied roles of facilitator, dedicated teacher, manager, learning strategist, guide, motivator, evaluator and native psychologist	4.1	None
4.2 Recognize the importance and influence of trainer's attitude on teaching effectiveness and student's performance		
4.3 Recognize the need for being familiarized with the simulators as an essential pre-requisite	4.2	None
4.4 Realize the correlation of his subject knowledge with its usage on simulators		
4.5 Appreciate the importance of being aware about different pedagogical and instructional techniques		
4.6 Determine the key element of establishing trust and rapport with the students		
5. Conceptualizing Simulator Training Programme		
5.1 Explain the general principle of conceptualizing and planning a training programme	5.1	Task 3
5.2 Discuss the simulator based learning objectives	5.1	
5.3 Explain the stage 1 of simulation based compliance	5.1	
5.4 Describe the competence as stipulated in STCW 2010 for maintaining a safe engineering watch	5.1	

Knowledge, Understanding and Proficiency	Course Compendium Ref.	Other Reference
5.5 Describe the parameters of stage 2 dealing with detailing the simulator programme	5.2	
5.6 Describe situational analysis	5.3	
5.7 Explain the setting of the level of simulation	5.6	
5.8 Discuss the simulator characteristics and specification	5.7	
5.9 Explain the 3 parameters of organization of the simulation course plan	5.9	
5.10 Describe the designing of simulation exercise and discuss the sample instructor worksheet	5.10	
5.11 Explain the importance of evaluating the trainee / training programme	5.10	
5.12 Describe and design evaluation for trainee	5.10	Task 3
5.13 Describe and design evaluation of training programme		
5.14 Explain the steps in designing a training programme	5.10	
5.15 Understand the filling of working / observation sheet	5.10	
5.16 Comprehend the importance of Student Evaluation Sheet	5.10	
5.17 Discuss the parameters of course feedback form	5.10	
6. Effective Interpersonal and Communication Skills		
6.1 List various elements of communication skills that can enhance the teaching effectives		
6.2 Demonstrate the usage of each sub-skill set in their lesson plan		
6.3 Distinguish the commonly mistaken statements as fact or opinion		
6.4 Display constructive feedback techniques		
6.5 Exemplify positive and productive ways of giving effective briefing and debriefing		
6.6 State the equation of effective teaching		
6.7 List the various presentation skills to create a lasting impression in minds of students	6.1, 6.2, 6.3, 6.4	None
6.8 Demonstrate each skill-set in their teaching to sustain the interest of the students		
6.9 List examples of the challenging behaviours that might be expected from the students		
6.10 Explain the various factors attributing to varied reactions from students including disruptive behaviours		
6.11 Identify disruptive behaviour in students		
6.12 Appreciate increased understanding of the do's and don'ts of dealing with difference in reactions from students		

Knowledge, Understanding and Proficiency	Course Compendium Ref.	Other Reference
6.13 Explain various questioning techniques		
6.14 State examples of different kind of questions		
6.15 Elaborate the specific type of questioning technique which can be used under given circumstances		
6.16 List the areas and implications of usage of questioning techniques in their course plan sessions		
7. Conducting a Simulation Exercise		
7.1 Explain setting the scene: comfort level, past experiences of participants, importance of building trust and respect amongst facilitators and participants	7.1 – 7.10	Task 6
7.2 Discuss the simulation experience as a contributor in the journey towards professional development and competence enhancement not viewed as an isolated and disjointed assessment of professional competence		
7.3 Explain clarity in objectives and expectations		
7.4 Discuss organization of the participants: role play, responsibilities		
7.5 Explain the role of the facilitating team		
7.6 Discuss anticipating the psychological factor		
7.7 Explain parameters for instructor "interference" in the simulation exercise		
7.8 List the four component of the simulation session as: briefing, planning, execution of simulation exercise and debriefing		
7.9 Describe the elements to be included in a preparation checklist at a minimum to be: pertinent parameters, additional equipment, materials to be used in the simulation exercise such as publications, manuals, charts, logbooks, stationary, etc.		
7.10 Explain that the environment and ambience of the simulation space will have an impact on creating a sense of realism.		
7.11 Note that environmental factors such as heating/cooling, lighting, noise, vibration, etc., should be set to as realistic level as possible.		
7.12 List the external and internal factors effecting the simulation session		
7.13 Recognize that participants need to be prepared both technically and psychologically for the simulation session		
7.14 State that necessary underpinning knowledge is to be covered prior to the simulation session		
7.15 Explain that the participants should be clearly communicated about the objectives of the session		

Knowledge, Understanding and Proficiency	Course Compendium Ref.	Other Reference
7.16 Explain the importance of making participants feel comfortable and mentally ready to accept the simulation exercise as an effective vehicle for professional development	7.1 – 7.10	Task 6
7.17 Understand that the simulation programme and individual exercises are not to be considered in isolation but as part of a journey of professional competence		
7.18 Recognize that the simulator instructor should gain as much information about the past experiences of the participants to assist in greater understanding of the current performance		
7.19 Understand how it is important to build a sense of trust and respect between the instructor and the participants		
7.20 List the individual factors which can influence the participants reaction to the simulation exercise		
7.21 Note the importance of a well-planned, thorough and structured briefing session		
7.22 List the critical elements of a briefing exercise as: setting the objectives of the session; explanation of the scenario; detailing the plan of action to be taken; listing all relevant parameters including starting condition; informing regarding any events which may occur; clarifying standard procedures/guidelines to be followed; assignment of roles; clarification of evaluation parameters and ground rules for conduct of the exercise		
7.23 Explain the factors to be taken into account when assigning roles to participants		
7.24 State how particular care is to be taken for assignment for the first main exercise after the familiarization		
7.25 Describe the ground rules regarding the conduct of the simulation session		
7.26 Describe the various roles and responsibilities of the facilitating team		
7.27 List the ideal complement for the facilitating team dependent on the type and level of the exercise		
7.28 Describe the advantages of peer observation and evaluation		
7.29 State that ample time must be dedicated for planning of the exercise by the participants		
7.30 Identify 2 stages in planning: detailed operational and procedural training and role playing prior to commencement of the exercise		
7.31 Describe the elements of operational and procedural planning		
7.32 Describe why the role playing briefing meeting is important for the team prior to commencing the simulation		

Knowledge, Understanding and Proficiency	Course Compendium Ref.	Other Reference
7.33 Describe why thorough familiarization to the simulator is important	7.1 – 7.10	Task 6
7.34 List the elements in carrying out familiarization of the simulation equipment and functioning		
7.35 Explain the importance of finding a balance between letting the simulation run without interference and injecting inputs when required		
7.36 Describe how overloading the participant can be detrimental		
7.37 State that the instructor must always keep the exercises objective in mind when deciding to increase or decrease the complexity of the simulation		
7.38 Describes how stimuli and cues can be introduced during the simulation exercise		
7.39 Describes how the parameters, actions and elements are to be noted, logged and recorded during the exercise		
7.40 List the conditions in which a simulation exercise may be aborted		
7.41 Conduct a planned debriefing session	7.1, 7.2, 7.3, 7.4	
7.42 Elaborate the effect of 'location' in debriefing session		
7.43 Explain the need of gap period in debriefing		
7.44 Demonstrate the role of trainer as an effective "evaluator"		
8. Assessment and Evaluation	8.1 – 8.5	Task 7
8.1 Explain what the performance test analysis is		
8.2 Describe the performance test criteria for simulated situations		
8.3 State that where possible, conditions of a performance test should mirror a real-life situation		
8.4 State the four parameters of performance criteria		
8.5 Explain the performance evaluation and certification assessment vis-à-vis training, competence and proficiency		
8.6 State that the types of evaluation and assessment includes informal evaluation, as well as formal evaluations		
8.7 Explain the competency based training and assessment system		
8.8 State that for assessing the performance of the trainee for competence it is necessary that the three cognitive, psychomotor and affective domains are assessed across different levels		
8.9 Explain the relationship between STCW and the competency based training and assessment		
8.10 Summarize the advantages of simulators for assessment		

Knowledge, Understanding and Proficiency	Course Compendium Ref.	Other Reference
8.11 Describe the eight steps of the assessment process		
8.12 Discuss the example of setting assessment criteria		
8.13 State the Learning Objectives, Domains, Evaluation Method and Simulator type and class of assessment		
8.14 Describe the choice of assessment criteria		

Part D: Instructor Manual

■ General

This manual reflects the views of the course designer on methodology and organization, and what is considered relevant and important in the light of his experience as an instructor. Although the guidance given should be of value initially, the course instructor should work out his own methods and ideas, refine and develop what is successful, and discard ideas and methods, which are not effective.

Preparation and planning constitute a major contribution to effective presentation of the course.

The course outline and timetable provide guidance on the time allocation for the course material, but the instructor is free to modify this if it is deemed necessary. The detailed teaching syllabus must be studied carefully and, where appropriate, lesson plans or lecture notes compiled.

Preparation and planning are the most important criteria in effectively presenting this course. Availability and proper use of course materials is also essential for maximum efficacy in conveying the subject to trainees. The capabilities and limitations of the facilities in use may dictate that the learning objectives be adjusted but it is suggested that this be kept to a minimum.

Compendium for Model Course

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Compendium for Model Course

CHAPTER 1

1. An Introduction to Simulation Training

For the effective education and training of seafarers, it is important that the three key elements of learning: knowledge, skill and attitude are incorporated into the learning programme.

Traditional methods of instruction have been largely adopted for maritime training courses, however with the advancement of technology and reducing costs, the industry is witnessing the increasing introduction of technology into the classrooms, including the use of simulation technology.

A competent seafarer is required to carry out a range of tasks and operations both in routine and unpredictable situations. He/she needs to have the ability to multi-task, take appropriate decisions at the right time, prioritize and work together effectively in a team. The application of theoretical knowledge in practical and at times demanding circumstances requires a seafarer to be able to assimilate many aspects of a situation real time.

The use of simulators provides a learning platform where all three elements of learning can be integrated into a valuable learning experience.

The Manila Amendments to the STCW Convention have also embraced the use of simulators for training and evaluation and assessment of competence. It is therefore important that the potential for utilizing this valuable training tool is realized to the maximum.

The four elements involved in providing training based on simulators show an intensive interaction:

- Simulator equipment
- Training programme
- Student
- Instructor.

The four elements are also dependent on each other. Any change to one of the elements will influence the other. This implies that the various elements should not be considered separately but always in relation to one another.

The role of the instructor for ensuring the successful implementation of simulation training programmes cannot be over-emphasized. It is the skill and sensitivity of the instructor that can allow the simulator to be used as a powerful means for an individual to practice and hone his/her skills in a safe environment. Creating a conducive atmosphere for learning and assimilation of the experience is as key an element as the actual features and performance of the simulator itself.

The purpose of this model course is to train the simulator instructors for training of seafarers and achieving the desired results of the competency based training method as reflected in the STCW Convention, as revised in 2010.

CHAPTER 2

2. Basic Simulator Design and Types of Simulators

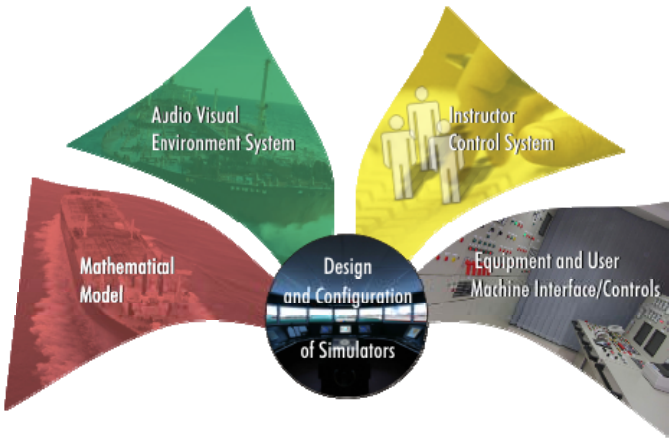
2.1. Design and Configuration of simulators

Simulation is close to real replica of equipment, systems, phenomenon or process. It is normally a mathematical or algorithmic model, combined with a set of initial conditions that allows prediction, visualization and control with change in time and the model allows easy manipulation of the conditions and parameters. Simulation is used in many contexts, such as simulation of technology for performance optimization, safety engineering, testing, training, education, and video games. Use of approved simulators to demonstrate certain competence has been specified in STCW 2010 as one of the methods of evaluating performance.
The basic operational features in simulation that are applicable to use of simulation for training and assessment are:-

- Representation of real operational scene
- Provision of control of the scene
- The calculated exclusion of some parts of the operational scene
- Provision of recording and playback of the scene for assessment and debriefing purposes

Based on the above operational features the basic design of a simulator may be said to comprise of the following Components:

1. Audio Visual Environment System
2. Mathematical Model
3. Equipment and User Machine Interface/Controls
4. Instructor Control System



The above components contribute to the four important characteristics of the simulators – physical realism, behavioural realism, setting/controlling, monitoring the operating environment. These characteristics vary depending on the level of fidelity, and accuracy of the components as well as on the number of modules or components. For instance, the increasing details in the graphic images to create the visual scene as well more number of projectors will improve the physical realism by displaying all round field view of photographic scene. However such fidelity is not required for performing all the tasks necessary for a competence. Moreover the tasks and their complexity vary with level of responsibility. A range of simulators from a PC based to full mission simulators are available for demonstrating competence for a specific function.

A simulator is an expensive resource and it needs to be approved by the Administration when used for mandatory simulator-based training and/or when used as a means to demonstrate competence. Since they are not the same, a distinction needs to be made between the various types, by classification of simulators or by creating a hierarchy within the different subject areas. Neither STCW nor any IMO guidelines or resolution provides for standards for approval of the simulators. With input from International Marine Simulators Forum (IMSF), DNV for example, has classed the simulators as follows on functional basis and further subdivided each class into four categories depending on the level of tasks it is capable of simulating. The maritime simulators are subdivided into following function areas:

- Bridge Operation
- Machinery Operation
- Radio Communication
- Liquid Cargo handling
- Dry Cargo and Ballast handling
- Dynamic Positioning
- Safety and Security
- VTS Operations


Different Types of simulators (LCHS & DP)

In turn each of those function areas is divided into four simulator classes:

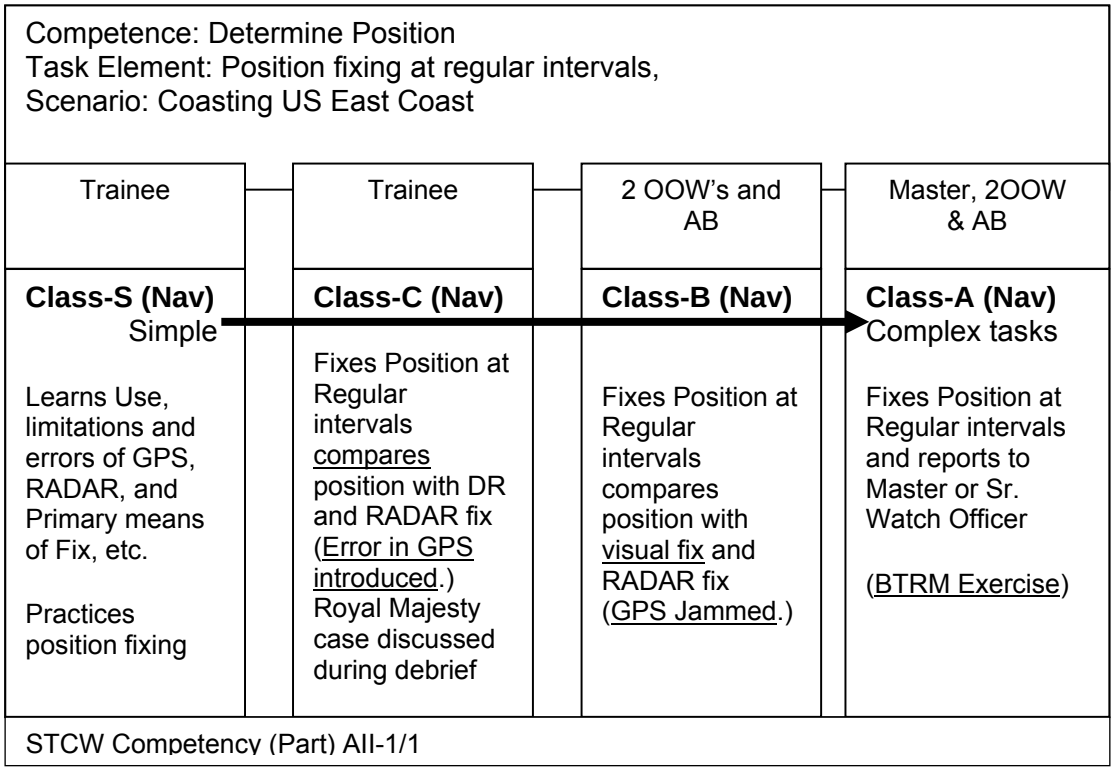
- Class A (full mission)
- Class B (multi-task)
- Class C (limited task)
- Class S (special task)

Table: Simulator classes for the function area bridge Operation (An example)		
Class A (NAV)	Full Mission Simulator	A full mission simulator capable of simulating a total shipboard bridge operation situation, including the capability for advanced manoeuvring in restricted waterways.
Class B (NAV)	Multi Task Simulator	A multi task simulator capable of simulating a total shipboard bridge operation situation, but excluding the capability for advanced manoeuvring in restricted waterways.
Class C (NAV)	Limited Task Simulator	A limited task simulator capable of simulating a shipboard bridge operation situation for limited (instrumentation or blind) navigation and collision avoidance.
Class S (NAV)	Special Task Simulator	A special tasks simulator capable of simulating operation and/or maintenance of particular bridge instruments, and/or defined navigation/ manoeuvring scenarios.

The DNV standard ensures that the simulations provided by the simulator include an appropriate level of physical and behavioural realism in accordance with recognized training and assessment objectives. The Administrations may use the standards as one way of carrying out approval of the simulators.

Different Types of simulators (SMS & ERS)

With this classification the trainee can be gradually introduced to the simulator from a simple task based simulator to a full mission simulator, thereby making optimum use of the costly simulator facilities and instructor time to achieve desired proficiencies without overloading the trainee, e.g.



Computer Simulations and Applications – A List of Definitions		
Term	**Definition**	**Application Examples**
Skills Trainers		
PC based Simulator		Loadicator Software
Limited task Simulator	Simulator that selectively focuses on training of specific critical skills de-constructed from larger tasks	Cockpit Procedures Trainer
Multi task Simulator	Simulator that selectively focuses on training of specific critical skills de-constructed from larger tasks	Cockpit Procedures Trainer
Full Mission Simulator	Simulator that encompasses the entire procedure or task to be trained	
Planning and Mission Rehearsal Systems	Simulator that is used for planning procedures, activities or tasks prior to execution	-Synthetic Theatre of War -Radiotherapy planning systems
Physical Simulator	Simulator that use physical objects for training such as equipment controls and switches, manikins, etc.	SimMan
Micro Simulator	PC-based simulator that provides training and assessment without specialized VE interface hardware or extensive, real-time graphics	MicroSim Military
Distributed/networked simulation	Simulator that connects different client locations through computer networks and supports multiple, simultaneous users	-Aviation Combined Arms Tactical Trainer-Aviation simulator (military) -Unreal Championship (game)
Exploration Environment	Synthetic, computer-generated spaces and environments	CAVE (Computer Automatic Virtual Environment)
Virtual Reality (VR)	Generic term, coined by Jaron Lanier in the 1980s, to describe human/machine interface technology that allows the operator to act in artificial, computer-generated worlds	
Augmented Reality	Superimposition of data, images, or graphics on real-world scenes through the use of VE interface displays such as glasses or HMDs	Shared Space project (HITLAB)
Pre-Rendered Animation	Laborious modelling process used in film and entertainment by which computer-generated video frames are developed. Animations can be photo realistic and appear to run in real-time, but are non-interactive.	Jurassic Park (movie)
Real-time graphics	Software development process used in gaming and other interactive applications to support real-time interaction between the user and the computer-generated virtual environment. Requires simplification of visual models and interactivity to run in real-time.	Quake (computer game)
Visualization		C3 Interactive – Legal 3D visualization

2.2. Critical Components

The components of a simulator vary with the type and class of simulator however the generic components will fall under the following categories:

1. Physical Realism (Equipment layout, HMI and Controls, etc.)

2. Behavioural Realism (Mathematical Model for different processes and systems, e.g. vessel)

3. Operational Environment (Visual scene including objects, degree of view, motion platform)

4. Monitoring and Evaluation

The layout of a simulator will also depend on the type and class of simulator but normally will have three essential areas - the Server Station, Instructor Station and the Trainee station. As an example, the components of the each of the stations for Bridge simulator are given below:

Server Station:

- Visual Scene Generator
  - Terrains
  - Vessels
  - Objects
  - Environment elements rain, snow

- Mathematics modeller
  - Vessel
  - Objects
  - Currents
  - Tides
  - Wind
  - Tugs
  - Contacts and mooring
  - Sea and swell
  - Interactions
  - Equipments
  - Alarms and Controls
  - Environment Effects
  - Sensors
  - Lights

- Exercise Area
- Network Equipment

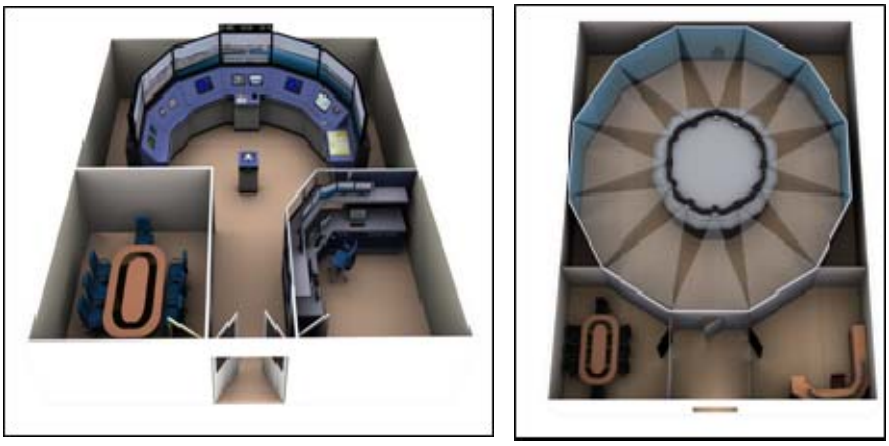
Trainee Station:

- Camera
- Speakers
- Overhead Indicators Panel
- Navigation Equipment
- Steering Control and Alarms
- Engine, thrusters Controls and Alarms
- Visual Systems (Projectors or Plasma)
- Lights and shapes Panel

Instructor Station:

- CCTV Monitor
- Speakers
- Visual Scene
- Instructor Monitoring controls

2.3. Sample layouts of various simulators



Sample layouts of Bridge Simulator (180 degree Plasma based and 360 degree Projector based)

Sample layout of DP simulator and FMERS

2.4. Minimum Performance standards

STCW with its revision adopted in 2010 sets the performance standards against each level of competency. The STCW competence tables specify the Knowledge, Understanding and Proficiency, Methods for demonstrating competence and Criteria for evaluating competence for each competency. The column (3) Methods for demonstrating competence Simulator is listed as one of the method.

