Didactical manual

Inland Navigation Simulator

Train the trainer

Debriefing for the Facilitator
Feedback for the Assessor

Learning inventory

Effective Learning

Challenges to the learner

Learning with a simulator

- learners experience
- trainers role
- learner centred learning
- facilitation
- objectives, preparation and execution (Taxonomy)

Objective assessment

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Introduction

This didactical manual has been designed for trainers who use simulators as a tool to aid in the learning process. The overall aim of this course is to increase the knowledge and skills of the trainer when using a simulator. This manual is developed to be used in a train the trainer course which makes use of an Inland Navigation Simulator. This course has a number of objectives and attempts to answer a number of questions:

1. What makes a simulator such an effective tool for education and training?
2. Why is it that a student, who successfully completes a course where a simulator has been used, does not possess sufficient knowledge for use in a working environment?
3. What are possibilities and limitations of a simulator?
4. What is the role of the instructor and assessor? What are the best practises?
5. How can we help ensure effective learning occurs?

With this proposal of a didactical manual European standards for evaluation and assessment of training personnel in the field of Inland Waterway Transport with use of Inland Navigation Simulators are created

This course will be competence based with an active learning approach. This means a combination of didactical methods like instruction and presentations, simulator training, self-study and role playing games.

Definitions

To clarify the different concepts in this didactical manual, first some definitions will be stated.

- Candidate trainer
  A participant of the Train the Trainer course
- Trainer
  The trainer of the Train the Trainer course
- Participant
  A learner during the simulator training, e.g. a student
- Assessor
  The person allowed to assess the participant at the end of the simulator training

Entry requirements

The train the trainer course is most effective when the candidate trainers will meet the stated entry requirements

Simulator instructor function

The candidate simulator instructor should be:

- qualified and experienced in the particular types and levels of training and assessment they give, regarding the competence of inland navigation and/or simulator
- qualified and experienced in teaching
- familiar with the applicable simulator

Simulator operator function

The role of the simulator operator is to:

- operate the simulator in a safe and efficient way
- perform the correct operation of each system function
- recognize equipment faults and take appropriate actions

The educational or training institute determines the suitability/competence of the staff due to usual established evidences (e.g. through patents, certificates, work experience, work sample, learning on the job by help of a senior instructor, assessment of necessary content/didactical and teaching know how etc.).

Learning objectives

The learning objectives of the course are described in the Competency table below:

Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence
Develop a simulator module	Proper development of a set of scenario's to be used in a course - Create scenario's based on learning objectives - Test a scenario on a target group - Evaluate the effectiveness of the scenario	Examination and assessment of evidence obtained from a personal portfolio.	The developed scenarios meet the learning objectives of the participants
Execute the simulator lesson	Proper execution of the simulator lesson: - Give an effective briefing in relation with the learning goals - Execute the scenario with a target group - Give an effective debriefing in relation with the learning goals	Examination and assessment of evidence obtained from an independently executed simulator lesson with professionals and/or other participants	The simulator lesson meets all the criteria of an effective simulator lesson
Evaluate and assess the learning outcomes	Proper assessment of the participants based on evaluation criteria	Examination and assessment of evidence obtained from independently executed simulator assessment with professionals and/or other participants	The simulator assessment meets all criteria of a valid assessment

1. Simulation Training

For the effective education and training of Inland Waterway Transport personnel it is important that knowledge skills and attitude are incorporated into the learning programme. With the advancement of technology the industry is witnessing the increasing use of Inland Navigation Simulators. The simulator provides a learning platform where all elements of learning can be integrated into a valuable learning process.

Use of a simulator can with correct assistance produce positive results on a broad spectrum of attitude, skills or cognition. This chapter will explain why simulators have a reputation for being so effective and how we can best use this knowledge to the benefit of both learners and educators to create effective learning.

By the end of this didactical manual you have an appreciation of the challenges presented to the participant when using a simulator. We will discuss some functions and characteristics of simulators in general. Additionally we will introduce the concept of pre-existing knowledge and the effect positive or negative it can have on the learning process. Participants join a course with pre-existing knowledge. They will enter the scene with prior knowledge, skills and concepts which can influence their perception of events and information, this in turn can affect their ability to remember reason, acquire knowledge and even solve problems.