As an example for the demonstrating competence for Mates and Masters, the Simulator should conform to the requirements of STCW 2010 Regulation I/12 (use of simulators), section A-I/12, parts 1 and 2, Performance Standards for the simulator and Simulator training Objectives and sections B I/12, 37, 38, 39 (guidance regarding the use of simulators).

2.4.1. SIMULATOR SPECIFICATIONS (Ship Manoeuvring and Bridge Team Work Course)

- Full – Mission Simulator consisting of one or more own ship stations having a full scale mock - up of a ship's bridge with instruments for navigation as listed below, as well as full scale display of target ships and surroundings as seen from the portholes of a wheel house.
- Equipment and consoles to be installed, mounted and arranged in a ship like manner.
- A separate instructor room equipped with equipment necessary to monitor the activities in the wheel house effectively.
- Each piece of equipment installed in the simulator shall have a similar functionality to corresponding equipment used on board ships.
- If any piece of equipment does not correspond to a specific make, (the applicable IMO performance standard (functionality requirements only) for such equipment shall be followed. If such a performance standard does not exist, then the functionality of the equipment shall, as a minimum, be the same as for any recognized genuine equipment of that type, in use on board ships.
- Each piece of equipment shall resemble the behavioural characteristics e.g. accuracy, reaction time and other limitations, related to corresponding equipment in use on board ships.
- User manuals for the simulator equipment and operational controls shall be available to the learners for use during exercises.

2.4.2. SHIP TYPES AND AREAS

1. The simulator shall include mathematical models of at least 10 types of own ship. The models shall resemble accurately the behavioural characteristics of an actual ship of that size, power and type, and realistically behave as per the hydrodynamic effects of wind, current and swell. (See section E for recommended ship types)

2. The simulator shall be able to present at least 20 different types of target ships, each equipped with a mathematical model, which accounts for motion, drift and steering angles according to forces induced by current, wind and wave.

3. The simulator should be able to provide at least eight international geographical visual areas for exercises which include open sea and high density traffic areas. (See section F for recommended Geographical Areas)

2.4.3. DETAILED SPECIFICATIONS

A. Visualization

1. At least 5 channels visualization of high resolution graphics, about 170 degree horizontal field of view. In addition, the remaining 190 degree view should be able to be viewed by panning.
2. The visual system shall present all navigational marks as displayed on ECDIS and paper charts for that area.
3. The visual system shall show objects with sufficient realism (detailed enough to be recognized as in real life).
4. The visual system shall replicate movements of all Own Ships according to 6 degrees of motion freedom.
5. The simulator shall provide a realistic visual scenario by day, dusk or by night, including variable meteorological visibility, changing in time. It shall be possible to create a range of visual conditions, from clear to dense fog.
6. It shall be possible to take accurate bearings of objects seen on the screen.
7. It shall be possible to use magnified view for observations.
8. The visual system shall present at least 25 degrees of vertical field view. In addition by any method, it shall be possible to observe the ship's side and the dock during mooring operations.
9. There should be a proper correspondence between the visual picture, RADAR and ECDIS.

B. Simulator Capabilities

1. The model shall realistically simulate own ship hydrodynamics in open water conditions, including the effects of wind forces, wave forces, tidal stream and currents.
2. The model shall realistically simulate own ship hydrodynamics in restricted waterways, including shallow water and bank effects and interaction with other ships.
3. The simulator shall provide an own ship engine sound reflecting the power output.
4. The target ships shall be equipped with navigational lights, shapes and sound signals, according to the "Rules of the Road". The signals shall be individually controlled by the instructor and the sound signals shall be directional and fade with range.
5. The simulator shall be able to present at least 20 target ships (See STCW-95, section A-I/12.4.3) at the same time, where the instructor shall be able to programme voyage routes for each target ship individually.
6. The simulator shall be capable of providing environmental sound (e.g. wind) according to conditions simulated.
7. The simulation shall include the depth according to charts used, reflecting water level according to tidal water situation.
8. The simulator shall provide waves, variable in direction and strength.

9. It shall be possible to simulate usage of at least 4 tugs for the purpose of mooring the vessel with the capability to control the power and orientation of the tugs (push and pull).

10. It shall be possible to berth and un-berth a vessel using mooring lines with the capability to control run out, heave, slack, stop, let go the various mooring lines bearing in mind their breaking stress.

11. It shall be possible for Own ship to let go the bower anchors and control is pay-out as per the strain on the cable. The simulator shall have the capability to read the number of shackles out and the strain at any time.

C. Own Ship Control Station

The following shall be provided as HARDWARE PANELS and shall be installed, mounted and arranged in a manner that would physically resemble a ship's navigating bridge. These hardware panels should have operational resemblance to actual shipboard equipment.

1. Propulsion Controls for controlling own ships engine ahead and astern.

2. Bow-Thrusters Control

3. Steering Console Stand

There shall be provision for the following, at or near the console:

(a) Steering wheel
(b) Steering motors (at least two)
(c) Hand, auto-pilot and non-follow up steering.
(d) Compass Repeater able to depict gyro and/or magnetic heading.
(e) Gyro failure alarm
(f) Auto-pilot

The Auto-Pilot should have the following capabilities:

i) Weather adjustment (yawing and course control)
ii) Rudder limit setting
iii) Counter Rudder
iv) Off-course alarm
v) Setting of constant rate of turn.

4. Engine Alarm Panel giving audible and visual alarm in case of:

(a) Start fail
(b) Shut down
(c) Slow down
(d) Over speed
(e) Overload

5. RADAR set with Automatic RADAR Plotting Aids (ARPA) – 21" colour screen

It shall be possible to simulate both 3 cms and 10 cms RADAR. The RADAR shall be capable of being operated in the sea stabilized relative motion mode and sea and ground stabilized true motion modes (see STCW 95, sections A-I/12.4.1 and 3).
The RADAR simulation equipment shall be capable of generation of interference, noise, RADAR/ARPA failure, yawing, clutter, spurious echoes, blind sector, and parallel index lines.

The ARPA simulation equipment shall incorporate the facilities for:

- Manual and automatic target acquisition
- Past track information
- Use of exclusion areas
- Vector/graphic time and data display
- Trial manoeuvres

6. ECDIS 21" colour screen

Vector charts should be available for the exercise areas. It should be possible to edit existing areas and be able to generate chart database of any area and scale if desired at a later stage. Normal features for ECDIS system should be available including cart scaling and zooming, review, selectable layer, route planning and monitoring.

7. VHF Communication System

Communication between ships and port VTS shall be simulated on VHF sets which will have at least the following channels = 16, 6, 8, 9, 10, 12, 13, 14, 75, 77, 69, 67.
The following realism should be depicted:

- Volume control
- Squelch
- Dual watch.
- Press switch when speaking
- Simplex communication system.

8. Intercom/Telephone

There should be a provision to communicate between Bridge and the other strategic locations like engine-room, steering flat, Master, C/O, 2/O, 3/O, C/E, forward, aft, etc.

9. General Emergency Alarm

There shall be a facility provided for activating the General Emergency Alarm from the wheelhouse.

10. Chart Table with paper charts and publications

Chart Table will resemble a ship's Chart Table of minimum dimension 4ft x 3ft. Paper charts and publications provided shall be appropriate for the areas in use.

11. Indicators

Each own ship station shall have at least the following indicators:

(a) Wind direction and speed indicator
(b) Rudder Angle Indicator
(c) Rate of Turn Indicator
(d) RPM/Pitch Indicator
(e) Clock (Exercise time indicator)
(f) Depth indicator
(g) Doppler Speed Log

It should be capable of indicating fore/aft and athwart ship speed. Depending upon the depth, speed shall be indicated on ground or water track.

12. Ships Horn

To be provided on the wheelhouse console as a push button.

The following equipment shall be SIMULATED:

If not using hardware panels, then, a colour monitor of not less than 17" size interfaced with the position and movement of own ship shall be used.

1. Electronic Navigation Aids

(a) Global Position System (GPS) - Simulation of all facilities of a standard GPS receiver shall be available. This should include display of latitude, longitude, course and speed over ground by the own ship, UTC, normal navigational calculation functions such as Great Circle, Rhumb line sailing, 100 way points, Alarms for X-track error, anchor drag, approaching way point, etc.

2. Echo Sounder

Simulation of complete echo sounder shall be provided. Facility to change gain adjustment, change over from DBS to DBK and vice versa, etc, shall be provided. Alarm for shallow water depth should be provided.

3. Anchor Control capable of simulating anchoring with 2 anchors (port and stbd - Bower anchors)

(a) Means to let go and heave up own ship's anchor.
(b) Indicators for amount of cable paid out, direction of cable and strain on cable.

4. Sound Signal Generator

Ship's whistle and fog signals: Facilities shall be available to generate fog signals manually or automatically operated by own ship(s) independently, as well as for each target separately by the Instructor console. The fog signals should be interactive and the intensity and direction at own ship stations shall correspond to relative range and position of the station generating the sound signal. The fog signal generator shall be capable of generating the sound signals for the following:

a) Vessel making way through water.
b) Vessel making no way through water.

c) Vessel restricted in her ability to manoeuvre.
d) Vessel at anchor.
e) Vessel aground.
f) Vessel not under command.

5. <u>Navigation Lights and Shapes Display</u>

Full set of Navigation, Christmas tree lights and shapes shall be available, which the own ship can select for display depending upon the prevailing circumstances.

D. Instructor

The instructor and the assessor shall be able to:

a. Start, halt, reset in time and place, and restart an exercise.
b. Visually observe the trainees and their actions and follow the proceedings of an exercise by any method.
c. Change the operating environment during the running of an exercise, viz. shall be able to alter the wind (direction and force), swell (direction and height), current (direction and rate), cloud cover, state of visibility.
d. Communicate with the trainees (i e. simulate the outside world) by VHF on relevant communication channels and by Intercom/Telephone (for within the ship conversations).
e. A display (min 19 inches monitor) providing a global view of the criteria simulation scenario. The display plots ships tracks, target movements and also provides a tool for altering the parameters of the various ships.
f. Be able to view the Own ship RADAR as set and operated by the trainee.
g. Activate simulation of failures in real time in the following equipment:

i) Navigation lights
ii) Gyro compass including insertion of error
iii) Doppler log failure or insertion of error
iv) Echo sounder
v) RADAR
vi) ARPA
vii) GPS (including degrading of signal quality)
viii) Autopilot
ix) Steering motor
x) Bow thrusters
xi) Engine

h. It shall be possible to replay a full exercise showing the actions performed by the trainees.
i. Instructor shall be able to create exercises where one or more own ship stations can be interactive within the exercise or to be able to run them independently and in differing areas if so required.
j. For educational purposes, the instructor shall be able to create a channel by inputting depths and buoys (buoyage system A and/or B)
k. Instructor can on request from Own ship, engage tugs and ship mooring lines during an exercise.

E. Recommended Ship Types and Sizes

	Type	Displacement (tonnes)
1.	Bulk Carrier (Handy size)	About 30,000
2.	Bulk Carrier (Panamax size)	About 60,000
3.	Containership	About 30,000
4.	Containership	About 70,000
5.	Containership	About 1,00,000
6.	Coaster	Under 10,000
7.	RO-RO / Car Carrier	About 15,000
8.	Tanker	About 85,000
9.	Super tanker	Over 1,50,000
10.	VLCC	Over 2,50,000

Note:

A. The above is a suggested list for general guidance

B. Among the Own Ship Types, there should be vessels equipped with bow thrusters and some with Controllable Pitch Propeller.

F. Recommended Geographical Areas

1. Dover Straits
2. Singapore Straits
3. Malacca Straits
4. Gibraltar Straits
5. Approaches to New York
6. Approaches to Rotterdam / Flushing
7. Bisan Seto / Kanmon Kaikyo
8. St. Lawrence River
9. Entrance to Mississippi River / approaches to Houston
10. Open Sea

2.5. Fidelity

Simulation fidelity is defined as the degree to which a simulation is a close representation of the real equipment, system, process and environment. The closer the simulator is to representation of the real systems, the better the fidelity.

Fidelity is determined subjectively, with high requirements on fidelity the cost and processing time of the simulation increases. Moreover it is not necessary that high fidelity improves the training experience or improves learning. Hence, the need for selective fidelity which is improving those components of a simulator that will have the greatest effect on training and assessment of task. Thus the level of fidelity required shall be determined by the training objectives. The underlying issue with regards to fidelity is the transfer of specific knowledge and skill to the actual operational or job environment. Specifically, if trainees are learning how to apply a particular skill, then the simulated training environment must respond in a manner that is similar to what would occur in the real world. Otherwise, the trainee will receive incorrect feedback and perhaps learn the wrong things. Equally important as physical realism (HMI, knobs, buttons hardware controls and consoles, etc.) is cognitive realism (the behavioral and operational environmental realism). It is also pertinent to note that the level of fidelity may vary with the stage of learning i.e. from simple tasks to complex tasks. For example for learning ROR it is not necessary for the simulator to have six degrees of freedom. However in marine simulation to build and improve confidence among mariners, training sponsors, and maritime administrations, there are strong pressures to use the highest level of realism possible.

A major technical consideration in the application of simulators and simulations is the need for consistently reproducible results from simulation exercises.

2.6. Validation

Validation is the process of evaluating specified characteristics of a simulator or simulation against a set of predetermined criteria. Validations include both objective and subjective elements. The elements of a simulation that require validation are the accuracy and fidelity of:

- Image portrayal, including the content, quality, field and depth of view, and movement of the visual scene
- Calculation and representation of the predicted parameters based on the relevant process
- Characteristics of equipment, vessel, engine or system being simulated
- Operational environment
- Functional resemblance to the real systems
- Physical resemblance to the HMI and controls
- Layout of the components of the simulators

The validation of some of the elements may be objective to some extent if the administration specifies a standard equipment or vessel. Otherwise most of the validation of marine simulation will be largely subjective. However for the subjective validation to be sufficiently close to the specified training objectives and assessment it is necessary that subjective validation is credible and consistent.

Present Validation Process

The simulator's performance and handling qualities are evaluated according to the performance standards of equipments, ability of the simulator to train and assess the trainee for performance of the specific tasks for which the simulation is to be used. Since the marine simulators generally simulate generic ships, bridge equipment, machinery, communication and other equipment, and the physical arrangement on board so it is not possible to objectively validate the simulators to accuracy. STCW code does not specify any standards directly relating to validation of the simulators however the STCW code A specifies performance standards sufficient for making detailed validation check list especially for RADAR, ARPA and ECDIS simulators. STCW Code B has specified detailed guidelines and recommendations for RADAR, ARPA, ECDIS, Mandatory and non mandatory simulators. The IMO Model courses based on use of simulations have also specified some requirements related to the simulators.

Moreover some of the marine administrations have notified standards related to the approval of simulations and approval of simulation courses. As mentioned earlier, the classification societies have also published standards for classification and approval of simulators based on the STCW competencies and guidelines. DNV is the premier classification society to have published guidelines for standardization and certification of simulations. DNV classifies simulations based on the functional and physical realism. However these standards are not universally accepted by the administrations for approving the simulations for using to meet the STCW training and assessment standards.

CHAPTER 3

3. The Scope of Simulation Training

Simulators are an excellent tool for training in the development of competence at different responsibility levels, from normal routine task performance training to complex task training to crisis management and emergencies. A simulator is a training tool, which has to be integrated into a total training programme.

The STCW Code, section A-I/12 states that each Party (i.e. the administration in the State where the training or assessment programme shall be approved) shall ensure that a simulator used under certain conditions shall fulfil six general performance requirements. The following is the interpretation of the essential aspects:

1. suitable for training and/or assessment objectives
2. physical realism appropriate to training and/or assessment objectives
3. sufficient behavioural realism
4. capable of producing a variety of conditions (operating environment)
5. the trainee should be able to interact
6. the instructor/assessor should be able to control/monitor/record exercises

The standards of competence as laid down in the STCW 2010 are grouped appropriately under the following seven functions:

- Navigation
- Cargo handling and stowage
- Controlling the operation of the ship and care for persons on board
- Marine engineering
- Electrical, electronic and control engineering
- Maintenance and repair
- Radio communications

The STCW code also specifies the following levels of responsibility:

- Management level
- Operational level
- Support level

Functions and levels of responsibility are identified by subtitle in the tables of standards of Competence given in chapters II, III and IV of the STCW, part A.

STCW discusses the simulators under the three important headings:

a) Training and assessment.
b) Use of simulator.
c) Minimum standards of competencies.

STCW mentions the possibility of using simulators as a tool during the discussion on ***Training and Assessment*** of seafarers as under:

- Regulation-I/6 – Training and Assessment
- Section A-I/6 – Training and Assessment (Mandatory)
- Section B-I/6 – Guidance regarding Training and Assessment

3.1. Regulation-I/6 – Training and Assessment

This regulation demands all parties to ensure that training and assessment of seafarers is in accordance with the STCW Code A and all instructors and assessors are appropriately qualified and competent to carry out their task.

3.2. Section A-I/6 – Training and Assessment (Mandatory)

This section desires that if the training is being conducted using simulator; the instructor employed should have received appropriate guidance in instructional techniques involving the use of simulators, and have gained practical operational experience on the particular type of simulator being used for the training. Moreover, when assessment is being done by using simulators, the assessor should have gained practical assessment experience on a particular type of simulator under the supervision and to the satisfaction of an experienced assessor.

3.3. Section B-I/6 – Guidance regarding Training and Assessment

This section is meant for providing the guidance on how to comply with the corresponding section of Code A, and mentions the IMO Model Courses for Instructors and for Examination and Certification of Seafarers.

Then there is a dedicated part of STCW, which highlights the *Use of Simulators*, as under:

- Regulation-I/12 – Use of simulators
- Section A-I/12 – Standards governing the Use of Simulators (Mandatory)
- Section B-I/12 – Guidance regarding Use of Simulators

3.4. Regulation-I/12 – Use of simulators

This regulation gives a legal cover to the performance standards of marine simulators being used for the training and assessment of seafarers and their certification in compliance with STCW.

3.5. Section A-I/12 – Standards governing the Use of Simulators (Mandatory)

This section has two parts:

Part 1 provides the performance standards of the simulators that can be used for the training and assessment of seafarers separately. STCW desires physical and behavioural realism of the simulators appropriate to the training and assessment objectives. Capabilities and limitations of the original equipment along with the possible errors should form part of the simulation. Simulators should be able to produce emergency, hazardous and unusual conditions for an effective training value. The most important aspect of the performance standards in STCW is the requirement of simulators to provide the simulator instructor with the control and monitoring facilities along with the recording equipment for an effective debriefing to the trainees.

Part 2 provides other provisions whereby training and assessment procedures have been discussed for the simulator trainers and assessors to have a standard conduct of the simulator training. STCW foresees briefing, planning, familiarization, monitoring, and debriefing to be part of any simulator based exercise. It also highlights the importance of guidance and exercise stimuli by the instructor during the monitoring and use of the peer assessment technique in the debriefing stage. Simulator exercises are required to be designed and tested by the simulator instructor to ensure their suitability for the specified training objectives.

3.6. Section B-I/12 – Guidance regarding Use of Simulators

STCW has made the RADAR/ARPA simulator training mandatory for the seafarers and in this section; it gives a detailed guidance how to use the RADAR/ARPA simulator for training and assessment purposes.

Different types of training can therefore be easily provided:

- Team training,
- Operator training,
- Decision training,
- Procedure training,
- Maintenance training
- Trouble shooting
- Special operations

In more complex scenarios or simulations, generally these different aspects of training are integrated within one simulation exercise. An extensive simulated task may require competency in operations, procedures, team work and decision making.

These examples of various types of training can be described as follows:

Team training:
A team is a group in which decisions are made based on evaluation of material in order to execute the necessary operation. Team training is carried out to establish or to improve a team as a means to give decision training.

Operator training:
Operator training is required in order to train a person in proper equipment operation procedures.