The responsibility upon the trainer is to be aware that different preconditions exist. It is for this reason that one should always have a solid introduction into the upcoming simulation, including familiarization, objectives to be addressed and expectations of the trainer.
In this manual attention is drawn to seeing the participant as the subject and the simulator as a tool to aid in the transfer of knowledge, skill or attitude. Correct use of a simulator can aid greatly in the learning process. The following are some general points concerning simulator functions[1], - characteristic and challenges for the participant.

[1] See Platina II reports / HINT project results Danube Navigation simulator requirements and concept

Simulators fulfil for example the following functions:

- to present information as realistically as possible whilst being able to store, process and display information
- to enhance the learning moment
- to allow the learner to practice
- to give the learner the ability to show whether the learner is competent to display the needed attitude, skills and knowledge.

Simulators have several characteristics:

- data storage and processing ability
- provide synthetic controls
- support learning at the intellectual and psychomotor level whether the objectives are knowledge, skills or attitude.
- display information in response to inputs either by learner or instructor
- to represent a dynamic response as close as possible to realistic situations
- the instructor must be able to control the system
- be able to be used for groups or individuals

During the simulator run some examples of the challenges for the participants are:

- spatial awareness
- ability to match outside view with traffic situation
- ability to interpret true wind and current.
- ability to multi-task (listen to radio conversation while manoeuvring)
- ability to prioritize
- ability to understand the concept of relative motion
- ability to act in a pro-active way

2. Basic Simulator design and Types 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 simulators to demonstrate certain competence is 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

These 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.

Since a variety of simulators exist, a distinction can be made by classification of simulators, such as full-mission or part-task, or by creating a hierarchy within the different subject areas.

Critical components

The components of a simulator will fall under the following categories:

1. Physical Realism (equipment layout, Controls, etc.)
2. Behavioral Realism (mathematical model for different processes and systems)
3. Operational Environment (visual scene including objects, degree of view)
4. Monitoring and Evaluation

The layout of a simulator will have essential areas, for example Server station, Trainee station and Instructor station.

Server Station:

- Visual Scene Generator. Generating the terrains, vessels, objects and environment elements
- Mathematic modeler. Calculating the characteristics and manipulations of the vessel, objects, current, tides, wind, interactions and environment effects
- …

Trainee station

- Camera
- Speakers
- Indicators Panel
- Navigation Equipment
- Steering Control
- Thruster Controls
- Visual Systems (Projectors or Plasma)
- Lights and shapes Panel
- …

Instructor Station:

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

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

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

3. The Scope of Simulation Training in Inland Navigation

Simulators are a suitable 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.

Each Educational and Training Institute using a simulator for inland navigation, has to ensure that a simulator used under certain conditions shall at least fulfil the following minimum performance requirements:

- suitable for the training and/or examination tasks
- physical realism appropriate to training and/or examination objectives, included the capabilities, limitations and possible errors of such equipment
- sufficient behavioural realism
- capable of producing a variety of conditions (operating environment)
- the trainee should be able to interact
- the trainer should be able to develop/control/monitor/record exercises

The standards of competence as laid down in the Platina Competence Table with respect to navigation are grouped appropriately under the following three functions:

- Navigation
- Controlling the operation of the ship and care for persons on board
- Communication

The Platina Competence Table also specifies the following levels of responsibility:

- Operational level and
- Management level

Functions and levels of responsibility are identified in the Platina Competence Table as well as in other rules, guidelines or standards like e. g. the Regulations for Inspection of vessels and related national legislation or national and international Radio Regulations.

Now we discuss the simulators under the following three important headings:

- Training and examination.
- Use of simulator
- Minimum standards of competencies.

Training and examination/assessment

All parties that are involved in Inland Navigation simulator based training and examination have to accept some basic rules outlined briefly in this document. Moreover all trainers must appropriately qualified and competent to carry out their task.