Decision training:
Decision training is done in order to train persons in making the right decisions, based on evaluation of a given situation and to carry out the necessary action to reach a defined goal. In many situations the decision maker can communicate directly with the equipment rather than through an operator. The decision maker thus becomes an operator.

Procedure training:
Procedure training takes place in order to train a group of persons the correct execution of a specific procedure.

Maintenance training:
This is done to train individuals in either technical or condition control maintenance.

Trouble shooting:
This is done to train individuals in tackling the slight deviation from the normal operation.

Special operation
This is done to train individuals in special operations such as navigating in restricted visibility.

Although it is important to understand these divisions, in any one simulator exercise a combination of types of training will be incorporated.

The table further illustrates the simulators application across three major functions:

Sl. No.	Simulator Application	Navigation / Bridge Ops	Eng / Mach Ops	LCHS Cargo Ops
1	Equipment Familiarization	ECDIS/RADAR/ Steering	ME/Gen/Boiler	CCR/Pumps
2	Equipment Operation	All Navaids	ME/Gen/Boiler	Valves/Line setting
3	Equipment Integration	Navaids/Steering/ME	E/Gen/ Boiler /Pumps	Pumps/valves/ for cargo ops
4	Systems Familiarization	Collision Avoidance	Simulator running on load	Hydraulics/IG
5	Basic Procedural Training	Ops/Mgmt/Value add	Ops / Mgmt	Ops /Mgmt
6	Basic Routine Regular Operations	S/Handling/BTM	Equip start/On load	Load/Disch
7	Routine Operations with faults injection	Navigation Equipment failure	Machinery failure	Valves failure
8	Trouble shooting and Problem solving	RADAR fail	Mach / Pumps fail	Cargo/PV valves
9	Complex regular operations involving multitasking	TSS/Arr/Dep Ports	Mach/Boiler breakdown	PV failure
10	Non regular operations	Ice Navigation	Electrical switchboard	Cargo heating
11	Crisis management/ Emergency situations	Collision/Grounding	Blackout	PV failure/ overflow
12	Specialized operations/area/ machinery			
13	Case Studies/Incident recreation	Ice/STS/Pilotage	COP/T-Gen	COW
14	Feasibility Studies			

Under the new revised STCW 2010, there is a detailed outline on use ECDIS training including the requirements for simulator training on ECDIS.

Furthermore, WHERE APPROPRIATE, new simulator training requirements have been incorporated for the following:

- BRM
- VTS
- BERTHING, ANCHORING, MOORING OPERATIONS, HANDLING OF CARGOES AND STORES (CRANE OPERATIONS)

For Chief and Second Engineers:

- Task & Workload Management
- Safe Operation of Boilers
- Operation of fuel systems
- Bilge & Ballast Water Management
- Mechanical Engineering Systems
- Electrical Power Generation
- Oil, Chemical and Gas Tanker Operation

3.7. Non-mandatory Simulators

STCW mentions the following non-mandatory simulation system, with the possibility of more systems used for the training and/or assessment of seafarers:

- Navigation and watch keeping simulator
- Ship handling and manoeuvring simulator
- Cargo handling and stowage simulator
- Radio communications simulator, and
- Main and auxiliary machinery operation simulator

STCW then briefly mentions the performance standards for these non-mandatory simulation systems. Here it is important to note that while STCW has discussed the RADAR/ARPA simulators in details, with a separate heading for training and assessment, all other simulators have been discussed with respect to the general provisions only. The RADAR/APRA simulators are a very basic form of simulation when compared to the, for example, Ship Handling Simulator (SHS) in respect of the equipment fitted, complexity of operations and responsibilities of the instructor. This clearly implies that as far as a simulator instructor is concerned, he has to put in a lot to design and conduct the training and assessment exercises on these simulators with only a few details available in the Convention.

The STCW mentions the simulators as one of the means to prove the competencies by seafarers. Chapters II, III and IV of Code A list down the competencies in the forms of tables required out of deck, engine-room and radio personnel at management and operational levels. These competency tables enumerate multiple means to prove the competency and approved simulator training is mentioned at numerous occasions together with the in-service experience and trained ship experience. This parallel between real ship and simulator itself puts heavy responsibilities on the simulator instructor to ensure that the simulator based training is designed and conducted in such a manner that it gives real time experiences to the trainees. Simulator training is required to put the trainee in almost the same working environment, mental scenarios and physical stress as on board a real ship.

The STCW also enumerates Performance Standards (physical realism, behavioural realism, minimum errors, instructor control, suitability for training objectives and man-machine interface), Training Procedure (briefing, familiarization, exercise stimuli, monitoring, debriefing, peer assessment) and Assessment Procedure (performance criteria, assessment criteria, briefing, grading methodology) to be adopted on simulators.

3.8. Standards for Simulator Based Training

It is required in the STCW Convention that simulators, when used for mandatory simulator-based training and/or when used as a means to demonstrate competence (assessment) according to the same Convention, shall be approved by the relevant maritime administration (STCW, regulation I/12).

The purpose of the standard, as delineated below, is to ensure that the simulations provided by the simulator include an appropriate level of physical and behavioural realism in accordance with recognized training and assessment objectives.

The main target group for the standard is the following:

a) A simulator centre, which uses a simulator for examination.
b) A simulator centre, which uses a simulator for mandatory simulator training.

The standard gives criteria for the simulated functions, the equipment and the environment, considered necessary for specified tasks in maritime operations.

The standard does not prioritize the reliability of specific equipment or software used in the simulator, e.g. redundancy, environmental testing nor maintenance. It is assumed that the simulator is built from parts of sufficient reliability.

It is assumed that the simulator centre addresses the operation of the simulator (i.e. using the simulator for training and/or assessment in a training programme) in a quality standard system (STCW, regulation I/8). In such quality standard system the instructor and assessor qualifications (STCW, regulation I/6) shall be addressed and the course curriculum shall be approved by the State.

It is further understood that the management of a simulator centre ensures that the simulator complies with all additional mandatory requirements, e.g. electrical installation of such equipment, which are not covered in this standard.

Simulator class: A three grade scale for levels of performance capabilities of maritime simulators. The three classes are Class A (full mission), Class B (multi-task), and Class C (limited task). In addition, Class S (special tasks) is used for simulators where the performance is defined on a case by case basis.

Bridge operation simulator: A simulator with the objective to create realistic situations for some of the competence requirements in STCW, chapter II.

Simulator Class – Bridge Operation – AS AN EXAMPLE

Class A – Bridge operation
The simulator shall be capable of simulating a realistic environment for all of the STCW competence requirements referred to in the column for Class A in the Table.

Class B – Bridge operation
The simulator shall be capable of simulating a realistic environment for all of the STCW competence requirements referred to in the column for Class B in the Table.

Class C – Bridge operation
The simulator shall be capable of simulating a realistic environment for all of the STCW competence requirements referred to in the column for Class C in the Table.

Class S – Bridge operation
The simulator shall be capable of simulating a realistic environment for selected STCW competence requirement referred to in the column for Class S in the Table.

Table 1 – Bridge Operations

STCW Reference	Competence	Class A	Class B	Class C	Class S
Table A-II/1.1	Plan and conduct a passage and determine position	A	B		S
Table A-II/1.2	Maintain a safe navigational watch	A	B		S
Table A-II/1.3	Use of RADAR and ARPA to maintain safety of navigation	A	B	C	S
Table A-II/1.4	Respond to emergencies	A	B	C	S
Table A-II/1.5	Respond to a distress signal at sea	A	B	C	S
Table A-II/1.8	Manoeuvre the ship	A	B	C	S
Table A-II/2.1	Plan a voyage and conduct navigation	A	B		S
Table A-II/2.2	Determine position and the accuracy of resultant position fix by any Means	A	B		S
Table A-II/2.3	Determine and allow for compass errors	A	B		S
Table A-II/2.4	Coordinate search and rescue operations	A	B		S
Table A-II/2.5	Establish watchkeeping arrangements and procedures	A	B		S
Table A-II/2.6	Maintain safe navigation through the use of RADAR and ARPA and modern navigation systems to assist command decision-making	A	B	C	S
Table A-II/2.9	Manoeuvre and handle a ship in all conditions	A			S
Table A-II/2.10	Operate remote controls of propulsion plant and engineering systems and services	A			S

CHAPTER 4

4. The Simulator Instructor

The short history of simulators has come a relatively long way and is now widely recognized and accepted by the educational world to be an effective training tool. In the new scenario, we envision, simulators offer the promising opportunities we hoped and also an alternative and powerful way of teaching and learning – through better presentation, engagement of senses and experiential learning. But one must not overlook the fact that however sophisticated and expensive a simulator system is, the teaching results achieved are only as effective as how the trainer uses it. The simulator can largely allure students through the multi-sensory approach of text, visual and audio effects in initial stages; it is the trainer's presence which provides the vital link between the real world and virtual representation of that world.

The simulation experience provides for more meaningful and higher learning styles. Apart from the *experiential approach* – where students play a central role in their learning, the trainer provides an opportunity to learn through an *inquiry approach* - raising questions and discussing the complex concepts (with trainer and peers). The much talked about and often ignored aspect of learning and training i.e. "motivation of the students" can be meaningfully drawn and sustained out of constructive feedback, reinforcement from the trainer during briefing, conduct and debriefing of the exercises. The importance of the trainer's expectations from students is far less recognized but nevertheless a determining factor for the overall performance of the students on simulators. It is seen naturally without noticing that trainers who have high expectations from the students are able to derive better performance from the students.

With the advent of a new approach to training, a trainer role has become even more critical. As learning shifts from "teacher-centred" to "learner centred", the role of the trainer has now shifted from the sole voice of authority to the following roles:

4.1. Role of the Trainer

1. **Facilitator** – the use of simulators does not obviate the need for the trainer but undoubtedly forces a shift in the role from '*sage on stage* to *'guide on side'.* The trainer must know when to intervene and when to leave the student alone, so as to encourage as much as possible experiential learning for the students.

2. **Dedicated teacher** – the trainer must realize that 'transfer of knowledge' is a process and not an event. 'One-off planning' is not sufficient – the trainer should do extensive, substantial planning at each stage keeping in view the various factors involved – objectives of the course, rank, number, background, etc., of the participants,

3. **Manager** – not merely repeating the same exercise but manipulating materials and activities to arouse interest and make it more direct and relevant for the participants.

4. **Flexible and Adaptable** – Reappraise the methods, techniques, resources to meet multiple learning styles and match and direct it to the common goals of the course.

5. **Learning strategist/organizer** – Sequencing the information for facilitating learning.

6. **Guide** –- aid the students in understanding the nature of satisfactory performance, establishment of correct responses, and avoidance of habitual errors. These, and other elements can be achieved through personal interaction and communication skills like empathy, flexibility and adaptability

7. **Motivator** – Providing for Individual Differences, giving positive and constructive feedback.

8. **Evaluator** – Setting criteria and assessing performance but helping in reinforcing desirable learning, providing encouragement, providing a yardstick to measure goals

9. **Native Psychologist** – when trainers use their knowledge of both the subject and the way pupils understand the subject, the use of the simulator has a more direct effect on student achievement. Understanding differences in learning styles accrued to experience, competence, culture, personalities without any harsh criticism or bias is also very important.

4.2. Skills Required From the Trainer

As mentioned above, a highly sophisticated simulator system is wasted if it is supported by a poorly skilled instructor; whereas the skilled instructor can take even the most basic simulator and produce valid and effective training outcomes. This creates a need that the presence of certain pre-requisite qualifications and skill-set should be investigated to the relevant quality of simulator based training.

4.2.1. General Attitude Towards Teaching

Although a trainer is not expected to have all the answers to the questions which are put to him/her, s/he does lose credibility if s/he is not able to answer any of the questions at all. Thus, being abreast with latest developments and changes in all aspects of the actual job for which the simulation has been designed, including professional, technological and legal aspects equips him to have more comprehensive knowledge than the students.

This becomes even more important if the training involves senior and experienced students, where students are often too happy to show off their vast knowledge and then it becomes vital for the trainer to not feel daunted and to have the necessary information readily at hand.

4.2.2. Operational Experience/Familiarization

Ability to use specific computer skills – in particular those skills related to the type of hardware/software being used in the simulator. Ability to operate projectors, video players, etc.

4.2.3. Techinical/Subject-related Knowledge

Ideally the trainer should hold at least the same qualifications as the students he is supposed to instruct and teach. Not only it will add to his confidence, but will also prove essential to get the message across properly.

This becomes challenging as the higher and more specialized the training becomes, the more difficult it becomes to have trainers holding the same degree. However, one can say that without any seagoing experience it will be hard to cope with all the routine items of the trade.

However many a times domain-relevant skills and knowledge is considered to be the sole competency required from an instructor. And when one has a "Certificate of Competency" supported by sailing experience; it is easy to presume that students 'should' follow and approve the ideas, proposals or recommendation that the instructor believes in. But, what would you do if you design an exercise in the most thoughtful manner and the students conduct it in some other manner missing on the "big picture" that you had in mind? How would you handle a debrief session where you wanted to educate them on some topic and students digress and pose "how", "why" and "what" of some random topic. Questions and issues like this clearly build up a picture where teaching doesn't involve re-iterating the text information or running of animated-sequenced Power-Point presentation.

The above discussion might be seen as minimizing the scope and importance of technical knowledge. But paradoxically, the "unstructured- learning -environment" makes it even more imperative for the instructor to be technically well-sound and abreast of all the latest developments. Also, the instructor should be aware and prepared for all that might emerge without notice and thereby work on it flexibly to help students have a meaningfully learning.

4.2.4. Pedagogy

There is a great importance for the simulator trainer to have a background or experience in teaching or instructional techniques. This would aid the trainer to:

Facilitate the various instructor-led and student-led interactions
Carry out briefing and debriefing in a safe learning environment
Monitor events and know when to intervene/leave alone
Ability to connect operations and theory

4.2.5. Establishing Trust

One of the key elements to developing an effective learning in students is establishing teacher-student trust. Considering the context in which the teaching and learning takes place on simulators, developing trust and building rapport are of paramount importance. The candidates entering the simulators bring along their knowledge and experience of working in real-life situations. This might give rise to "know-it-all" attitude or "just-a-video-game" notion among students.

To add more to the complexity, the instructors spending a lot of time in planning and 'structuring' the exercises on simulators, fails to understand that there still is a room for the indeterminable and unpredictable events springing up; as the "operational part" of the simulation exercise lies in the hands of the students. Thus, a candidate might display the capricious defensive behaviour when he can't ace at a critical situation given to him.

Also, learning from constructive feedback, reflecting on one's own performance honestly and admitting one's mistakes highlights the importance of a good relationship between the instructor and student built upon trust and rapport.

Rapport formation – Building block for establishing trust

Establishing trust must start on day one and should continue to build throughout the programme. The trainer can make the students feel important and can strengthen their relationship with the students by using the following guidelines:

- As students walk in the room, greet them with a smile; you don't have to engage them in a lengthy conversation just a simple hello. This shows them that you recognize their existence and are glad to see them.

- The introductory class can be used as an "ice breaker" where the trainer can ask non-threatening questions. During breaks, or when you see students in the hallway, take a moment to ask how their day went or to ask what their plans are for the weekend. Try to find a balance between prying too much into their personal lives and being restrained and formal. You will need to see how comfortable each individual is and relate to them accordingly.

One of the surest ways to attract the attention of your students is to use them in your teaching. If you are giving an example of something, then use your student's names in the example. If you need some volunteers to demonstrate a concept, ask some of your students to help you. This not only helps students to want to be involved in your lesson, but it also helps the other students pay attention better when they hear or see their own peers in your lesson.

CHAPTER 5

5. Conceptualizing a Simulator Training Programme

Simulators are valuable multifaceted tools for developing individual and team competence not only in performance of skill-based tasks but also in management of tasks including management of emergency and crisis situations. In the maritime domain STCW Code has introduced simulators as integral part of training and assessment.

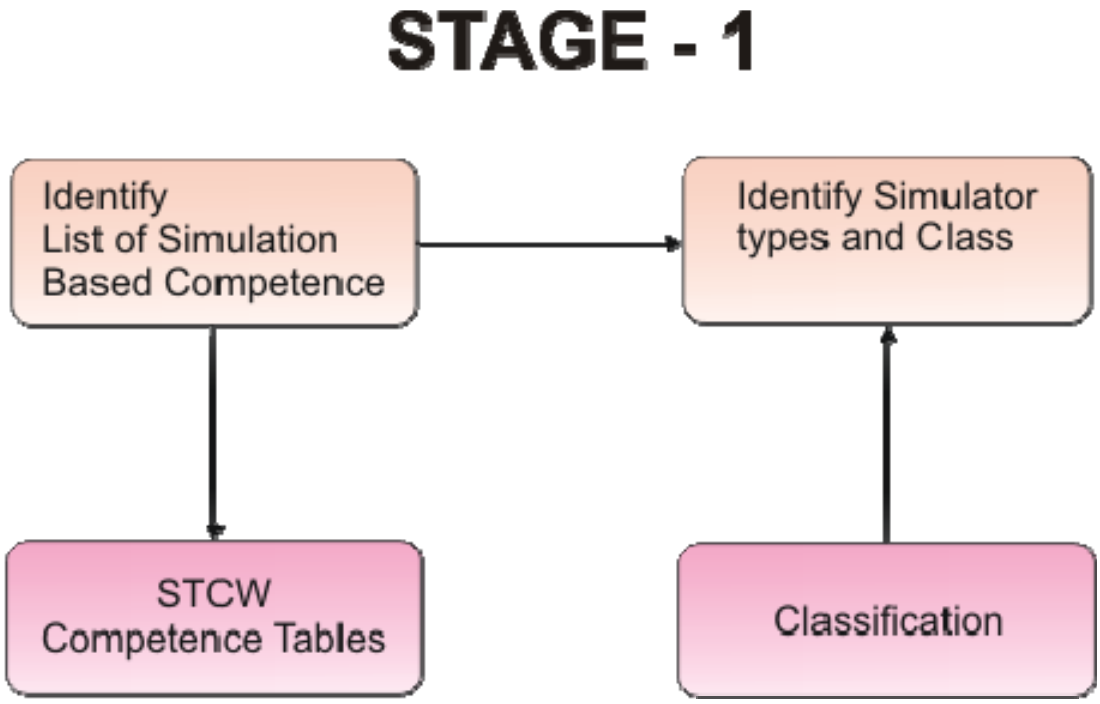
The simulators are an expensive resource in terms of value and time. Keeping this in mind the simulator manufacturers have designed simulators that can be used for different levels from support to operation and management level. Moreover there are different simulators available for training in single task to multiple tasks to complex tasks and it is also possible to integrate simulators based on functions or department.

Thus it becomes necessary that the use of simulators is optimized. The optimization is possible by appropriately conceptualizing the simulator training and developing the progressive simulation programme.

The development of the simulator training programme shall be executed in two steps namely, identifying learning objectives possible to be achieved using simulators and then detailing the simulator programme.

5.1. Simulator Based Learning Objectives

The STCW competence tables clearly specify the Knowledge, Understanding and Proficiency, Methods for demonstrating competence and Criteria for evaluating competence for each competency. Moreover in the column (3) Methods for demonstrating competence Simulator is listed as one of the method. All these competencies must first be filtered and then they need to be mapped with class and type of simulators using DNV Standards of classification of Simulators.



Column 1	Column 2	Column 3	Column 4
Competence	**Knowledge, understanding and proficiency**	**Methods for demonstrating competence**	**Criteria for evaluating competence**
Maintain a safe engineering watch	Thorough knowledge of Principles to be observed in keeping an engineering watch, including: .1 duties associated with taking over and accepting a watch .2 routine duties undertaken during a watch .3 maintenance of the machinery space logs and the significance of the readings taken .4 duties associated with handing over a watch Safety and emergency procedures; change-over of remote/ automatic to local control of all systems Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems	Assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved training ship experience **.3 approved simulator Training**, where appropriate .4 approved laboratory equipment training	The conduct, handover and relief of the watch conforms with accepted principles and procedures The frequency and extent of monitoring of engineering equipment and systems conforms to manufacturers' recommendations and accepted principles and procedures, including Principles to be observed in keeping an engineering watch A proper record is maintained of the movements and activities relating to the ship's engineering systems

An Example:

Function: Marine Engineering at the operational level

Competences addressed by machinery operation simulator for marine engineering at the operational level

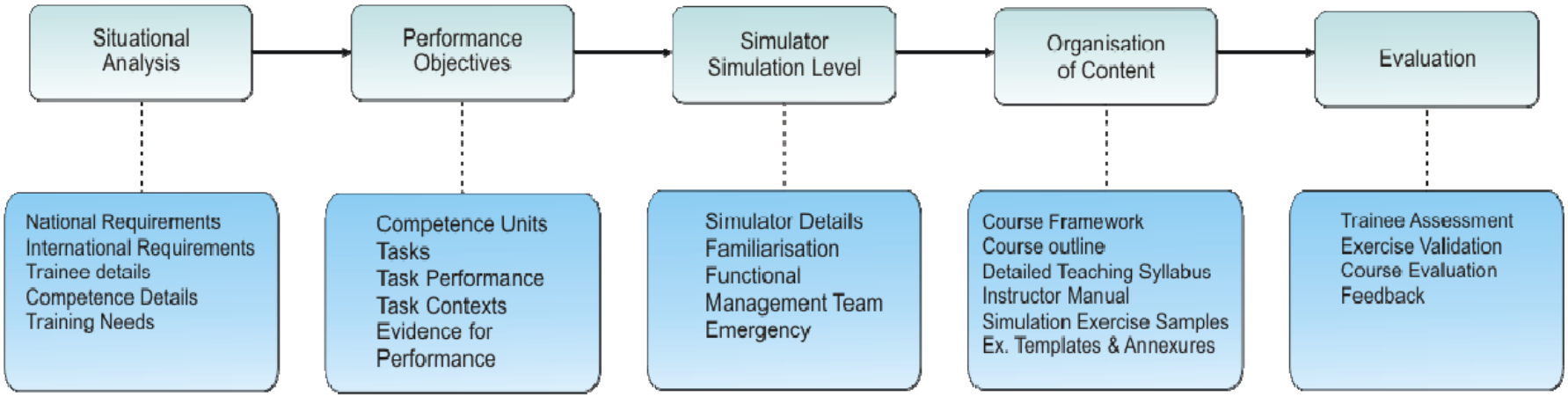
STCW-95 reference	*Competence*	*Class A (ENG)*	*Class B (ENG)*	*Class C (ENG)*	*Class S (ENG)*
Table A-III/1.1	Maintain a safe engineering watch	A	B		S
Table A-III/1.3	Use internal communication systems	A	B		S
Table A-III/1.4	Operate main and auxiliary machinery and associated control systems	A	B	C	S
Table A-III/1.5	Operate fuel, lubrication, ballast and other pumping systems and associated control systems	A	B	C	S

5.2. Detailing the Simulator Programme

Now refer to IMO model courses where the detailed teaching syllabus with learning objectives for the various functions and levels to be performed by the candidates is outlined. From the learning objectives the task performances have to be drawn out such that the practical performances to be demonstrated by the candidates are short listed. This can be done by analysing the learning objectives for the performance related verbs such as demonstrates, plans, applies, identifies, calculates, etc. Thus from the learning objectives for the different level and for each function the tasks to be performed can be discerned. From the list of tasks so determined, the performance elements specific to simulation activity will be drawn as performance objectives.