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 or similar type of simulator being used for the training. A Trainer who works as an instructor has to provide situations for the trainees in which hand-on experience can be gained.

Is the trainer in the role of a teacher, he has to provide a learning environment in which knowledge and competencies of the students can be gained. Also he has to enable students to transfer their knowledge to real-life-situations and to solve problems based on the gained knowledge.

Moreover, when examination or assessment is being done by using simulators, the examiner/assessor should have gained practical examination/assessment experience on board of an inland vessel or on a particular type of simulator. He should know the specific differences between training in reality and training in the simulator.

Training and examination shall be:

- structured in accordance with written programmes, including such methods and media of delivery, procedures, and course material (see CMINET) as are necessary to achieve the prescribed standard of competence (see PCT) and
- conducted, monitored, evaluated and supported by qualified persons.

Qualifications of instructors and assessors

It is to ensure that instructors, teachers, examiners/assessors as well operators are appropriately qualified and experienced in the particular types and levels of training or examination/assessment they give regarding to the competence of inland navigation and as well teaching techniques.

Any person conducting Inland Navigation Simulator training which is intended to be used in qualifying for a patent or a certification (e. g. by a Chamber of Industry and Commerce) shall

- have a full understanding of the training programme and an understanding of the specific training objectives for the particular type of training being conducted.
- be qualified in the task for which training is being conducted.
- have received appropriate guidance in instructional techniques involving the use of simulators.
- have gained practical operational experience on the type of simulator being used.

Any person conducting examination/assessment as part of Inland Navigation Simulator training which is intended to be used in qualifying for a patent or a certification (e. g. by a Chamber of Industry and Commerce) shall

- have an appropriate level of knowledge and understanding of the competence to be examinated/assessed.
- be qualified in the task for which the examination/assessment is being made.
- have received appropriate guidance in examination/assessment methods and practice.
- have gained practical examination/assessment experience on the particular type of simulator under the supervision and to the satisfaction of an experienced examiner/assessor.

Any person responsible for the supervision of training of a boatman intended to be used in qualifying for a patent or a certification should have appropriate knowledge of instructional techniques and of training methods and practice. In Addition the person should have a full understanding of the examination/assessment system, assessment methods and practice.

The provider of a course is responsible for the compliance of content, organization and implementation of a course as well as for the qualification of the staff. He determines the suitability and competence of the staff due to usual established evidences (e.g. through state examination, patents, certificates, ...).

The content of training courses or examinations shall lay down in written manuals. Here are the requirements and recommendations of EDINNA (see e. g. the project CMINET) taken into account.

The Use of Simulators for Inland Navigation

Up to now there is no regulation that gives a legal cover to the performance standards of simulators for inland navigation being used for the training and examination of boatmen and their certification in compliance with e. g. the Regulations for Inspection of vessels and other related national legislation or national and international regulations. However, these are currently being developed by PLATINA involving all relevant professionals. As soon as these are published, these regulations will be considered as a basis for the discussion in this document. Up to this time, a simulator should perform all functions necessary for the execution of a training task or examination task as realistic as technically and economically feasible. This means that the features of the simulator should comply with the applicable equipment regulations. In addition is desirable that the simulated vessel behavior closely corresponds to reality.

Approved simulators must meet specified performance standards and other provisions, so that they may be used for training and examination. Such simulators should be approved by the competent authorities.

3.2.1 Standards covering the Use of Simulators

The PLATINA standards under construction 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 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.

Simulator based training should meet general performance standards. The simulator 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
- permit an instructor to control, monitor and record exercises for the effective debriefing of trainees.

Any simulator used for the examination/assessment of competence or for any demonstration of continued proficiency so required, shall

- be capable of satisfying the specified examination/assessment objectives.
- be capable of simulating the operational capabilities of the shipboard equipment concerned to a level of physical realism appropriate to the examination/assessment objectives, and include the capabilities, limitations and possible errors of such equipment.
- have sufficient behavioural realism to allow a examinee/candidate to exhibit the skills appropriate to the examination/assessment objectives
- provide an interface through which a examinee/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 examiner/assessor to control, monitor and record exercises for the effective examination/assessment of the performance of candidates.