Once the learning objectives for given simulation based competence have been discerned then the simulator programme needs to be designed in detail. The process of designing a simulator based training programme requires situational analysis, identifying the performance objectives, selection of simulators and simulation exercise, organizing and writing of content for programme and the evaluation mechanism.

STAGE 2: Detailing of Simulation Program



5.3. Situational Analysis

Is the process of establishing facts and figures before developing the simulation programme related to the unit of competence, with regards to level of responsibility of trainees, prior knowledge and skill possessed and required, cognitive elements and individual traits possessed and to be developed.

The national guidelines in the form of notices, circulars, orders, and guidance notes are issued and notified by the flag administration, respective departments. Other drivers within the maritime industry include the charterers, PSC, organizations such as BIMCO, INTERTANKO, clients, etc.

The situational analysis is possible to be developed for the different units of competence for each function across different levels and category. The STCW competence tables and IMO model courses shall be used as guide for the same.

Instructors must begin the development of a simulation-training programme with a need assessment related to the trainee, competence and its context.

Trainees	**Particulars**
Number of Trainees per course	
Number of Trainees per Simulator	
Qualification	
Experience	
Prior Relevant courses	

Competence	
Tasks	
Task Context	
Experience	
Pre requisite Units	

5.4. Performance Objectives

At this step the standards of performance in terms of a set of outcomes related with the task which need to be achieved in order to be deemed competent must be specified. More than one task may be combined for the performance. The range of contexts and conditions to which the performance objectives apply must also be specified. The example in detail is given below where the competence unit is detailed into specified tasks to be performed, the performance criteria and evidence required for same is recorded.

5.5. IMO Model Course 7.04 (Officer In-charge of Engineering Watch)

5.5.1. Competence Tasks

Function & Level		**Marine engineering at the operational level**
Unit of Competence		Maintain safe engineering watch
Competence Tasks		
1.	Inspect machinery spaces before taking over a watch	
2.	Take over the engineering Watch	
3.	Respond to alarms	
4.	Maintenance of the machinery space logs and the significance of the readings taken	
5.	The frequency and extent of monitoring of engineering equipment and systems conforms to manufacturers' recommendations and accepted principles and procedures, including Principles to be observed in keeping an engineering watch	

5.5.2. Task Performance Objectives

Function & Level	**Marine engineering at the operational level**
Unit of Competence	Maintain safe engineering watch
Competence Task- 1	Inspect machinery spaces before taking over a watch
Under pinning knowledge	Principles to be observed in taking over an engineering watch (STCW, VIII/4-2)
Performance Condition and context	Aboard ship, having a main propulsion machinery of 750 kW or more, while underway in engine-room.
Performance Criteria	1. Determine status or condition of main and auxiliary machinery (including fuel, feed water, and exhaust systems), control systems, indicating panels and communication systems. 2. Report and record the status or condition of main and auxiliary machinery (including fuel, feed water, and exhaust systems), control systems, indicating panels and communication systems. 3. Determine the status and condition of the steering system and all associated gear. 4. Report and record the status and condition of the steering system and all associated gear. 5. Determine the condition of the bilges with respect to water level and contamination. 6. Report and record the condition of the bilges with respect to water level and contamination. 7. Check and report for safety violations.
Attitude	Conduct an inspection of machinery spaces before taking the engine-room watch reading and recording different parameters.
Evaluation Criteria for Performance	1. Correctly determine, record and report the status or condition of main and auxiliary machinery (including fuel, feed water, and exhaust systems), control systems, indicating panels and communication systems. 2. Correctly determine, record and report the status and condition of the steering system and all associated gear. 3. Correctly determine the condition of the bilges with respect to water level and contamination. 4. Report and remove safety violations.

Function & Level	**Marine engineering at the operational level**
Evidence	1. Electronic engine-room logbook appropriately filled up. 2. Status of all main and auxiliary machinery checked as per checklist and recorded, same stored. 3. Status of steering gear system checked as per checklist, same stored. 4. Water level of bilges records stored. 5. Non Conformity for safety violation filled up and record stored.

5.6. Setting the level of Simulation

Simulation training if not appropriately conceptualized can lead to loss of confidence in the trainee rather than building his/her confidence. The simulation training shall be gradually planned with increasingly complexity from familiarization, operational, functional, team building to high-level decision making and then leading to high-level, high-stress, decision-making scenarios in crisis situations, etc.

Task is something an individual needs to do. It can be a small activity such as taking a compass bearing of a terrestrial object, noting exhaust temperature of a main engine unit or the task can be complex such as determining position or troubleshooting causes of high exhaust temperature requiring the task to be broken into subtasks. Whereas more complex tasks such as manoeuvring a vessel in a narrow channel or cold starting the main engine will require that the even the subtasks are broken into elements. The tasks may be categorized as follows for setting up the level of simulation:

1. Familiarization: where the trainee is familiar with the equipment, layout, procedures and routine tasks.
2. Operational: the task relates to the inputs/outputs and their relationships and is to do with performance of a function. For example, ability to operate the RADAR equipment, etc.
3. Functional: the task relates to the functions or activities performed by the system without reference to which of the elements of the system perform those functions. For example, use of RADAR for determining position or collision avoidance, etc.
4. Management task: relates to management of combination of more than one system to perform a given job, e.g. situational awareness or position determination after combining the RADAR outputs with the ECDIS.
5. Communication task: relates to effective communication between different human resources to report, get feedback or to execute a task.
6. Emergency: the tasks performed in circumstances where there is variation or deviation from expected scenario or situation.
7. Crisis: the tasks performed when the emergency situation has developed into a crisis.

In addition to the above category of tasks, certain tasks are team based and require honing of the individual traits such as communication, personal relationships, team playing, influencing, negotiating, self-learning, establishing trust, managing and leading, etc.

The performance objectives need to be specified against a different range of contexts and circumstances, e.g. from fair weather to rough weather, open sea to restricted waters, normal temperatures to icy cold temperatures, normal to heavy load conditions, etc.

Setting Level of Simulation						
Function & Level		**Marine engineering at the operational level**				
Unit of Competence		Maintain safe engineering watch				
S.N.	Competence Tasks	Level of Simulation				
		Familiarization & Operational	Functional	Management	Communication	Crisis & Emergency
1.	Inspect machinery spaces before taking over a watch	√			√	
2.	Take over the engineering Watch	√	√	√	√	
3.	Respond to alarms	√	√	√	√	√
4.	Maintenance of the machinery space logs and the significance of the readings taken	√	√			
5.	The frequency and extent of monitoring of engineering equipment and systems conforms to manufacturers' recommendations and accepted principles and procedures, including Principles to be observed in keeping an engineering watch	√	√	√	√	

5.7. Simulator Characteristics:

The simulator characteristics and specifications shall be such as to provide a training platform to produce functional and physical fidelity similar to the working environment on board ship and is able to meet the training objectives. The detailed specifications are available in DNV Standard for Certification no. 2.14, Maritime Simulator Systems. An example of brief specifications for Engine-Room Simulator is given below:

The engine-room systems and equipment simulator shall be equipped with the equipment and devices of a real ship engine automation monitoring and control system to simulate the real operation environment on board. The subsystems shall be possible to be operated by buttons and switches on the local control panels in the simulated engine-room. The simulation models in real time mode shall be able to display various parameters at the node points such as pressure, temperature, and flow rate. The interfaces between the systems and interdependency shall be simulated. The simulator shall be able to simulate the sound of the engine-room environment. The following activities should be possible on the simulator related with taking over of an engineering watch:

1. Safe engineering watch keeping should be possible in the ECR and machinery space of the simulator.
2. The instructor should be able to alter parameter values to abnormal and alarm levels.
3. All trainee events and activities should be recorded. It should be possible to view these at the instructor station.
4. All alarms should be logged and it should be possible to print an alarm log which provides the status and the time of the alarm condition, and the change from alarm to normal condition. Trainees should be able to use the alarm log to analyse engine-room parameters while taking and handing over a watch.
5. It should be possible to compare the electronic logbook maintained by the simulator to the logbook maintained by trainees.
6. It should be possible to change Main engine and auxiliary machinery controls from local to automatic/remote control, e.g.:
    a. Pumps can be started from the mimic pipeline panel, main switch board and pumps panel.
    b. Main engine can be started from Bridge, Engine control room or from local control.
    c. In case of oil spill corrective action can be taken to stop any oil transfers or associated pumps, which have led to the spill.
7. Trainees should be able to check quantities and levels of the engine-room service tanks.
8. Trainees should be able to check engine-room bilge level, e.g.:
9. High bilge well level alarm – This alarm could be injected by instructor to observe trainee response of accepting alarm and taking corrective steps.
10. Overflow of any fresh water tank could cause this alarm. Here trainees should be able to transfer bilges and also find out the cause of filling bilges.
11. Trainee should be able to keep safe engineering watch on the main and auxiliary stations similar to the ones on board merchant vessels.
12. It should be possible to check engine-room fresh water, heavy fuel oil, diesel oil, lube oil and sludge tanks levels.
13. Tanks should be provided with high- and low-level alarms.
14. Examine the machinery local and remote controls.

15. It should be possible to operate machinery remotely or on local control, e.g.:
    a. It should be possible to start pumps from mimic pipeline panel, main switch board, and pumps panel in the ECR.
    b. It should be possible to start and operate main engine from bridge, engine-room or local control.
    c. Examine the Emergency fire pump and Fire, bilge & G.S. pumps.
    d. It is possible to operate main and emergency fire pumps from mimic pipeline panel, ECR, or Main switch board.
16. Ensure that the relieving watch members are capable of performing their duties.
17. Examine the engine-room log.
18. Trainee must view logged down main and auxiliary machinery parameters.
19. Trainee should be able to print out logbook on demand or with time frame or be provided the same with start up conditions at the time of taking over watch:
    a. Receive an oral report from the engineer officer in charge of the watch for the period of watch keeping now completed.
    b. Enter in the engine-room log any abnormal operational conditions noted during inspection.
    c. Trainee will examine the Alarm log and note the problems.
    d. Accept, if satisfied responsibility for the machinery space operation.
20. Trainee can monitor main and auxiliary machinery data from the logbook and machinery individual panel.
21. Maintain the logbook.

5.8. Organizing of the Simulation Course Plan

The next step is to organize the simulation course plan in terms of Course framework, Course Outline, Detailed Teaching Syllabus, Instructor manual, Simulation Exercise Samples and Exercise Templates.

5.8.1. Course Framework:

The course framework shall contain the following:

- Scope of the course
- Course Objectives
- Entry Standards
- Course Certificate
- Course intake limitations
- Staff requirements
- Teaching Facilities and Equipment
- Teaching Aids
- References
- Textbooks
- Bibliography

5.8.2. Course Outline

The course outline shall summarily specify the subject areas and hours required for teaching teach subject area.

5.8.3. Detailed Teaching Syllabus

The detailed teaching syllabus shall be written in learning objective format. It should specify what the student must do to demonstrate the specified knowledge or skills achieved. The format shall also include the IMO/STCW reference, textbook, bibliography and teaching aids, simulators required to cover each learning objective.

5.9. Instructor manual

The manual reflects the views of the designers of the course on methodology and programme structure that he considers relevant and important as guidance for the instructor, however the instructors may use their own methods and ideas for the conduct of the course. With regards to the simulation programme it is important that the instructor manuals cover the following areas:

1. Pre session briefing
2. Simulator Exercises
3. Designing exercises
4. Exercise Scenarios
5. Conducting of exercise
6. Monitoring of exercise
7. Debriefing
8. Evaluation of programme
9. Assessment of trainee and performance criteria

5.10. Designing the Simulation Exercise and Sample

After the performance objectives have been ascertained the instructor needs to design the simulation exercise. The exercises should not be so complicated that the students will have difficulty in carrying out their tasks and duties. The exercise should start with simple activities, in which students can use simple elements such as valves, pumps, fluid systems or tanks. Step by step they should proceed towards more complex activities. It is better to have two short exercises then to have one long one to ensure that the learning process is effective. The simulator is designed to provide training for normal to difficult operation. It is important for the students to achieve a satisfactory level of competence under normal conditions before proceeding to exercises in which faults have been introduced.
The proper designing and rehearsing of the exercise is important to ensure that the learning objectives are met and the simulation provides situations and conditions similar to the ones actually faced on board ships. The process of designing simulation exercises shall consist of:

1. Designing the simulation exercise
2. Choreographing the simulation in line with performance objectives
3. Rehearsing the simulation exercise
4. Writing the simulation exercise sheet

Exercise Samples:

The Instructor must work from a written simulation worksheet to provide the necessary documentation of what the trainees are to be trained to do. The exercise Sample shall consist of the following elements:

1. Scenario type
2. Objectives
3. Simulator Status
4. Condition of Parameters
5. Instructions for the Trainee
6. Instructions for the Instructor
7. Trainee Evaluation Sheet

Example:

Sample Instructor Worksheet	
Exercise No.:	
Name	Taking Over an Engineering Watch at Sea
Function	Marine Engineering at Operational Level
Competence Unit	Maintain safe engineering watch
Task / Objective	Inspect machinery spaces before taking over a watch
Scenario	In the Mediterranean sea (Special area) after full away
Context	Normal routine to abnormal main engine parameters and rough weather condition
Initial condition	RFA, All Parameters Normal
Duration	One and Half Hour
Briefing	Make sure that the student is able to : – Ensure that the members of the engineering watch are apparently fully capable of performing their duties effectively – Understand the propulsion- and auxiliary plant status including: o the nature of all work being performed on machinery and systems, the personnel involved and potential hazards o the level, and where applicable, the condition of water or residues in bilges, ballast tanks, slop tanks, reserve tanks, fresh water tanks, sewage tanks and any special requirements for use or disposal of the contents thereof o the condition and level of fuel in the reserve tanks, settling tanks, day tanks and other fuel storage facilities o the condition and mode of operation of centrifuges o any special requirements relating to sanitary system disposals o condition and mode of operation of the various main and auxiliary systems, including the electrical power distribution system o the condition of monitoring and control console equipment and which equipment that is manually operated o the condition and mode of operation of automatic boiler controls and other equipment related to the operation of steam boilers o the reports of engine-room ratings relating to their assigned duties o the availability of fire-fighting appliances; and o the state of completion of the engine-room log

Sample Instructor Worksheet	
	– initiate relevant communication from the EOW being relieved, bridge or other stations to update himself with the real situation: e.g. bunkering, emergency stations including equipment status – understand the standing orders and special orders of the Chief Engineer Officer relating to the operation of the ship's systems and machinery – Understands effects on machinery and systems of potentially adverse conditions resulting from bad weather, ice, or contaminated or shallow water.
Action	Start the simulation and let the student – Take a round of the engine-room space including the steering area – Meet the EOW and engine rating and interacts with regards to condition of machinery – Observe the operational parameters of main engine, aux. engine steering gear – Check and record o the level, and where applicable, the condition of water or residues in bilges, ballast tanks, slop tanks, reserve tanks, fresh water tanks, sewage tanks and any special o requirements for use or disposal of the contents thereof o the condition and level of fuel in the reserve tanks, settling tanks, day tanks and other fuel storage facilities o the condition and mode of operation of centrifuges o any special requirements relating to sanitary system disposals o condition and mode of operation of the various main and auxiliary systems, including the electrical power distribution system o the condition of monitoring and control console equipment and which equipment that is manually operated o the condition and mode of operation of automatic boiler controls and other equipment related to the operation of steam boilers o the availability of fire-fighting appliances; and o the state of completion of the engine-room log – record the parameters in the taking over checklist For the second trainee: Call the trainee and inform him that the weather is going to worsen with increasing to gale force winds. Increase engine load and introduce surging of RPM and observe student reaction and action. For the third trainee Increase the engine-room bilge water level
Debrief	After the exercise has been carried out the handing over and taking over procedures and checks must be checked. Any deviation from the normal operation shall be discussed and investigated more closely.

5.11. Student Evaluation Sheet

Observation	Weight	Marks
Inspection	0-10	
Inspects all operational units, noting conditions and any deviation from normal		
Checks water level in steam boiler (if a boiler is part of the plant)		
inspects bilge and under floor spaces		
Inspects steering gear (this is usually outside the engine-room, and can be inspected en route to engine-room)		
Observation (Observes, notes and, where necessary, checks)	0-8	
Telegraph instruction from bridge		
Engine control position and engine rpm		
Engine-room log		
Quantities in service tanks (fuel, water, lube. oil)		
Reports	0-10	
Receives report from engineer officer in charge of watch for period now being completed		
Records	0-10	
Records in the engine-room log any observations regarding operating conditions noted during inspection and worthy of comment		
If satisfied, **accepts responsibility** and takes over engine-room watch	8	
Total Marks	**100**	
Remarks and Observations of examiner:		

5.12 Course Feedback Form

Course Feedback Form	Score Count					
Question Session/Topic	1	2	**3**	**4**	**5**	**Remarks**
GENERAL						
Was the training of interest to you?						
Your role						
CURRICULUM						
1. The training met my expectations.						
2. I will be able to apply the knowledge learned.						
3. The training objectives for each topic were identified and followed.						
4. The curriculum content was organized and easy to follow.						
5. The materials distributed were pertinent and useful.						
SIMULATION						
1. The Simulation Exercise was pertinent to the learning Objective						
2. The roles were appropriate to the exercise and the Pre-briefing Session was useful for the exercise.						

Course Feedback Form	Score Count					
3. The assessment criteria were appropriately explained at the beginning of the exercise.						
4. The conduct of the simulation exercise was realistic and achieved the learning and assessment objectives						
5. The debriefing session achieved its objective to summarize the lessons learnt and reinforce the learning objectives.						
6. The simulation time was sufficient for developing skills outlined in the learning objectives						
DEPARTMENT STAFF/INSTRUCTORS						
1. The Instructors were knowledgeable.						
2. The quality of instruction was good.						
3. The presentations were interesting and practical.						
4. The instructors met the training objectives.						
5. Good training aids and audio-visual aids were used.						
6. Class participation and interaction were encouraged.						
7. Adequate time was provided for attendee questions.						
8. Staff were interested and addressed attendee's concerns.						

Course Feedback Form	Score Count					
TRAINING SPECIFIC QUESTIONS						
1. How do you rate the training overall?						
2. The training will help me do my job better.						
3. This training is worthwhile and should be conducted on a regular basis.						
PROCEDURES AND INFORMATION						
1. Did you receive timely, advance training information?						
2. Was adequate time allowed for breaks and meals?						
Totals						

5.13 Sample Instructor Worksheets:

Objective: Familiarization with simulator and BEQ	**Duration:** 3 Hours	**Issued by:**	**ID:**
Exercise Area: (Open Sea – Denmark Strait)	**Exercise No.**	**Rev. No.**	**Issue Date:**

Start Information	**Own Ship**
Date: Time: Visibility: Precipitation: Area: Tidal condition: Special condition Special information Special Instructions	Start Position: Lat x x N/S Long x x E/W Heading: Speed: Working Channels: for Internal & External communication Charts & Passage plan : Checklist : Publications: Machinery Status

Wind	**Current**	**Sea State**
Direction Speed	Direction Speed	Direction Speed

The Task
➢ Ship Particulars ➢ Proceed on given heading ➢ Follow pre planned track ➢ Familiarize with bridge equipment and virtual environment ➢ Try out hand steering and familiarize with different steering modes ➢ Try out main engine and thrusters ➢ Become familiar with all bridge equipments ➢ Become familiar with virtual world ➢ Tick off familiarization checklist ➢ If any doubts should be clarified with open-minded behaviour

Performance Criteria
➢ Familiarization with bridge equipment ➢ Familiarization with simulator and various buttons ➢ Familiarization with virtual world ➢ Trainee should have felt elements of the virtual world and thus experienced tele-presence ➢ Instructor should be able to change external environmental parameters from instructor station ➢ Instructor should be able to stop, start & pause exercise

Objective: Standard Manoeuvres	**Duration:** 3 Hours	**Issued by :** -	**ID:**
Exercise Area : (Open Sea – Denmark Strait)	Exercise No.	**Rev. No.**	**Issue Date:**

START INFORMATION	OWN SHIP
Date: Time: Visibility: Precipitation: Area: Tidal condition: Special condition Special information Special Instructions	Start Position: Lat x x N/S Long x x E/W Heading: Speed: Working Channels: for Internal & External communication Charts & Passage plan : Checklist : Publications: Machinery Status

WIND	CURRENT	SEA STATE
Direction Speed	Direction Speed	Direction Speed

THE TASK
➢ Familiarize with the Ship Particulars ➢ Carry out turning circle trial ➢ Describe how to carry out zigzag manoeuvre ➢ Carry out crash stop in loaded condition ➢ Carry out coasting stop in loaded condition ➢ Repeat above manoeuvre in ballast condition ➢ Record time, position ,heading and other relevant data ➢ Plot the manoeuvre from recorded data ➢ Compare loaded and ballast conditions ➢ Describe how trim affects the pivot point during turns

PERFORMANCE CRITERIA
➢ Plot the manoeuvre from recorded data ➢ Compare loaded and ballast conditions ➢ Demonstrate how to make pilot card and a wheel house poster ➢ Information in the manoeuvring information booklet can be used when planning a manoeuvre ➢ Understanding of IMO resolution A.601(15) ➢ The results among different groups to be compared when using same ship model

5.14 Sample RADAR Simulator Exercise

EXERCISE	CREATED/UPDATED	BY
Use of Radar for navigating in restricted visibility with traffic and arrival port	**DD/MM/YYYY**	**Instructor – Capt YYY**

START INFORMATION	
Chart No: 2052, 2693 and 1491 Location: Approaches to Felixstowe	Date: DD/MM/YYYY Time: Day

OWN SHIP		
Type: Oil Tanker – MT Bauhinia Draft: 11m EK	Starting position: 52° 00'N 001° 52.36'E Heading: 225°	Speed: 8.0 kts. Half ahead
TARGET SHIPS		
12 ships of different types on pre-determined routes along the passage of own ship 4-8 Fishing vessels/Trawlers scattered along the route Pilot Boat close to Pilot Barding		

WIND	CURRENT	SEA STATE
Wind Direction: S Wind Speed: Force 4	Current Direction: 210° Current Speed: 1.0 – 1.5 Kts	Sea State Direction: Slight Visibility: Reduced

TRAINING OBJECTIVES

- The trainee will use correct procedure for switching on the radar
- The trainee will set up the radar for the prevailing conditions
- The trainee will effectively use radar for navigating in restricted visibility
- The trainee will effectively take appropriate action for collision avoidance
- The trainee will carry out parallel indexing
- The trainee will correctly apply Rule 19

THE TASK

- Make out a passage plan on paper chart up to pilot station
- Plan parallel indexing for legs where applicable
- Assess the clearing ranges for the passage
- Execute the passage
- At the start of the exercise switch on the radar and adjust the controls for prevailing conditions
- Choose the appropriate vector length and type – Relative or True
- Appropriately use trails
- Acquire targets and monitor the CPA- TCPA
- Carry out Trial Manoeuvre to assess for action to avoid close quarter situation
- Take appropriate actions for collision avoidance and in accordance with rule 19
- Carry out parallel indexing for legs where appropriate

INSTRUCTOR NOTES
• Brief the team about the exercise. • Discuss Rule 19 in detail and briefly refresh other rules applicable to the situation. • Select team for the exercise. • Check passage plan to ensure that normal requirements have been met. • Monitor discussion of passage plan, briefing of team members on their roles. • Monitor preparations for approaching an area of restricted visibility. • Monitor the correct switching on procedure for Radar and adjusting the controls • Monitor communications • Monitor actions of application of the rules • Monitor full exploitation of the radar for safe passage
ASSESSMENT POINTS
• Correct switching on procedure • Correct adjustment of radar controls • Correct selection of vectors • Correct sequence and selection of targets and monitoring of CPA – TCPA • Correct application of Rule 19 • Optimum tuning of radar for changing weather conditions • Correct application of parallel indexing • Correct reporting and communications - – Internal information and reporting within the ship and external with AIS targets, VTIS, etc.

5.15 Sample ECDIS Simulator Exercise

EXERCISE	CREATED/UPDATED	BY
Use of ECDIS for navigating through approach channel and manoeuvring vessel to berth	**DD/MM/YYYY**	**Instructor – Capt XXX**

START INFORMATION	
ENC cell GB50162D.000 Location: Approaches to Milford Haven	Date: DD/MM/YYYY Time: Day

OWN SHIP		
Type: Oil tanker – MT ASTAR0 Draft: 14.0 m EK	Starting position: 10nm SW of Pilot Boarding	Speed: 10.0 kts Heading: 095 deg

TARGET SHIPS
12 ships of different types on pre-determined routes in the passage of own ship 4-8 Fishing vessels/Trawlers scattered along the route Pilot Boat close to Pilot Barding

WIND	CURRENT	SEA STATE
Wind Direction: Variable	Current Direction: Westerly	Sea State Direction: Slight
Wind Speed: Force 3-4	Current Speed: 1.5 – 2.0 Kts	Visibility: Good

TRAINING OBJECTIVES

- The trainee will prepare plan a passage on the ECDIS
- The trainee will check the route.
- The trainee will carry out route monitoring.
- The trainee will make appropriate settings for route planning and monitoring

THE TASK

- Make the appropriate safety settings on the ECDIS as per the draft of the vessel.
- Update the ship data on the ECDIS
- Assess the No-Go areas on the ECDIS
- Check if the appropriate Cell is loaded on ECDIS and check the updates.
- Make out passage plan on paper chart from pilot station to tanker berth no 2 and transfer to ECDIS
- Carry out route check and make suitable corrections on each leg
- If required make suitable changes to the cross track error and radius of turn.
- Make suitable settings for alarm and indications.
- Execute the route
- During route monitoring perform the following:
    - Parallel Indexing
    - Mark contingency anchorage area and other No Go areas
    - Mark VTIS reporting points
    - Crosscheck charted depths in relation to Echo Sounder output
    - Cross check GPS positions with visual bearings and radar ranges
    - Mark change in pilot boarding 1 nm SW of western approach channel
- Use Editor functions to mark Stations Fwd and Aft 0.5 nm from south Hook buoy
- Monitor speeds and rates of approach during manoeuvring.

INSTRUCTOR NOTES

- Check the correctness of ship data inputs
- Check alarms and indication settings
- Check safety and depth settings as per UKC policy
- Check Tasks and use of Editor function
- Check the accuracy of route execution
- Check the terminology during route check

ASSESSMENT POINTS

- No major observations in route check
- Understanding of Cell symbols
- Using the correct Cell number (largest scale) and appropriate scale
- Response to alarms and indications and subsequent corrective action
- Cross verify integrated information with other equipments and visual data
- Proper execution of the passage plan – Ship within cross track, crosscheck fix, W/O positions, monitoring targets, etc.
- Reporting and communications – internal with engine-room, stations, etc., and external with VTIS AIS targets for intends, Pilot, Terminal, etc.

CHAPTER 6

6. Effective Interpersonal and Communication Skills

Effective teaching entails a combination of skills. It is not just about having the requisite technical knowledge, but there is as important an element: the ability to be able to TRANSFER that knowledge to the learner. The teacher – student relationship can develop into a unique bond in which fundamental change within an individual can take place. A successful trainer is one who can reach out to the student, understand the student's individual needs, provide guidance and direction and support the student in achieving their goals for development.

A key component which influences this journey is the use of effective communication skills by the trainer. A trainer who has a repertoire of helpful tools for improving communication is able to connect more easily with the student.

6.1. Effective Body Language / Presentation skills

Good presentation skills include appropriate body language supported by verbal skills. A relaxed, confident and open demeanour provides the learning with a platform on which to grow.

6.1.1. Variety/Variability

- It is important to vary all aspects of your performance as a trainer. Reliance on any one part of your repertoire as a trainer may lead to monotony and loss of student interest.
- Consider variation in the use of teaching strategies, voice, questioning techniques, feedback of students, assessment, instructional technology, space in the class room, etc.

6.1.2. Audibility

- Projecting your voice is not merely a matter of yelling, it is technique to 'throw' your voice back to the room to ensure all can hear you.
- Problems with audibility sometimes result from slurring or poor articulation of words. Aim to enunciate as clearly as possible.
- Aim for variety in volume that aids the sense of your message.
- Invite students to speak up if they can't hear you.

6.1.3. Pace

- Monitor the basic pace or speed at which you speak- students cannot take notes or absorb information if you speak too quickly. They will quickly lose interest if you take too slowly or too quickly.
- Be aware that nervousness causes many people to speak too quickly. If you feel the speed of your delivery increasing, pause for a moment and start again at a more even pace.
- Change the pace to suit the meaning of your sentence.

6.1.4. Pitch

- Pitch is the musical quality in your voice that relates to the highness or lowness of your voice. Variability in the pitch will add to effectiveness of you presentation as long as it does not become monotonous or repetitious.
- Be aware that nervousness often results in extremes of pitch- many people adopt a very high pitch when they are anxious.
- Attempt to use upward inflection when sense is indefinite and downward inflection when the sense is finished.
- A change of pitch can be used to indicate the beginning of new thought.
- Use inflection to support the meaning and for emphasis.

6.1.5. Articulation/pronunciation

- Attempt to pronounce words correctly – proper sounds, emphasis and sequence.
- Form vowels and consonants that make up words, correctly.

6.1.6. Emphasis

- Use emphasis in your voice to signal to students important concepts.
- Changes in emphasis can assist to create more varied and interesting presentations.
- Use verbal markers to signal things of importance to students-"now this is important"; "this is difficult idea to grasp".

6.1.7. Pause

- Pause to give students time to think about what you're saying and for you to check your notes or prepare for the next point. Students also need time to write adequate notes, so ensure that you pause long enough to allow note – taking. Silence can also be used as an effective method of capturing student attention.
- Avoid what are called vocal pauses – "uhm", "you know", "like", etc. Your audience will be distracted by overuse of such words and sounds.

6.1.8. Energy and enthusiasm

- Inject physical and mental energy into your presentation as a trainer. Students will not find themselves caught up in the energy and enthusiasm you convey, not only for your subject matter but also for the opportunity to teach others about your area of specialization. Your enthusiasm will be conveyed through your choice of language – active rather than passive words tend to motivate students.

6.1.9. Eye contact

- Maintain eye contact with your group so that you can establish a relationship with them. Eye contact invites them to listen to you.
- Do not focus on one spot in the room; allow your eyes to roam the group and look into individual students eyes.

6.1.10. Gestures and movements

- Do not be afraid of using gesture and movement because non-verbal behaviors have a powerful impact in the classroom. Use them in a natural way to assist in conveying the meaning of your oral message.
- Use non-verbal communication to complement, not contradict, your verbal communication.
- Avoid gestures or mannerisms that are repetitive and likely to distract the group. It is helpful to invite a colleague to sit in one of your lectures to monitor any irritating habits you may have unknowingly adopted.
- Don't be afraid to move around the teaching space, so long as students can still hear what you are saying. However, do not pace nervously from one side of the room to the other. Use movement in a presentation of your material, not to distract your audience.
- Keep your movements simple.
- Use facial expression to bring your presentation to life.
- Don't be afraid to smile – this can make the students feel more comfortable and may assist you in reducing nervousness.

6.1.11. Stance

- Maintain good posture – stand tall.

6.1.12. Confidence

- The value of appearing confident (even when you do not feel confident) cannot be overemphasized.

6.2. Positive Motivation

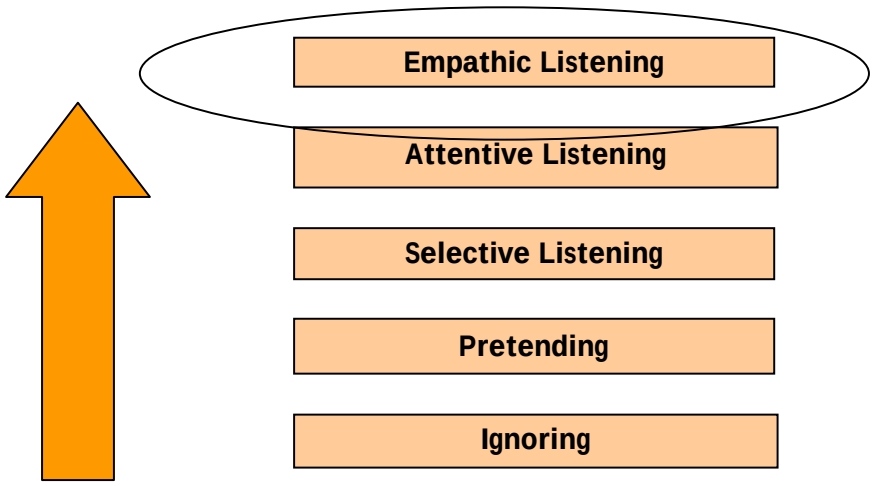
It is the job of the teacher to create enthusiasm and interest and to remove any fear and inhibitions that a student may have towards a subject/topic.

6.3. Sense of Humour

The importance of this factor has been regularly underestimated, while a dour trainer can kill the interest of the students; a good sense of humour may help to keep the students active, make them comfortable in opening up and clarifying their doubts.

6.4. Understanding the students/empathy

Trainers should encourage students to communicate openly. There should be emphasis on cultivating a dialogue rather than a monologue. Trainers should also convey empathy i.e. the ability to communicate care and concern so that they are able to not only teach their minds but touch their hearts as well.



6.5. Listening

Empathetic listening is the highest form of listening. It can be done through:

- Listening not only with ears…(listen to content, opinions, feelings, non-verbal gestures)
- Being mindful
- Avoid being judgmental, being rigid about the set structures.

In short, empathic listening is about having the ability to see things from the other's point of view. As soon as a teacher can grasp how a student is "seeing his world" he will then immediately be able to adapt the learning experience to meet his specific needs. For example, a student who may be lacking in confidence may never openly admit so, but through closed body language, averted eye contact and withdrawal from participating in the group, the trainer should be able to gauge that the student requires a boost to his/her confidence.

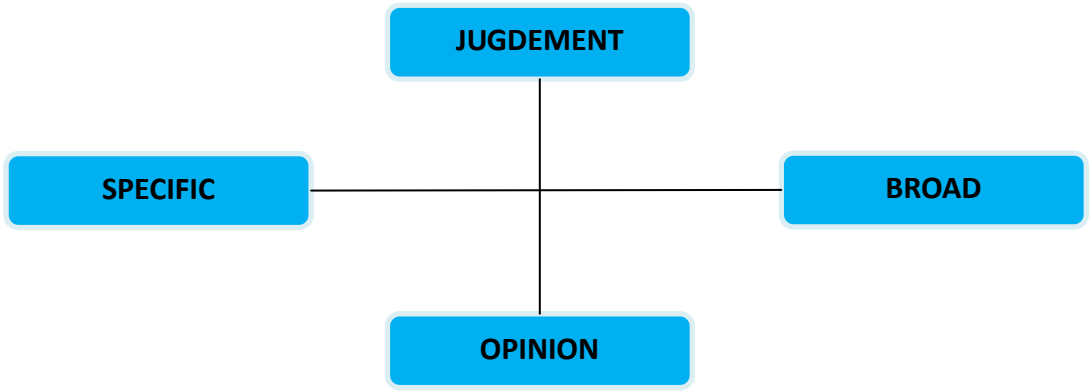
6.6 Feedback:

Feedback is a two way process of formally/informally evaluating how a session or learning experience is progressing/has progressed. It is important for both trainer and learner to be able to evaluate whether the objectives are being met, whether more time or a different approach may be required; whether the level of technical difficulty is appropriate. Honest, open discussion through feedback will facilitate a successful learning experience.

Silence: The ability of a trainer to use silence effectively means giving few more seconds to students to respond to a query. Silence can help the students as:

- Length of students' correctness of their response increase
- The number of "I don't know" decreases.
- More number of answers

6.7 Communication Grid



Knowing which quadrant of the communication grid you are communicating from is very important for accurate and unbiased communication. We have a tendency to slip into the "broad – opinion" quadrant whilst representing it falsely as a "specific – judgment".

"Young officers these days are generally less responsible than the earlier generation"

is a broad – opinion but is sometimes put across as a judgment. Unless backed up by empirical evidence, these kinds of statements need to be used judiciously. Trainers must always be careful and conscious about how and what they are communicating. Quick, thoughtless and off the cuff remarks can be misinterpreted, misunderstood and lead to de-motivation, lack of learning and disrespect.

6.8 Dealing With Personal Reactions to the Simulation Training

Students working on simulators may come up with different feelings and reactions. The trainer must be aware of the various factors and reasons that has caused the unsettling, disruptive behaviour such as defiance, anger, humiliation, disruptive behaviour, lack of interest, seriousness, denial, regression withdrawal, lack of acceptance.

Some reasons for disruptive behaviour might be:

A) **Observer's effect** – the awareness of being under observation may cause the participants to alter their performance. The change can be positive because of the attention they receive from the trainer, or negative due to fear or anxiety of being evaluated. Senior officers particularly might be sensitive to the evaluation of their performance. Many times it has been heard by senior officers that they have had years of experience without any major incidents, so what is the need for the training. In fact if any incident does occur during the simulation, the natural tendency is to blame the simulator or the way the exercise was conducted. The student immediately reverts to a defensive position.

B) **Role Assumed** – In certain circumstances, a student may "overplay" a role which is of some authority figure among his peers. Whereas in other cases, a high ranked student, given the role of crew to act on simulators may come across as challenging and defiant.

C) **Trainer's expectations** – trainers who have place high trust and expectations upon the students may encourage a better performance (***Pygmalion effect, or Rosenthal effect*****)** and on other hand trainer with lesser expectations can lower the enthusiasm and willingness to learn in students thereby affecting their performance.

D) **Student's expectations** – the general attitude of the students toward the simulators and their own expectations from the course.

E) Students may adopt certain **Defence mechanism to justify their performance** on simulators.

F) **Cultural differences**

6.9 Strategies for Dealing with Challenging Behaviour in the Classroom

6.9.1 Challenge

1. Don't become defensive. Explain (not defend) instructional objectives and how assignments fit.
2. If student presses during discussion, ask to continue discussion later, privately
3. Be honest if something REALLY isn't working. (but watch for manipulations) Saying NO assertively (not aggressively or submissively).

6.9.2 Hostility

Verbally aggressive or verbally abusive in frustrating situations which they see as being beyond their control; anger and frustration becomes displaced onto others; fear of rejection and feelings of righteous indignation are frequently associated with this pattern.

1. Reduce stimulation. Invite person to a quiet place to talk
2. Check out your interaction style with person
    a. defensive
    b. authoritarian
    c. condescending
    d. loaded words
    e. flaunting power
    f. unreasonable, unclear demands
    g. atmosphere of mistrust
3. There may be times when ignoring is best.
4. Allow them to ventilate

5. Recognize feelings. "I can see you're very upset."
6. Tell them that you can't deal with verbal abuse "When you yell at me, it's hard to hear what you are saying."

Don'ts

1. Get in an argument
2. Press for explanation of behaviour. "Why are you acting like this?"
3. Walk away from person
4. Get others to help you quiet them down i.e. other student, faculty, etc.

6.9.3 Harassment

1. Act as if you are not aware. Don't reinforce in any way. Keep with professional agenda.
2. Address harassment personally, privately, and directly. Request the ceasing of specified behaviours.

6.9.4 Talking and inattention

1. Make direct eye contact
2. Don't START talking until have full attention
3. Physically move to that part of classroom
4. Vary methods of presenting content
5. Speak to the student(s) privately

6.9.5 Defence mechanisms and offensive tactics

Defense mechanisms are the "automatic" (i.e. unconscious) behaviors all of us employ to protect or defend ourselves from the threatening or challenging situations.

⇒ **Denial** – Denial is an outright refusal to admit or recognize that something has occurred or is currently occurring.

⇒ **Selective Inattention** – This tactic is denial, where individual acts oblivious and actively ignores the warnings, expectations of others, and in general, refuses to pay attention to everything and anything that might distract them from pursuing his own agenda - "I don't want to hear it!" behavior.

⇒ **Rationalization** – A rationalization is the excuse an individual tries to offer for engaging in an inappropriate behavior or justifying the poor performance "this will not happen in real life situations on board"

⇒ **Diversion** – A moving target is hard to hit. When you try to keep a discussion focused on a single issue an individual doesn't agree to, he would expertly change the subject, dodge the issue to keep the focus off their behavior.

⇒ **Intimidation/Shaming** – This is the technique of using subtle sarcasm and put-downs as a means of increasing fear and self-doubt in others.

⇒ **Playing the Victim Role** – portraying oneself as an innocent victim of circumstances. "In my con, I was given tough scenario/heavy traffic"

⇒ **Projecting/Blaming** – looking for a way to shift the blame for their weaknesses or shortcomings.