Additional performance standards are also necessary. In addition to the requirements which have been set forth above special simulation equipment (for example: Radar Simulation) shall meet the performance standards given in accordance with their specific type.

Example: Radar simulation

Radar simulation equipment shall be capable of simulating the operational capabilities of navigational radar equipment which meets all applicable performance standards and incorporate facilities to:

- operate in relative motion head-up mode (inland navigation)
- model weather, tidal streams, current, shadow sectors, spurious echoes and other propagation effects, and generate shorelines, and navigational buoys; and

- create a real-time operating environment incorporating at least two own ship stations with ability to change own ship's course and speed, and include parameters for target ships and appropriate communication facilities.

In addition, other provisions are also necessary, in which the training and examination/assessment process for the simulator trainers and examiners are determined to have a standard conduct of the simulator training. Briefing, planning, familiarization, monitoring, and debriefing should 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.

Training procedures

All parties involved should ensure that the aims and objectives of simulator-based training are defined within an overall training programme and that specific training objectives and tasks are selected so as to relate as closely as possible to shipboard tasks and practices.

In conducting simulator-based training, trainers shall ensure that:

- trainees are adequately briefed beforehand on the exercise objectives and tasks and are given sufficient planning time before the exercise starts.
- trainees have adequate familiarization time on the simulator and with its equipment before any training or assessment exercise commences.
- guidance given and exercise stimuli are appropriate to the selected exercise objectives and tasks and to the level of trainee experience.
- exercises are effectively monitored, supported as appropriate by audio and visual observation of trainee activity and pre and post exercise evaluation reports.
- trainees are effectively debriefed to ensure that training objectives have been met and that operational skills demonstrated are of an acceptable standard.
- the use of peer assessment during debriefing is encouraged; and
- simulator exercises are designed and tested so as to ensure their suitability for the specified training objectives.

Examination/Assessment procedures

Where simulators are used to examine/assess the ability of candidates to demonstrate levels of competency, examiners/assessors shall ensure that

- performance criteria are identified clearly and explicitly and are valid and available to the candidates.
- examination/assessment criteria are established clearly and are explicit to ensure reliability and uniformity of examination/assessment and to optimise objective measurement and evaluation, so that subjective judgements are kept to the minimum.
- candidates are briefed clearly on the tasks and/or skills to be examined/assessed and on the tasks and performance criteria by which their competency will be determined.
- examination/assessment of performance takes into account normal operating procedures and any behavioural interaction with other candidates on the simulator or simulator staff.
- scoring or grading methods to examine/assess performance are used with caution until they have been validated; and
- the prime criterion is that a candidate demonstrates the ability to carry out a task safely and effectively to the satisfaction of the examiner/assessor.

3.2.2 Guidance regarding Use of Simulators

Existing course manuals are a good basis to develop detailed guidelines how to use simulators for training and examination/assessment purposes in inland navigation can be helpful.

All parties involved should use such common guidelines that describe the training and examination/assessment aspects for a special training (e. g. Radar operation and observation) in detail.

Different types of training can therefore be easily provided, for example:

- Team training
- Operator training
- Decision training
- Procedure training
- Maintenance training
- Trouble shooting
- Operation in suboptimal conditions
- Emergency response

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.

- Training in suboptimal conditions

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. Table 1 illustrates the simulators application for the main function in inland navigation.

Table 1. Simulator Application for the function "Navigation/Control position Operations"

No.	Simulator Application	Function: Navigation/Control Position Operations
1	Equipment Familiarization	Inland ECDIS/RADAR/Steering
2	Equipment Operation	All Navigational aids
3	Equipment Integration	Navigational aids/Steering/Main Engine (ME)
4	Systems Familiarization	Collision Avoidance
5	Basic Procedural Training	Operations (Ops: BERTHING, ANCHORING, MOORING OPERATIONS)/ Management (Mgmt)/Value add
6	Basic Routine Regular Operations	Steering (S)/Handling/ Bridge Team Management (BTM)/ Bridge Ressourcen Management (BRM)/Vessel Traffic Service (VTS)
7	Routine Operations with faults injection	Navigation Equipment failure/Machinery failure
8	Trouble shooting and Problem solving	RADAR fail
9	Complex regular operations involving multitasking	Traffic Separation Scheme (TSS)/ Arriving/Departure Ports
10	Non regular operations	Ice Navigation
11	Crisis management/ Emergency situations	Collision/Grounding
12	Specialized operations/area/ machinery	Ship to ship(STS: bilge oil boats, water police)/
13	Case Studies/Incident recreation	Ice/Pilotage
14	Feasibility Studies	Port design/bridge design/river design

Apart from the above stated simulated systems can be used for Inland Navigation Simulator training of:

- Ship handling and manoeuvring
- Navigation

- Radio communications
- Main and auxiliary machinery operation

Here it is important to note that all simulators that are used for training and examinations must be described in detail.

In inland navigation so called Full Mission Ship Handling Simulators are desirable, their performance requirements must at least meet the requirements for inland waterway vessels. Compared to a simulator only for radar operating these simulators are very complex 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.

EDINNA mentions the simulators as one of the means to prove competencies. Therefore the competencies are listed in the Platina Competence Tables (PCT) required to different 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.

In addition to Performance Standards, Training Procedures (briefing, familiarization, exercise stimuli, monitoring, debriefing, peer assessment) and Examination/ Assessment Procedures (performance criteria, assessment criteria, briefing, grading methodology) must be defined to be adopted on simulators.

3.2.3 Standards for Simulator Based Training

It is required that simulators, when used as a means to demonstrate competence (examination) according to government regulations (patents, certificates, …), shall be approved by the relevant competent authority.

The purpose of such a standard, as mentioned before, 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 examination/assessment objectives.

The main target group for such a standard is

- a provider of a simulator, which uses a simulator for examination.
- a provider of a simulator, which uses a simulator for mandatory simulator training.

The desirable standard gives criteria for the simulated functions, the equipment and the environment, considered necessary for specified tasks in maritime operations. The standard should 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 examination/assessment in a training programme) in a quality standard system. In such quality standard system the instructor and examiner/assessor qualifications shall be addressed and the course curriculum shall be approved by the provider of the simulator.

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

As mentioned Full Mission Ship Handling Simulators are the highest grade scale for levels of performance capabilities of inland navigation simulators. It is a simulator with the objective to create realistic situations for Control Position Operations (Bridge Operations). Table 2 shows for example the competence requirements that can be trained and examined/assessed.

In addition, there are other Control Position Operation simulators that are not able to simulate all necessary tasks, but only a number of individual tasks or one specific task.

Table 2. Competences for Control Position Operations on inland navigation vessels

No.	Competence
1	Plan and conduct a passage and determine position
2	Maintain a safe navigational watch
3	Use of RADAR to maintain safety of navigation

4	Respond to emergencies
5	Respond to a distress signal at the river
6	Manoeuvre the ship
7	Plan a voyage and conduct navigation
8	Determine position and the accuracy of resultant position fix by any Means
9	Determine and allow for compass errors or GPS errors
10	Establish watchkeeping arrangements and procedures
11	Maintain safe navigation through the use of RADAR and other modern navigation systems (GPS/ECDIS) to assist command decision-making
12	Manoeuvre and handle a ship in all conditions
13	Operate remote controls of propulsion plant and engineering systems and services

4. The Simulator Trainer

Today simulators are widely recognized and accepted by the educational world to be an effective training tool. Simulators offer promising opportunities 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 training results achieved are only as effective as how the trainer uses it. The simulator can largely allure trainees 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 trainees 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 trainees is far less recognized but nevertheless a determining factor for the overall performance of the trainees on simulators. It is seen naturally without noticing that trainers who have high expectations from the trainees 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 much more roles.