⇒ **Minimization** – the individual asserts that his behavior is not really as harmful or irresponsible as someone else may be claiming

While, from a certain perspective we might say someone engaging in these behaviours is defending their ego from any sense of shame or guilt, it's important to realize that at times he is not primarily defending but rather fighting to maintain position, gain power and to remove any obstacles in the way of getting what he wants. Thus, the trainer can use the following guidelines for effectively dealing with the students:

The Trap of the Power Struggle – Things you may do to make it worse:

- Lose your temper (yelling or using sarcasm)
- Engage in the interaction in front other students
- Try to persuade the student
- Threaten the student
- Trying to embarrass the student or put them down
- Letting the struggle go on way too long
- Crowd the student
- Get annoyed at every little thing

Things you can do to make it better:

- Use a calm neutral voice
- Give clear directions to the student
- Discuss things briefly and in private to remove the audience
- Making sure to listen to the student and consider what they are saying
- Have clear boundaries and predetermined consequences for problem behaviour
- Think Discussion, Not Complaint

6.10 Questioning Techniques

Asking questions effectively

Asking the right question is at the heart of effective communications and information exchange. By using the right questions in a particular situation, you can improve a whole range of communications.

Questioning techniques are helpful not only in checking the understanding of students but also to arouse interest, open discussion, obtain learner participation, provoke thinking, accumulate data, arrive at conclusions, evaluate comprehension, limit or end discussion.

1. **Open and Closed Questions** – A closed question usually receives a single word or very short, factual answer, where as Open questions elicit longer answers. They usually begin with what, why, how. An open question asks the respondent for his or her knowledge, opinion or feelings.

Open questions are good for:

- Developing an open conversation or for ice-breaking.
- Finding our more detail: "What else do we need to do to make this a success?"
- Finding out the other person's opinion or issues: "What do you think about those changes?"

Closed questions are good for:

- Concluding a discussion or making a decision: "Now we know the facts, do we all agree that this is the right course of action?"
- Frame setting: "Are you happy with your performance bank?"

2. Funnel Questions – This technique involves starting with general questions, and then homing in on a point in each answer, and asking more and more detail at each level.

Funnel questions are good for:

- Finding out more detail about a specific point:
- Gaining the interest or increasing the confidence of the person you're speaking with.

3. Probing Questions asking probing questions is another strategy for finding out more detail. Sometimes it's as simple as asking your respondent for an example, to help you understand a statement they have made. At other times, you need additional information for clarification, or to investigate whether there is proof for what has been said, "How do you know that the new database can't be used in this case?"

Probing questions are good for:

- Gaining clarification to ensure you have the whole story and that you understand it thoroughly; and
- Drawing information out of people who are trying to avoid telling you something or are not very articulate.

4. Leading Questions – **Leading questions try to lead the respondent to your way of thinking. They can do this in several ways**:

   - With an assumption: "How inappropriate do you think your course of action was? This assumes that the action of course was certainly not appropriate.
   - By adding a personal appeal to agree at the end: "he was very efficient, don't you think
   - Phrasing the question so that the "easiest" response is "yes" (our natural tendency to prefer to say "yes" than "no" plays an important part in the phrasing of referendum questions): "Shall we all approve Option 2?" is more likely to get a positive response than "Do you want to approve option 2 or not?

   Leading questions are good for:

   - Getting the answer you want but leaving the other person feeling that they have had a choice.

5. Rhetorical Questions

   Rhetorical questions aren't really questions at all, in that they don't expect an answer. They're really just statements phrased in question form: "Isn't Sumit's work so creative?" People use rhetorical questions because they are engaging for the listener - as they are drawn into agreeing.

Rhetorical questions are good for:

- Engaging the listener.

6.10.1 Using Questioning Techniques

Questions are a powerful tool, for presentation, evaluation, briefing and debriefing:

- **Learning: Ask open and closed questions, and use probing questioning.**

- **Relationship building: People generally respond positively if you ask about what they do or enquire about their opinions. If you do this in an affirmative way "Tell me what you like best about working here", you will help to build and maintain an open dialogue.**

- **Managing and coaching:** Here, rhetorical and leading questions are useful too. They can help get people to reflect and to commit to courses of action that you've suggested:

- **Avoiding misunderstandings:** Use probing questions to seek clarification, particularly when the consequences are significant. And to make sure you avoid jumping to conclusions,

- **Diffusing a heated situation:** You can calm an angry or upset participant by using funnel questions to get them to go into more detail about their grievance. This will not only distract them from their emotions, but will often help you to identify a small practical thing that you can do, which is often enough to make them feel that they have "won" something, and no longer need to be angry.

- **Persuading people:** No one likes to be lectured, but asking a series of open questions will help others to embrace the reasons behind your point of view.

APPENDIX

EXERCISE/WORKSHEET/QUIZ

	Body language	**Behavioural actions**	**Plausible reason/root cause**	**Dos and don'ts to deal with such behaviour**
Defiance				
Hostility				
Aggression				
Withdrawal/ inattentiveness				
Challenging authority				

QUESTIONS TO ASK YOURSELF

How do I engage uninterested students?

How do I incorporate innovation into my teaching?

How do I know that my students comprehend what I am teaching?

How do I use student evaluations to improve my teaching?

What teaching resources do I use?

How do I assess what my students already know?

How do I capture their attention?

How do I meet the needs of different types of learners?

How do I assess the needs of the students?

How do I encourage student participation?

COURSE METAPHORS

My course is like _____ because _____.

A roadmap because I am leading you to a destination.

A human body because I want students to understand the inter relationship of all the systems.

A flock because a shepherd does not lead from the front but from behind.

A construction site because I expect students to build knowledge.

A garden because I expect them all to grow.

A marriage because I am your partner.

A pizza because I expect students to pile on the toppings.

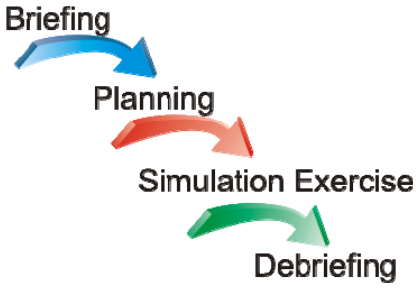
An index of a book and I expect students to fill in the topics.

A mis-tuned car because I am like a mechanic.

An obstacle course because students are always hurrying to figure out the new professor.

CHAPTER 7

7. Conducting a Simulation Exercise



The simulation session comprises 4 main components:

1. Briefing
2. Planning
3. Simulation Exercise
4. Debriefing

7.1. Preparation Prior Carrying Out the Briefing Session

It is important to have a checklist for planning and execution of the simulation exercise. The instructor worksheet should include not only the pertinent parameters for the simulation exercise but also all additional equipment, material, etc., which may be utilized by the participant during the session. This may include: publications, manuals, and charts, logbooks, stationery, etc.

The environment and ambience of the simulation space will have an impact on creating a sense of realism and encouraging the participants to immerse themselves into the simulation experience.

Depending on the design and availability of control over the environment due attention should be made to the levels of:

- Heating/cooling of the area: an engine-room space may have an increased ambient temperature than the engine control room.
- Lighting: reflective of the time of day, weather conditions, actual lighting arrangements in the real world.
- Noise: the addition of aural cues for the participant is important as these environmental factors form a part of conscious/unconscious monitoring and assessment of the situation. Feedback in the form of engine noise and equipment sound, weather conditions, ambient noise from the surrounding area, etc., is desirable and should be as close to reality as possible.
- Vibration.

7.2. External Factors Effecting the Simulation Session

1. where the session falls in relation to the overall course (initial session, middle or final)
2. Time of day
3. The proceeding activity

Due attention should be made to these factors as they can have some influence on the mindset of the students. Counteracting any negative fallout will be important. For instance, if it is getting late at the end of a long day, you may wish to structure the debrief so that it does not drag for too long.

7.3. Internal Factors Effecting the Simulation Session

1. The appropriateness of the simulation exercise to fulfil the objectives of the session.
2. Group Dynamics
3. The relationship formed between the instructor and the participants

7.4. Understanding the group members

Preparation for a simulation exercise will require the participants to be primed on two accounts: technically and psychologically:

Technically: any necessary underpinning knowledge or particular technical information which is required for successful conduct of the simulation exercise should be covered prior to the simulation session. The main focus of simulation is not the acquisition of technical knowledge but the ability to apply it in real time in context.

Psychologically: the context of the simulation session, the relevance to real life operations and the specific objectives of the session are to be clearly communicated to participants. Focus should be placed on making the participants feel comfortable and having the mindset that the simulation exercise is an effective vehicle for them to practice application of knowledge, skills and attitude and gain professional competence.

7.5. Setting the scene

The comfort level of the participants is one of the most crucial factors in successful simulation training. The simulation exercise or the training programme must be viewed not in isolation but in the context of the continual development of professional competence for an individual. For the participants to be receptive to the positive aspects of the programme, the simulation exercises must be viewed as a journey of discovery along a path of accumulated experience rather than as a unique and unconnected incident. The simulation exercises should not be viewed as if an individual is being picked up and placed in a series of experiments or tests in which he is being forced to perform a set of responses. The experience of the simulation programme should be understood and regarded as an opportunity to hone skills and reflect on performance for continuous improvement.

It is critical that the simulator instructor understands the participant as a professional who brings with him to the simulation programme a wealth of knowledge, varied experiences, attitudes and beliefs. Due respect to the professionalism of the individual is required and the instructor should aim to find out as much about the participant as is possible. It is only when this atmosphere of respect and trust is built up between instructor and participants that the simulation exercises will be successful.

7.6. Understanding the Individual

Based on a number of individual factors, each person will react differently to the simulation exercise. Some of the factors to be considered are:

- Age
- Rank
- Years of experience
- Competence

- Nationality
- Incidents on board
- Perception of self
- General attitude towards learning
- Reason for attending the programme (mandatory for certification; company specific, individual choice; for assessment; for career promotion, for professional development)
- Earlier experiences on a simulator programme

7.7. Briefing

The briefing is to be thoroughly thought out and planned prior to the session. It is not a hurried, rushed brief summary of what is supposed to happen, but is a structured and systematic introduction to the exercise, the objectives of the session, the way it is to be covered and the expectations for the conduct of the session.

Points to be included in the Briefing will include:

- Setting out the objectives of the simulation exercise
- Explaining the simulation scenario
- Explaining the plan for the exercise
- Listing all the relevant parameters, conditions, limits, etc.
- Explaining the starting conditions for the exercise
- Informing about any incidents and events which are to occur
- Clarifying which standard operations/procedures are to be followed: e.g. company procedures, international or national guidelines, manufacturer instructions, etc.
- Assignment of roles and providing detailed instructions for each role as appropriate
- Explaining about the type and format of the assessment and evaluation to be conducted
- Clarification of whether evaluation of performance will be individual/team
- Ground rules for the conduct of the exercise.

7.7.1. Assignment of Role

The assignment of role is to be carefully considered. If information has been provided prior to the conduct of the course, then the roles may be assigned earlier. However, if they are carried out at the time of the briefing then due regard may be made to factors such as age, rank, past experience (type of vessel/operation/equipment), apparent confidence level of the participant, and dynamics of the group.

Particular care should be taken for assignment of role for the first main exercise after the familiarization. The initial exercise will require a greater depth of explanation and motivation levels and the mindset of the participants will be at varying levels. Some participants may be super keen, others sceptical, overconfident or fearful. Early identification of the mind frame of the participants will help the instructor work appropriately with each participant. The leadership or main role for the first exercise is usually assigned to an individual who appears to be balanced and confident or who may have more experience.

It is not always helpful to place the most senior or dominant member of the group in charge of the first exercise as they will have the tendency to dominate the rest of the group and hinder contribution from others.

Similarly it is generally helpful to refrain from giving the "command" to a participant who appears to be lacking in confidence or hesitant. This individual may need to participate in one or two exercises before he feels ready to lead the team.

It is important to set some ground rules regarding the conduct of the simulation which would include fulfilling the role as assigned and respecting the roles given to others. This would be particularly important for groups with mixed ranks/level of seniority. The seriousness of the simulation exercise in terms of playing the role as expected is to be reinforced at this stage.

7.7.2. The Facilitating Team

Of course the number of facilitators available for conducting and monitoring the simulation exercise will largely be dependent on cost, availability of trained / expert individuals and the level of complexity of the simulation exercise.

For single task or part task, process oriented and basic operations and familiarization one facilitator or instructor who controls the instructor station as well as acts as a technical observer would be sufficient, however if the group size is large then an additional instructor would be beneficial to provide individualized attention to the participants.

However for more complex operations and scenarios in which there are multiple players, team roles, multi-tasking and often trouble shooting, crisis or emergency situations a team approach is desirable:

- An instructor to monitor and control the instructor station
- An instructor for role playing of other onboard/external parties as required
- A specially trained psychologist for observation of soft skills, group dynamics, etc.
- An additional technical observer would also be ideal for large scale simulations if possible and practicable.

The instructor playing the role of the other parties may have various "hats" to wear: onboard crew/officers; company DP, VTS, media persons, superintendents, tug masters, shore based personnel. This instructor is to be clear about the extent of information/assistance to be provided to the participants during the exercise. For leadership or advanced level programmes, a non-cooperative or disruptive role may be required to add an additional dimension to handling an incident. The level of realism is to be maintained to assist the participants in immersing themselves into the simulation experience.

The use of one of the participants as an "observer" is encouraged as it has a number of advantages and develops the skill of analytical peer evaluation. Any participant acting as an observer though, must be provided with guidelines for an objective observation, parameters for evaluation to be provided and reinforcement made that this is not a blaming or fault finding exercise.

7.8. Planning

Ample time must be dedicated for the students for the thorough planning of the exercise. The success of the simulation exercise is directly proportional to the time spent in planning.

Planning can be carried out in 2 stages:

1. Detailed operational and procedural planning
2. Role playing prior to commencement of the exercise

The detailed operational and procedural planning will comprise all aspects of the task to be completed. Decisions either singularly for single tasks exercises, or group wise for team exercises, regarding plan of action, chronological introduction of events, .record keeping, etc., will be covered. At this stage the instructor (s) have the option of purely observing or providing inputs where felt necessary. An example of a plan for a deck watch-keeper student could be to submit a proposed passage plan for the exercise. Details of exercise parameters such as weather, tide, current, traffic movements, navigation aids and dangers along the route should be provided. Engineer watch-keepers could be required to prepare an operational checklist for an engine starting exercise. Operational manuals should be available.

Immediately prior to the commencement of a team exercise, a second level of planning will take place which will form a brief planning meeting in which the participants in role, mirror the planning meeting which would take place on board. The meeting is to be led by the individual who is performing the lead role in the exercise. The expectations, duties, responsibilities, instructions and procedures to be followed by the team members are to be spelt out. This also forms a critical part of the simulation exercise because critical information or instructions missed out at this stage, lack of clear communication, lack of clarity of roles, etc., can be significant contributory factors to the performance of the operation and will be an important point of discussion during the debriefing stage. It is important to note that this important aspect of planning is sometimes missed out altogether or brushed over hurriedly and yet is a key part of the process. The instructor(s) would almost always not interfere or interject during this planning meeting unless absolutely necessary.

Familiarization

The first exercise in the programme is usually the familiarization session where the participants acquaint themselves with the simulator. It is of vital importance that the participants are given adequate time to familiarize themselves with the features, equipment, controls and operation of the simulator. If the confidence of the participant is not gained at this initial stage, then it will be difficult to convince them that realistic training can be conducted in such an environment. The limitations of the equipment must also be demonstrated so that the participants are clear on the parameters in which they are operating and the use of compensatory cues to overcome any lack or reality can be introduced at this stage.

7.9. During the Simulation Exercise

The key to an effective instructor is to finding a balance between letting the simulation exercise run without interference and injecting inputs when required. There is no right or wrong method in this, but sound judgement is required from the instructor to assess the most appropriate course of action at the time.

It is advisable to stick to the plan; however there is a need to be flexible and open to any situation which may arise. A decision at the exercise creation stage would have already taken place as to how much to "load" the participants, however an instructor may decide to lighten or increase the load during the course of the exercise and the advantage of simulation technology is that the course of events can be guided to some extent by an experienced instructor. For example, if an individual is moving at slower speed than expected and a resultant close quarter situation is unlikely to occur, an instructor in role can encourage the participant to speed up by informing that the pilot pick up time has been pre-poned. However at all times the specific objectives of the exercise are to be borne in mind. An instructor would typically have a full repertoire of faults that can be injected into the exercise at any time. Care should be taken that an over-zealous instructor does not become fall into the trap of endlessly introducing series of faults without any real reason. It must be borne in

mind that the simulator is a tool which can enhance performance but conversely can also crush confidence in an individual.

It is also at the discretion of the instructor to provide technical stimuli and cues during the exercise. If required this may be done directly, either in response to a request from a participant or if the instructor feels it is required. An experienced instructor may also be skilled enough to be able to introduce the cue without the participant actually being aware, for instance he may role play and provide additional information to the participant as if it were the natural course of the exercise.

The parameters to be monitored, recorded and analysed will be set at the simulation creation stage and checklists for the same are to be created. Other critical parameters such as communication, orders, instructions and guidance, observation regarding the functioning of the team, detours from standard procedures, etc., should be noted as the exercise is in progress. If available, the psychologist, otherwise the technical instructor, would be focusing on a range of soft skills including leadership qualities, communication skills, planning and delegation, signs of stress and anxiety, etc. The use of plotters, printers, data recorders and logs are key tools to assist in accurate recording of information and action taken which can be closely reviewed during the debriefing.

"Abort Point"

There may be a point in the exercise where the instructor decides that it is best to abort and either restart the exercise completely or take the scenario back in time to a particular point.

Usually this decision would lie with the facilitating team in discussion with the participants but there are exceptional circumstances where the request may come directly from the participants.

The decision to abort would be in consideration of:

Whether the objectives of the exercise are clearly not going to be met
Whether the objectives have already been met
The consequences of the simulation exercise have the potential to damage the participant psychologically, if things seem to be going too far out of hand
Disruption, disturbance or non-cooperation amongst team members
Realism not achieved due to lack of seriousness from one or more team members
Despite pre-planning appears to be overload or under load for the participants.

7.10. Debriefing

The debrief is arguably the most critical part of the simulation exercise. This is the platform where the students are able to review their performance, evaluate whether they have met the training objectives, reflect on whether the action taken was appropriate and recommend changes which can be made. Creating a "no-blame" but "wanting to learn" environment at this point is crucial.

7.10.1. Goals of Debriefing

The goal of the debrief session is to provide an opportunity for the performance of the participants to be reviewed. It is important that the training objectives and parameters set at the start of the exercise are borne in mind, otherwise there is a danger that the debrief session could go off track and lose it's focus.

An effective debriefing session works on the principle of learning from experience with a positive and objective analysis of how things could have been improved. Indeed, the skills which are employed in successful debriefing sessions are those which, when transferred to shipboard experience, are going to be significant in continuing professional development and striving for excellence – so the ability to analytically evaluate performance and set goals for self improvement is an extremely valuable and useful generic skill to develop in seafarers.

7.10.2. Planning Debriefing

As with the rest of the simulator exercise, debriefing needs a level of pre-planning.

1. **Location** – the ideal set up would comprise a room which has the facility to playback the simulation exercise: through video and software, however this will naturally depend on the nature of the simulator set up. If this is not available, then it is usually advisable to conduct at least some of the debrief close of the instructor unit which would have a playback feature and where actions taken, etc., can be reviewed.

2. **Gathering data** – all relevant information by the trainer and the students must be gathered – documents, video records, log, check list, printouts, rough notes, charts, etc., this provides for providing objective feedback based on facts rather than opinion. It also helps them to re-think and re-evaluate their plan of action in more practical and data-based ways.

3. It is ideal to give the students a **gap-period** before discussion of events for reflecting, reviewing and jotting down their points for discussion.

7.10.3. Conducting the Debrief

1. Setting the Tone

It may be reiterated to the students at the start of the debrief that the group is requested to work in a no blame culture, that the goal is to learn from their actions, that due respect for each other is important and that comments and inputs should, as much as possible, be backed up with objective evidence and be factual in nature. The focus to be on constructive suggestions.

2. Structuring the Debrief

Although not a hard and fast rule, it is often helpful to have the participant who played the "lead" role in the simulation to provide the first input with their comments and thoughts. If necessary, the trainer may need to facilitate this with some leading questions. The trainer will also need to guide the discussion to ensure that positive and constructive comments are brought out.

Once the lead role has shared his/her views, the rest of the team may be requested for their inputs.

Positive and supportive self and peer evaluation are effective methods for internalizing learning and for ownership of the lessons learnt as should be encouraged as much as possible.

The trainer's role is generally kept low-key during the debrief. The trainer must avoid the temptation to take over and give a lecture on how the exercise should be done. To illustrate a point being made, the trainer should reference back to the playback facility and "show" the participants from the actual record of the simulation exercise. The trainer should have a good overview of the points which are to be drawn out from the debrief and then attempt to orchestrate the session so that the lessons are provided by the students themselves. The data and notes taken during the exercise are to be readily available for review and for demonstrating what could have been done.,

In some circumstances, the trainer may wish at this point, to re-enter back into the simulator, take the students back to a certain point in the exercise and carry out some of the exercise again. The flexibility of the simulator to be able to provide the students this opportunity to "try again" is one of the main advantages and should be exploited as and when required. In fact, a set procedure, series of actions or combination of operations may be repeated a number of times to reinforce and stress a critical area of learning.