Role of the Trainer

Simulator based training is placing trainers in new roles, which can be exciting as well as frustrating. Understanding the reasons for this change is as important as the instruction itself and may help clarify the trainers' roles. The goal of using simulation technology is to allow trainers to facilitate learning using new techniques and simulated nautical situations. These techniques require trainees to participate in hands-on, real-time problem solving. Trainers utilize simulation for recurring instructions and processes which allow for trainees practice and for feedback from the trainer.

The trainers' objective is to

- facilitate the education and training of the trainees
- educate with an emphasis on conceptual knowledge, basic skills and an introduction to the actual work.
- train with an emphasis on the actual tasks and the work to be performed in an authentic setting.
- examine/assess performance and competency of both individual learners and teams

Therefore, the work of a trainer includes

- knowing more and more about trainees learning styles.
- training trainers how to train.
- establishing strategic directions for the organization.
- facilitating process improvement
- constantly being in touch with trainees and work processes and be aware of their skill needs.
- knowing information technology and explore the use of electronic training opportunities
- development training programs.
- facilitate problem-solving
- help trainees to think over their jobs

From the goals that must follow a trainer, and the other aspects, which he must meet, various roles of a trainer can be specified:

- **Assessor**

  As Assessor develops and leads the trainer through a process to assess the success of the learning process by the trainees or for example, to obtain information on the organization and implementation of a course. Assessments are internal processes in which the trainee is judged without the involvement of Examiners.

- **Examiner**

  This is the role of a trainer, who evaluates knowledge, reactions, or qualifications of students or candidates/examinee e. g. by questions or assigning tasks. He implements exams at school, in colleges or universities in order of an official institution (e. g. Chamber of Industry and Commerce), so the trainees can get an certificate.

- **Evaluator**

  The evaluator is setting criteria and assessing performance but helping in reinforcing desirable learning, providing encouragement, providing a yardstick to measure goals. Evaluation is the process in which learning is evaluated by, for example, the student/apprentice himself or herself.

- **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 trainees.

- **Guide**

  The trainer 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.

- **Instructor**

  The instructor instructs usually apprentices and provides situations in which hands-on experience can be gained. The term is often used synonymous to "teacher", but the main teaching aims and methods are often quite different.

- **Learning strategist/organizer**

  Sequencing the information for facilitating learning.

- **Manager**

  The trainer should not merely repeat the same exercise but also manipulate materials and activities to arouse interest and make it more direct and relevant for the trainees.

- **Motivator**

  Providing for Individual Differences, giving positive and constructive feedback.

- **Operator**

  This is a person in simulators, who operates the simulation system. Normally a trainer does not operate a simulator, but occasionally this can occur in personal union with other roles.

- **Psychologist**

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

- **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,… So the teacher provides a learning environment in which knowledge and competencies can be gained and he enables students to transfer their knowledge to real-life-situations and to solve problems based on the gained knowledge. This role requires to appraise the methods, techniques, resources to meet multiple learning styles and match and direct it to the common goals of a course.

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. In performing the activities of mentioned trainer roles the trainer has to consider four basic factors namely:

- Subject matter expertise

  An trainer needs to possess the technical knowledge of the simulation system which is referred to as Job Knowledge. Apart from this the trainer needs to possess a broad knowledge of the organization, the general rules, regulations and policies. Job skills which include the ability to operate various equipments and tools where relevant, should also be present in a trainer. The ability to select between variety of instructional methods or skills to guide trainees and counsel them is also important.

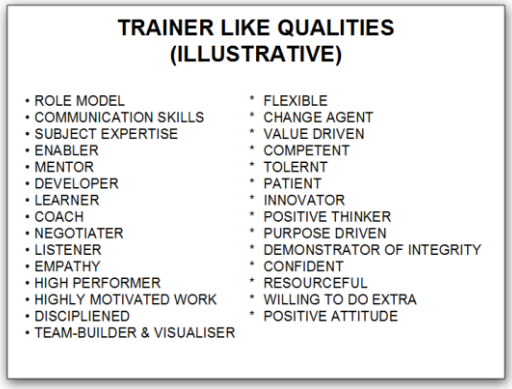
- Educational and andragogical knowledge and skills

  This includes some formal qualification coupled with an understanding of the principles of learning and motivation.
- Communication skills

  A good communicator (both in oral and written) is an asset to any trainer. Questioning, explaining, listening, illustrating and preparing training material demand very high communication skills.
- Personal traits and qualities

  This include e. g. Listening, Negotiating, Coaching, Facilitating small group interaction, Strategic planning, Problem solving, and …

Figure show trainer like and unlike qualities in brief.