3. Elements for Evaluation

The objectives if the exercise is to be used as a basis to evaluation. The debriefing session must include an analysis to whether the students performed the necessary tasks/requirements within acceptable limits. Factors to be considered will include (but not limited to):

- Degree of accuracy
- Time taken to respond
- Procedures and practices followed
- Communication channels used
- Clarity of instructions provided to team members
- Organization of operations/tasks
- Understanding of basic principles
- Application of knowledge to real life situations
- Prioritization of tasks
- Trouble shooting
- Judgement and decision making
- Etc…

4. Time allocation

It is important to allocate generous time for debriefing. A rushed debrief at the end of the day when the students are all set and ready to leave can nullify the opportunity for important learning to take place. The simulation exercise should be planned in such a manner that there is ample time to conduct the debrief in a peaceful and relaxed manner.

5. Summarizing and Goal Setting

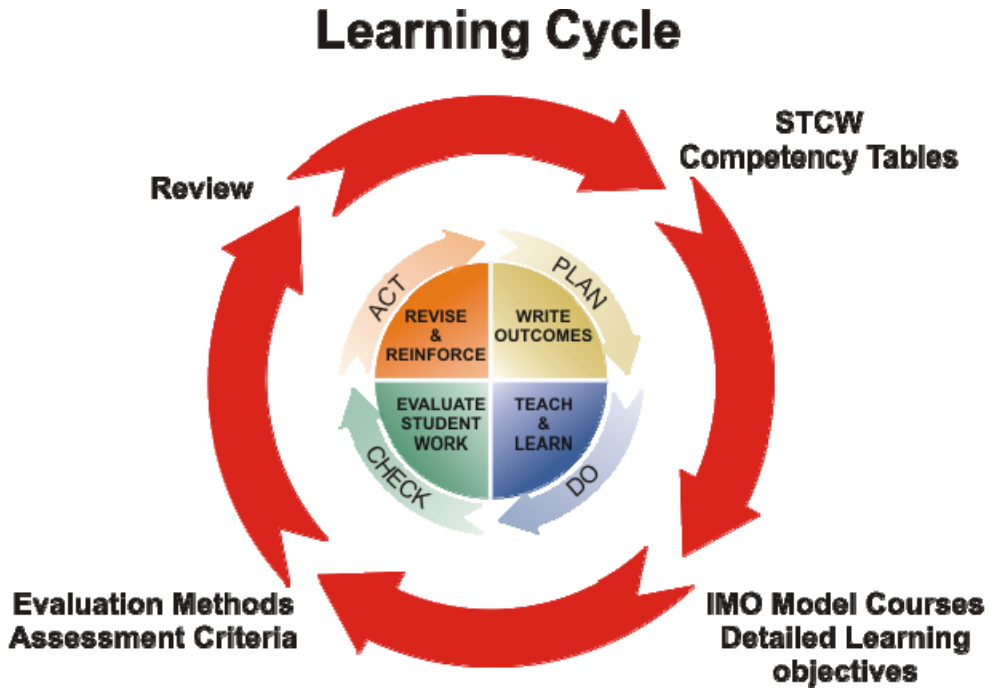
For long-term development or change to take place, more formal structured and documented summary is useful. Ensuring that the students note down individual and personal goals for self development concretizes the lessons learnt and becomes and form of informal commitment to change. Providing a documented direction for further action and implementation on board is a necessary step towards effective transference of knowledge to the workplace. Summarizing, rounding up and setting targets forms a closure to the session in which the students will recognize the benefits of the simulation exercise.

CHAPTER 8

8. Assessment and Evaluation

8.1. Introduction

Assessment is necessary to enhance the learning process and is critical to certify the competence of the learner. Assessment is defined as verification of competency of learners. In a competence-based assessment system the purpose of assessment is to collect sufficient evidence that individuals can perform or behave to a specified standard in a defined role. The assessment technique varies with the different domains namely cognitive (what the learner should know), psychomotor (what skills the learner should be able to do), and affective (how the learner feels or modifies his/her attitudes).

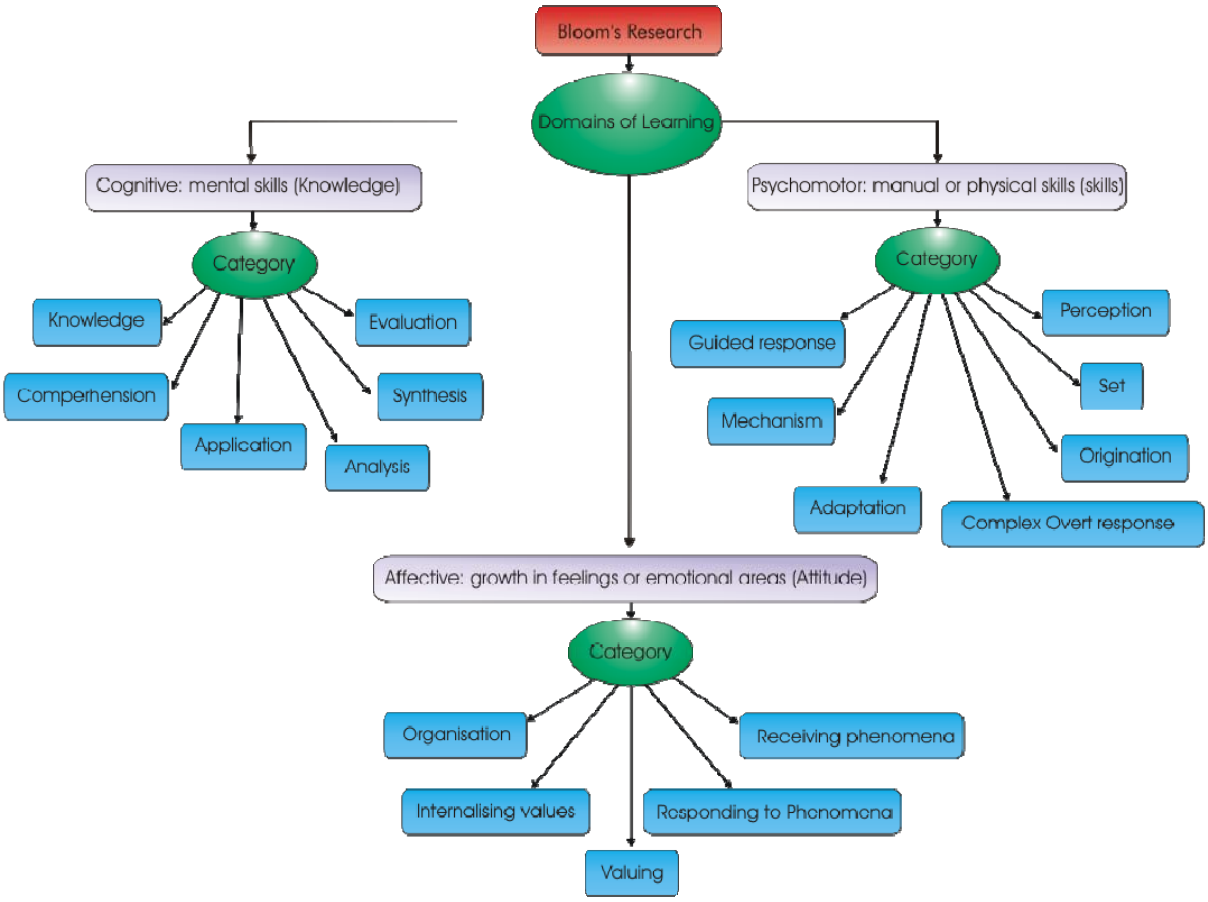


8.2. Competence-based Training and Assessment System

In a competence based training and assessment system, the standards of competence are related to functions and the basis of the training design is measurable standards of performance. The assessment forms an essential part in a competence-based system and has the following critical elements:-

- The competence-based standards form the framework for assessment.
- Evidence of performance needs to be monitored and appropriately measured using well defined assessment criteria
- The assessment criteria shall be **relevant, valid, reliable, consistent and realistic**.

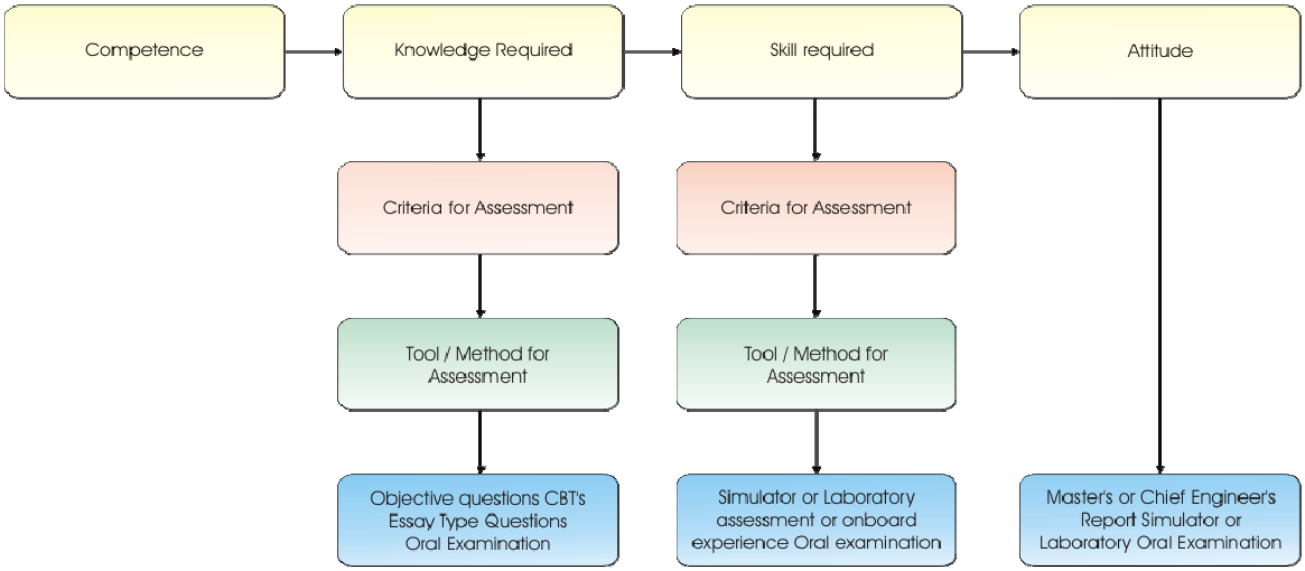
For assessing the performance of the trainee for competence it is necessary that the three cognitive, psychomotor and affective domains are assessed across different levels. These levels are defined below:



8.3. STCW and CBTA

STCW defines Standard of competence as the level of proficiency to be achieved for the proper performance of functions on board ship in accordance with the internationally agreed criteria as set forth herein and incorporating prescribed standards or levels of knowledge, understanding and demonstrated skill. The STCW competence tables specify the competencies in the three domains under the column head: knowledge, understanding and proficiency and it also specifies the methods for demonstrating competence as well as the criteria for evaluating competence.

As the competence based assessment is derived from a specification of a set of outcomes that can be objectively defined as measurable tasks and activities. Once the tasks and activities associated with outcomes are clearly defined it is easily possible to make assessment using simulators.



The STCW competence tables specify the different methods of evaluating performance.

- In Service Experience
- Simulators
- Laboratory Equipment
- Skills/Proficiency Testing Software
- Projects
- Assignments
- Evidence from prior experience
- Written Examinations
- Oral Assessments
- Computer Based Assessments

Out of the above assessment methods, Simulation method is the most comprehensive method for evaluating the performance of the trainee for the three domains across the different levels. Even though it is expensive, time consuming and the assessment is to some extent subjective. Assessment using the simulator is conducted by the following:

- Remote monitoring of the audio and video of trainee response to various stimuli injected by the instructor from the instructor station.
- Pre and post briefing and debriefing activity
- Analysing trainee reaction based on logged activities
- Assessment of the trainee using automatic weighted measurement against predefined task based criteria

The evaluation methods may also be compared by using the knowledge and performance parameters as given below.

Evaluation Method	Domain Applicability	Limitations
In Service Experience	Performance	Limited scope
Simulators	Knowledge, Understanding, Performance	Time Consuming, Costly, Level of Subjectivity
Laboratory Equipment	Knowledge, Understanding, Performance	Limited scope
Skills/Proficiency Testing Software	Knowledge, Understanding, Performance	Limited scope
Projects	Knowledge, Understanding,	Time consuming, Level of Subjectivity, Limited scope
Assignments	Knowledge, Understanding,	Time consuming, Level of Subjectivity, Limited scope
Evidence from prior experience	Knowledge, Understanding, Performance	Limited scope
Written Examinations	Knowledge, Understanding,	Limited scope
Oral Assessments	Knowledge, Understanding, Performance	Time consuming, Level of Subjectivity, Limited scope
Computer Based Assessments	Knowledge, Understanding, Performance	Limited scope

The advantages of simulators for assessment may be summarized below:

1. Simulations provide realistic training and assessing environments.
2. Simulators provide for assessment of competencies in realistic environments, relevant to work place.
3. It provides for practical assessments of routine and emergency tasks likely to be experienced on board ship.
4. The performance can be assessed for individual skills as well as and team coordination and performance.
5. The individual competence and performance in a team can be assessed in routine tasks and the management of crisis scenarios.
6. The assessment can be done against predefined performance and evaluation criteria, which may be objective for certain measurable parameters and subjective for complex procedures. The assessment is more consistent and reliable.
7. Procedures, planning, management skills and actions as well as behaviour and human factors of the trainees can be assessed.
8. Continuous assessment and improvement of skills is possible.
9. Assessment can be recorded and stored and used for comparison as well as for validation of assessment process later on.

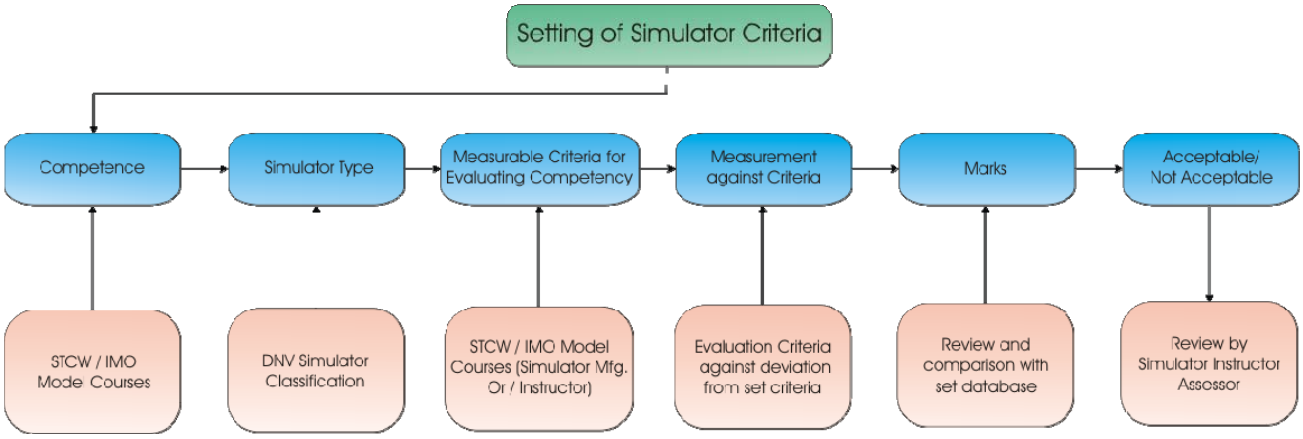
With the prices of simulations becoming reasonable more and more simulators being installed and web based simulation likely to be available, in times to come the use of simulations for assessment will be more common. The problem is more so due to a level of subjectivity and no appropriate standards for assessment using simulators.

Successful integration of simulation-based training into a valid, consistent, reliable and realistic evaluation of performance requires setting up clear objective and subjective assessment criteria. The process of setting criteria is explained below and should be used to create standard evaluation criteria for assessment of different competencies.

8.4. Assessment Process

To create assessment criteria for simulation courses it is required that the learning outcomes for the required competence are measurable through an applicable assessment for that outcome. The process to create online assessment should be objective covering competency and tasks, subtasks and activity required for the competency and most important the criteria set for evaluation must be measurable. The following is an example of a step by step method to create and write assignments:

1. The first step is to pick up the competency from the STCW competence table along with knowledge, understanding and performance, method of evaluation and evaluation criteria.
2. The second step is to create detailed list of knowledge, understanding tasks, subtasks or learning objectives required for the competency using the Bloom's domains across 6 levels. The same may be selected from detailed teaching syllabuses of the IMO model courses.
3. The third step is to select the type and class of simulators for the specific learning objective for performance of the tasks.
4. The fifth step is to decide if the activity to perform the task is critical for the performance of the task or not and accordingly give the weight age.
5. The sixth step is to set the gradations (0-10) for evaluation of the knowledge, tasks and subtasks required to be performed. Knowledge, task or subtask that is critical to the performance of competency should have higher grading and should lead to non-competence if poorly executed.
6. The seventh step is to set the range of measurement for assessment of the task against the gradations.
7. The eighth step is to practice on models. Students should be tested on sample assessments during the conduct of the course. This practice can build a student's confidence by teaching them how the instructor would use the tests on their summative assessment.
8. The last step is to review the work based on the result and feedback from the students and finalize the criteria.



The assessment criteria of different competencies may be defined along with evaluation criteria using Rubrics methodology and process.

Example for setting assessment criteria:

Step: 1

STCW Table

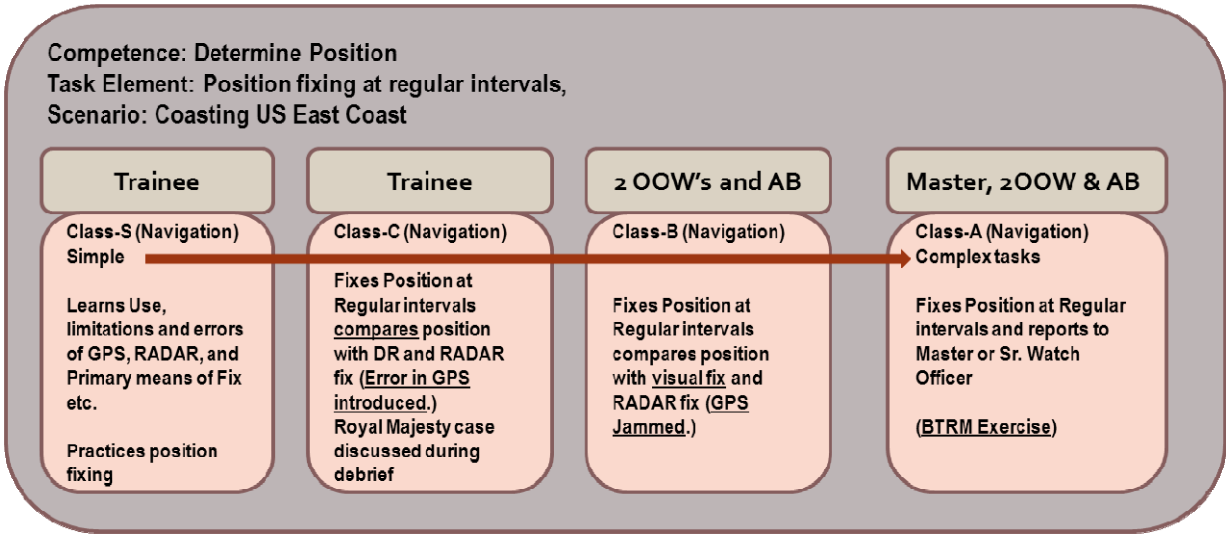
Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
Plan and conduct a passage and determine position	…… *Electronic systems of position fixing and navigation* Ability to determine the ship's position by use of electronic navigational aids …..	approved simulator training, where appropriate approved Laboratory equipment training	The primary method of fixing the ship's position is the most appropriate to the prevailing circumstances and conditions The position is determined within the limits of acceptable instrument/system errors The reliability of information obtained from the primary method of position fixing is checked at appropriate intervals Calculations and measurements of navigational information are accurate

Steps: 2, 3 and 4

Learning Objectives, Domains, Evaluation Method and Simulator type and class

Sn.	Required Performance	K, U, A	Evaluation Method
1	States the basic principle of GPS operation	K	MCQ
2	Describes the system configuration	U	MCQ
3	Describes the Dilution of Precision (DOP)	K	MCQ
4	Explains the errors of GPS	U	MCQ
5	Describes the reasons for selective availability and the effect it has on the accuracy of a fix	U	MCQ
6	Describes differential GPS	U	MCQ, NavSim- X
7	States the accuracy obtainable with GPS and how the accuracy can be downgraded	U	MCQ, NavSim- X
8	Explains WGS 84 and datum Shift	U, P	MCQ, NavSim-X
9	Explains why a fix obtained from the GPS receiver cannot be plotted direct onto a navigational chart	U,P	MCQ, NavSim-X
10	Demonstrate checking of the reliability of the information obtained from the primary method of position fixing is checked at appropriate intervals	K,U,P	NavSim-B

Choosing Simulator type:



Step 5-8:

Performance values**				Weighting					
Assessment criteria (Demonstration of Tasks)	Specified Parameters or limits	Actual Outcome	Competence Factor E-essential (0-5) D-desirable (0-3)	0	1	2	3	4	5
1 Safe navigation position at all times	Not <3 nm to land	> 3 nm	E						5
2 Acquire & plot ARPA targets			E						5
3 Maintain min. CPA to all targets	Not < 1 nm	Least 0.8 nm	E				3		
4 Interpret radar info correctly			E					4	
5 Compare gyro/magnetic compasses	Every hour	Not done	D	0					
6 Check GPS position by radar	Every 30 mins	OK	E						5
7 Check GPS by visual means	Every 60 mins	OK	D				3		
8 Keep a visual lookout			E						5
9 Change chart to largest scale			D				3		
10 ETA pilot at 1700 hours	On time	20 min late	E				3		
11 Call pilot cutter	30 before ETA	OK	E						5
12 Select appropriate VHF chan			E						5
13 Comply with Master's Standing Orders			E					4	
14 Call the Master	30 mins pre ETA	5 mins late	D			2			
15 Prepare the pilot ladder			E						5
16 Maintain the bridge logbook		No action	D			2			
			Totals	**0**	**0**	**4**	**12**	**8**	**35**

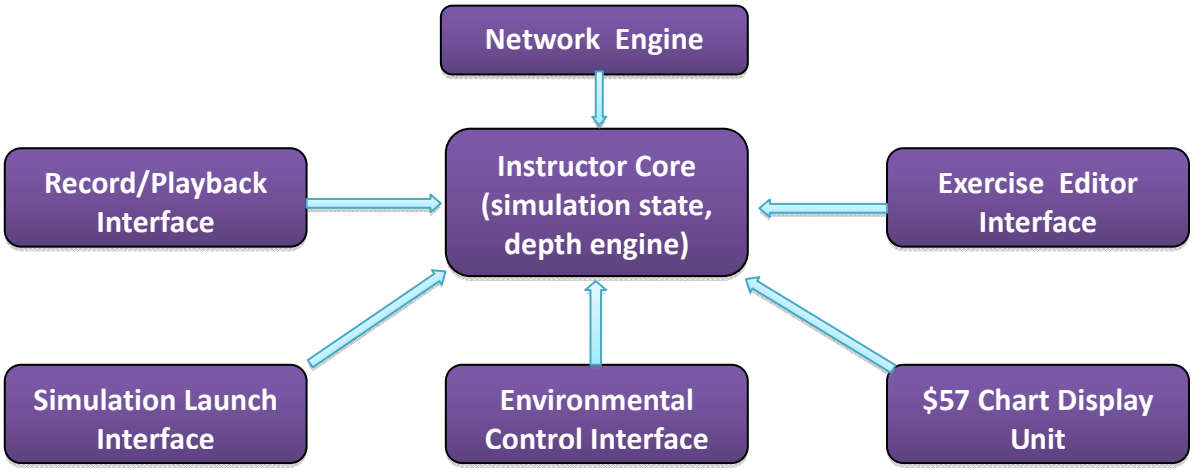
Competency Score = Number of E factors x 5 + Number of D factors x 3 x 70/100
Competency Weighted Score = 49 Actual Performance Score = 59

In above example the weighted criteria are set for the BTM exercise. Similarly other criteria tables may be drawn.

Block diagram for SMS Simulator

Block Diagram of SMS Simulator	
Instructor side	
Server station	Instructor station
Starting of a simulator session	Instructor panel RADAR with ARPA Visual Display Audio / Video recording capability External / Internal Communication
Trainee Side	
Equipments	Visuals
Navigational aids RADAR with ARPA Conning Station with controls of ship Steering ECDIS	Mono-Scopic view of simulated world

Instructor Station Block diagram



Simulation Observation and Response Record

Name _____
Rank_____No. of years in this rank _____Date____/____/____

SIMULATION SCENARIO_____

COMMUNICATION		Comments	Grade
Verbal Communication			
Clarity of voice	Tone Pitch Volume Speed		
Instructions and Orders	Clear and Precise Well Organized Planned (few changes / corrections if required)		
Following Bridge procedures with communication principles	Orders repeated Focus on Task/Situations Identified channels of communication channels being followed inclusion of all members of the team		
Open Communication	Willingness to accept inputs from team members		
Non-verbal Communication			
Body Movements	Pacing up and down Movement around the bridge		
Posture	Relaxed/Rigid		
Gestures	Hand tapping/leg shaking/eye movement		
Other factors			
Stress Response Agitation Over activity/Inactivity			
Planning and Organisation skills			
Anticipation of Events			
Response to Unexpected events /crisis/emergency			
Utilisation of all Information Resources			
comments			

Student Performance Sheet

Student/Group _____

Evaluation Area	Good	Fair	Needs Improvement	Unable to rate
Ability to write simulation training objectives				
Ability to create objective specific exercises				
Ability to debug exercises				
Ability to create documentation associated with simulation exercises				
Ability to conduct simulator exercises				
Ability to conduct briefing and debriefing sessions				
Ability to create evaluation documentation and evaluate trainees				
End of course exercise/presentation – Ability to conduct a simulator based training course for watch keeping engineers				

General Comments:

Instructor:_____

Student Feedback Sheet (Example)

Course #_____

Exercise#_____

In order to help maintain a high degree in the service quality, you are requested to answer the following questions. Please tick the appropriate box.

1- You found the exercises:

- ☐ Very realistic
- ☐ Realistic
- ☐ Unrealistic
- ☐ Not realistic

2- Do you believe that the evaluation was in line with the objectives of the exercise?

☐ YES ☐ NO

3- Finally, if you have any constructive criticisms about the exercise, please write them in on the following lines.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Trainee name (optional):_____

8.5. Assessment Criteria

In conducting competency based assessment it is necessary that all the six learning levels as defined by Blooms covering cognitive, psychomotor and affective domains are accounted for in the online assessment.

	Cognitive Domain	Verbs
1.	Knowledge: Remembering or retrieving previously learned material.	State Identify Relate List Define Recall Record Name Recognize Label Reproduce Measure Select
2.	Comprehension: The ability to grasp or construct meaning from material.	Identify Justify Select Indicate Illustrate Represent Name Formulate Explain Contrast classify Locate Report Recognize Express Discuss Describe Review Infer Conclude
3.	Application: The ability to use learned material, or to implement material in new and concrete situations.	Apply Relate Develop Translate Use Operate Organize Employ Restructure Interpret Demonstrate Illustrate Practice Calculate Show Exhibit Dramatize Predict Assess Perform
4.	Analysis: The ability to break down or distinguish the parts of material into its components so that its organizational structure may be better understood.	Analyse Compare Probe Inquire Examine Contrast Categorize Differentiate Contrast Investigate Detect Survey Classify Deduce Experiment Scrutinize Discover Inspect Dissect Discriminate Separate
5.	Synthesis: The ability to put parts together to form a coherent or unique new whole. Examples of verbs that relate to this function are:	Compose Produce Design Assemble Create Prepare Predict Modify Tell Plan Invent Formulate Collect Set Up Generalize Document Combine Relate Propose Develop Arrange Construct Organize Originate Derive Write Propose
6.	Evaluation: The ability to judge, check, and even critique the value of material for a given purpose.	Judge Assess Compare Evaluate Conclude Measure Deduce Argue Decide Choose Rate Select Estimate Validate Consider Appraise Value Criticize Infer Support

Example 1: Student Working/Observation Sheet

Exercise: Taking Over Watch

Name of Candidate:

Main Engine		Units			Units
Fuel lever settings (notches)			Speed setting of air		
Engine load					
Average rpm			Engine Revolution counter		
Flow meter reading					
Main Engine fuel oil inlet temperature			Main Engine fuel consumption for 4 hours		

Main Engine Unit 1			**Main Engine Unit 2**		
Exhaust Temperature			Exhaust Temperature		
Piston Cooling Water Temp.			Piston Cooling Water Temp.		
Jacket Cooling water Temp.			Jacket Cooling water Temp.		
Main Engine Unit 3			**Main Engine Unit 4**		
Exhaust Temperature			Exhaust Temperature		
Piston Cooling Water Temp.			Piston Cooling Water Temp.		
Jacket Cooling water Temp.			Jacket Cooling water Temp.		
Main Engine Unit 5			**Main Engine Unit 6**		
Exhaust Temperature			Exhaust Temperature		
Piston Cooling Water Temp.			Piston Cooling Water Temp.		
Jacket Cooling water Temp.			Jacket Cooling water Temp.		
Main Engine Unit 7			**Main Engine Unit 8**		
Exhaust Temperature			Exhaust Temperature		
Piston Cooling Water Temp.			Piston Cooling Water Temp.		
Jacket Cooling water Temp.			Jacket Cooling water Temp.		

Pressures			**Turbochargers**		
Sea Water Pressure					
Jacket Cooling Water Pressure			RPM		
Piston Cooling Water Pressure			Cooling water in & out temperature		
Lube Oil Pressure (bearing, Crosshead, camshaft)			Air cooler in & out temperature		
Fuel Oil Pressure			Pressure drop across turbocharger air cooler filter to judge the blockage		
Air Bottle Pressure			Air temperature in and out of the turbocharger		
			Exhaust gas temperature in & out		

Other Temperatures/Levels		Units			Units
Heavy oil service and settling tank temperature			Sea water temperature		
Thrust bearing temperature and pressure			Engine-room temperature		
Stern tube temperature and pressure			Main engine sump level		

RAC Units			**Compartment Temperatures**		
Suction pressure and discharge pressure of refrigerant			Meat room		
Lube oil pressure			Fish room		
Lube oil suction and discharge pressure			Vegetable room		
Air inlet and outlet temperature			Dairy room		
			Handling room		

Fresh Water Generator			**Auxiliary Machinery**		
Jacket cooling water in & out temperature			Exhaust temperatures of all units		
Condensor sea water in & out temperature			JCW temperatures of all units		
Shell temperature			Alternator forward and aft bearing temperatures		
Vacuum pressure			Scavenge air pressure and temperature		
Ejector pump pressure			Air cooler in & out temperatures		
Distillate pump pressure			Lube oil in & out temperatures		
Feed line pressure			Sea water in & out temperatures		
Flow meter reading for fresh water			Turbo charger of auxiliary engine exhaust temperature		

Tank Levels					
Heavy oil service tank			Heavy oil settling tank		
Heavy oil service tank			Heavy oil settling tank		
Diesel oil service tank			Diesel oil settling tank		
Diesel oil service tank			Diesel oil settling tank		
Cylinder lube oil storage and Daily tank reading			Auxiliary engine crank case lube oil storage tank reading		
Main engine crank case lube oil storage tank reading					
Stern tube Gravity tank (high/low) tank readings			Stern tube aft & fwd seal tank level		

Remarks and Other Observations

Example 1: Simulator Programme: …….

LEVEL: Operation

Student Name: _____

CATEGORY	Weight for Each Category	4	3	2	1	Max Marks
Appraisal Charts	5	Appropriate Charts Updated Charts Order of Charts Scale of Charts	Appropriate Charts Updated Charts Order of Charts	Appropriate Charts Updated Charts	Appropriate Charts	20
Appraisal Publications	2	Appropriate Pub. Updated Pub. Use of Pub. Reference Pub.	Appropriate Pub. Updated Pub. Use of Pub.	Appropriate Pub. Updated Pub.	Appropriate Pub.	8
Planning Passage	8	Safe Courses Alteration point Safe Labelling Wheel over Mark	Safe Courses Alteration point Safe Labelling	Safe Courses Alteration point	Safe Courses	32
Calculations	6	Sailing Type Course Calculation Distance Calculation ETA Calculation Marking on Chart	Sailing Type Course Calculation Distance Calculation ETA Calculation	Sailing Type Course Calculation Distance Calculation	Sailing Type Course Calculation	24
Documentation	4	Passage Plan Position Fixing Methods Safe Anchorages Other Safety Measures	Passage Plan Position Fixing Methods Safe Anchorages	Passage Plan Position Fixing Methods	Passage Plan	16
					Total	100

ANNEXURE – 1

INSTRUCTION FOR OPERATING DEMO 2: BRIDGE SIMULATOR

The training module can be opened in any of the html viewers (Internet Explorer, Google Chrome, Mozilla Firefox, etc.).

1) The main screen consists of an index of all the training modules on the left hand side which can be started with left click of the mouse.
Index consists of:
(i) Instructor
(ii) Vessels
(iii) Environment
(iv) Navigational Equipment
(v) Tugs
(vi) Failures
(vii) Lights
(viii) AIS

2) Click the Play button on the Right hand side of the screen to start the instructor training.

"Instructor" menu is used to make Route Plan for ships, Load/Unload charts, customizes the views & displays, customize symbols, display vector/trail history, choose between scales, zoom in/out and measure range and bearings of objects.

3) Click on the vessels tab on top to continue training after completion of above.

"Vessels" menu is used to amend heading, position, choose between Hand/Auto steering, status of ship movement and engine order/RPM. This menu is also useful in monitoring all vessel parameters.

4) Click on the Environment tab on top to continue training after completion of above.

"Environment" menu is used to amend wind force, current, waves, cloud cover, visibility, application of rain or snow, cloud cover & time of day settings.

5) Click on the Navigational Equipment tab on top to continue training after completion of above.

"Navigational Equipment" menu is used to introduce various failures of Navigational Equipment e.g. Gyro, Doppler, Echo Sounder, GPS, RADAR / ARPA & LORAN-C

6) Click on the Tug tab on top to continue training after completion of above.

"Tug" menu is used to apply tugs at various positions, amends efficiency of the tug, line length & Tug Force.

7) Click on the Failures tab on top to continue training after completion of above.

"Failures" menu to introduce various slowdown/shutdown failures of engines, steering gear, & generator failures and various fire or general alarms

8) Click on the Lights tab on top to continue training after completion of above.

"Lights" menu is used to simulate switching on/off navigational lights or Signal lights and introduce power failures.

9) Click on the AIS tab on top to continue training after completion of above.

"AIS" menu is used to simulate the complete operation of AIS equipment.

ANNEXURE – 2

INSTRUCTION FOR OPERATING DEMO 2: LIQUID CARGO HANDLING SIMULATOR

The training module can be opened in any of the html viewers (Internet Explorer, Google Chrome, Mozilla Firefox, etc.).

1) The main screen consists of an index of all the training modules on the left hand side which can be started with left click of the mouse.
Index consists of:
(ix) Creating loading exercise
(x) Shore line up
(xi) Ship line up
(xii) Starting loading operation

10) Click the Play button in the Middle of the screen to start this training module.

11) Click the "Next button" on the screen to start the "Start-up wizard" training.

"Start-up wizard" menu is used to create/edit/run an existing exercise or replay, saving exercise, setting trainee station set-up.

12) Click on the "Control" tab on top to continue training after completion of above.

"Control" menu is used to amend tank properties, pauses or run the exercise.
This is default panel when exercise is started.

"Shore" panel is used to select cargo, line up shore pipelines, change loading rate and shore tank level.

13) Click on the "Aux. System / Gas detect" at the bottom to continue training after completion of above.

"Aux. System/Gas detect" Panel used is to set hydraulic system in auto/manual mode as well as to start pump room fan.

"Main deck "panel is used for setting ship's line for loading and manifold connection.
Once line up is ready loading can be started from "Shore" panel.

14) Click on the "Load Monitor" tab on top to continue training after completion of above.

"Load monitor" Panel is used to monitor trim calculation, stress and stability.

It indicates online cargo quantity in tanks along with updated drafts.

Tank level change can also be monitored on "CCR" panel.

In confirmation with standard loading procedures and on checking all required parameters rate can be changed from shore panel and cargo operation can be monitored.

ANNEXURE – 3

INSTRUCTION FOR OPERATING DEMO 3: ENGINE-ROOM SIMULATOR

The training module can be opened in any of the html viewers (Internet Explorer, Google Chrome, Mozilla Firefox, etc.).

1) The main screen consists of an index of all the training modules on the left hand side which can be started with left click of the mouse.
Index consists of:
(xiii) Loading exercise
(xiv) Setting up scenario
(xv) Changing setting and inducing fault
(xvi) Monitoring

15) Click the Play button in the Middle of the screen to start this training module.

16) Click the "**OK**" button on the screen to Load the "Engine-room simulator-Instructor" menu.

"Instructor" menu is used to create/edit/run an existing exercise or replay, saving exercise, setting trainee station setup and monitoring.

This is also default window for instructor panel.

17) Click on the "**Bridge**" tab on top to continue training after completion of above.

"**Bridge**" panel help instructor to view and use bridge controls like Telegraph, Steering Control, Steering Motors, etc., and view responses from the Engine Control.

"**Pipeline**" panel is used to view all the engine machinery and associated pipeline. "Navigation arrow" on this panel help to move left-right with-in pipeline panel.

18) Click on the "**Main Engine**" on top to continue training after completion of above.

By clicking any "**Machinery list button**" and selecting from its categories, the instructor can view and edit various parameters across all machineries viewed in the parameter window.

Machinery list consist of Main eng, Global, Main switch board, Turbo generator, Emergency generator, A.C, Steam, MARPOL, Sea water system, Fresh water system, COPT & I.G, Fuel oil system, L.O. System and generators.

The individual machinery parameter window consists of values for all parameters across various machineries, used in the simulator.

By clicking "AUTO / MANUAL". Instructor can change the machinery status from 'AUTO' to 'MANUAL' or vice versa. 'AUTO' colour is bright yellow and 'MANUAL' tab is dull yellow.

By clicking "**N button**" across chosen parameter under "**Fault**" column fault can be induced. **Fault induction window** help in inducing fault with certain values and with a delay.

19) Click on the "Close" tab on top to continue training after completion of above.

"Instructor events" Panel is used to view all action taken by an Instructor during an exercise.

"Active alarms" Panel is used to view active alarms.

On clicking the "**Console Button**", the instructor can view the engine-room main and auxiliary machinery current running state.

ANNEXURE – 4

TASK SHEET 1

Activity Sheet: TASK 1	
Activity	**Map STCW Competence with Simulator types and class**
Situation	The STCW competence tables specify the Knowledge, Understanding and Proficiency, Methods for demonstrating competence and Criteria for evaluating competence for each competency. In the column (3), the methods for demonstrating competence, Simulator is listed as one of the methods. All the competencies that require simulators as one of the methods for demonstrating competence; the Classification Society Standards of classification of Simulators classifies simulators based on the tasks that can be performed on the simulators. This needs to be mapped accordingly.
Action	First filter the competencies that can be demonstrated on simulators and then map them with class and type of simulators using Classification Society Standards of classification of simulators.
Resources Required	1. STCW Code 2. Classification Society Standards of classification of simulators.

TASK SHEET 2

Activity Sheet: TASK 2	
Activity	**Familiarization on Simulator Systems**
Situation	Prior to the conducting of exercise, familiarization on the simulator(s) will be undertaken
Action	Controls on the simulator(s) shown; trainees familiarize themselves independently with the controls and operation of the simulator(s)
Resources Required	1. Bridge / Engine-Room / LCHS Simulator(s) 2. Familiarization Checklist for Participants

TASK SHEET 3

Activity Sheet: TASK 3	
Activity	**Drawing out performance objectives from STCW and Local Legislation**
Situation	The STCW competence tables specify the Knowledge, Understanding and Proficiency, Methods for demonstrating competence and Criteria for evaluating competence for each competency. Subsequently, the local legislation has incorporated the requirements with reference to the various competencies. The trainee classifies performance objectives based on the tasks that can be performed on the simulators
Action	Choose a relevant section from STCW and filter the competencies, relating the same to the associated local legislation that can be demonstrated on simulators. From these write out the performance objectives to be carried out for a simulation training programme.
Resources Required	1. STCW Code 2. Parts of Local legislation

TASK SHEET 4

Activity Sheet: TASK 4	
Activity	**Familiarization of instructor stations of available simulators.**
Situation	Having watched Demo 2, which highlights some of the key functions and operations of the instructor station of different simulators, the participants carry out a familiarization exercise on the actual instructor stations available for the course.
Action	Using a familiarization checklist, each participant is to be fully conversant with the functions, features, capability and operations available on the simulator instructor stations. The extent of conditions which can be set, environmental factors, faults and emergencies that can be introduced, recording and analysing functions that are available must be made aware to all participants.
Resources Required	1. Instructor Station Familiarization Checklist 2. Simulator (Bridge / Engine-Room / LCHS)

TASK SHEET 5

Activity Sheet: TASK 5	
Activity	**The design and creation of two simulation exercises**
Situation	Two different exercises to be designed using the available simulator(s). These exercises will actually be carried out by the participants during the course so that they experience the full cycle of planning, designing, conducting and evaluating a simulation exercise
Action	Participants to plan and create two simulation exercises: one basic and one more complex. Participants are expected to design and prepare for each simulation exercise: a simulator exercise checklist; instructor worksheet and trainee evaluation sheet.
Resources Required	1. STCW Code 2. Other specific reference material (legislation, equipment manuals, etc.) 3. Simulator

TASK SHEET 6

Activity Sheet: TASK 6	
Activity	**Conduct simulations with different simulators OR different level of complexity**
Situation	To understand the complexities of actually carrying out and conducting a simulation exercise, course participants are required to execute their own created simulation exercises so that they benefit from experiential learning. This process is central to the whole training programme in which the participants are encouraged to review their performance through individual, peer and instructor relation.
Action	The participants carry out their pre-planned simulation exercises following the set process as if they were conducting an exercise during a simulation training programme. Briefing, role playing, conduct of the exercise and debriefing will all be incorporated into the activity.
Resources Required	1. Simulator(s) – (Bridge / Engine-Room / LCHS) 2. Exercise Checklist 3. Exercise worksheet 4. Evaluation Sheet 5. Other reference material as required

TASK SHEET 7

Activity Sheet: TASK 7	
Activity	**Assessment, Evaluation and Verification**
Situation	The success of any simulator based training is not only dependent upon the actual successful conducting of the exercise, but also on the proper evaluation at the end of the exercise in order to ascertain whether the training objective has been met.
Action	Using the prepared training evaluation sheet, the participants will carry out peer evaluation based on the performance of the group members during the simulation exercise. Conduct group/peer evaluation using training evaluation sheet. They will thereafter evaluate the appropriateness of the method which they adopted and suggest improvements to the same.
Resources Required	1. Trainee evaluation sheet. 2. Observations sheets, Records, video-playback, data analysis, etc., assimilated during and after the simulation exercise