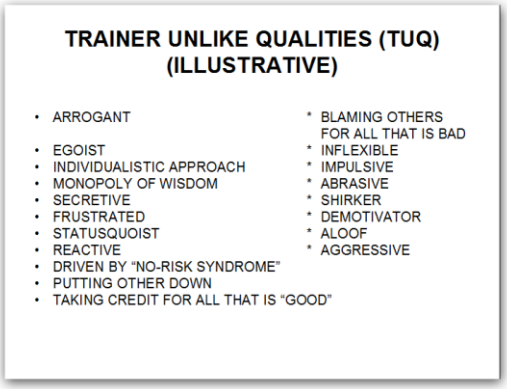


Figure 1. Trainer Like Qualities[2]

Figure 2. Trainer Unlike Qualities2

Below some specific situations are described that offered advice what behaviors are expected of a good trainer.

4.2.1 General Attitude Towards Training

Although a trainer is not expected to have all the answers to the questions which are put to him/her, she/he does lose credibility if she/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.

[2] Source.

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 Technical/Subject-related Knowledge

Ideally the trainer has the same qualifications or competences as the participants he is supposed to train. Not only it will add to his confidence, but will also prove essential to get the message across properly.

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 apprentice 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.

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.

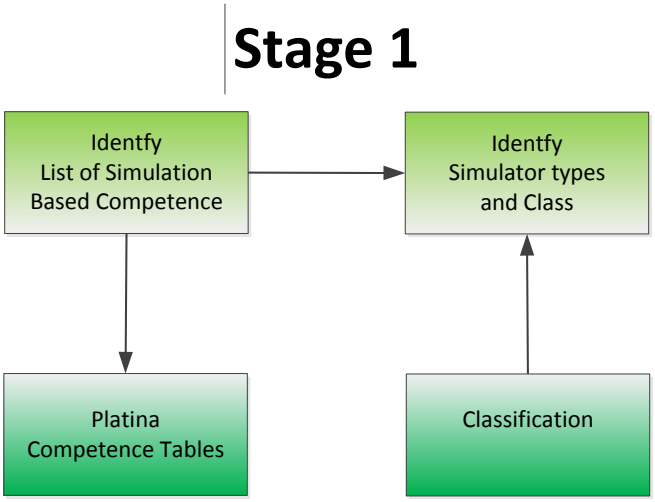
The simulators are an expensive resource in terms of value and time. Keeping this in mind the simulator manufacturers have designed simulators that can be used for different levels from support to operation and management level. Moreover there are different simulators available for training in single 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.

- identifying learning objectives possible to be achieved using simulators and then
- detailing the simulator programme.

5.1 Simulator Based Learning Objectives

The Platina 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.



ML 1. Navigation

The boatmaster chooses the most logical and economical sailing route to reach the loading and unloading destinations taking into account most efficient sailing time schedule according to actual circumstances.

1.2 The boatmaster sails and manoeuvres ensuring safe operation of the vessel in all conditions on inland and maritime waterways. He is able to:

Column 1	**Column 2**	**Column 3**	**Column 4**
COMPETENCE	**KNOWLEDGE, UNDERSTANDING AND PROFICIENCY**	**METHODS FOR DEMONSTRATING COMPETENCE**	**CRITERIA FOR EVALUATING COMPETENCE**
5. Use modern electronic navigational aids, with specific knowledge of their operating principles, limitations, sources of error, detection of misrepresentation of information and methods of	1.Knowledge of and ability to use nautical sensors and indicators providing navigation information. (D)GPS, position, heading, course, speed, distance, depth. Inland ECDIS, radar, compass, turn indicator, etc 2.Knowledge of and ability to use River Information Services (RIS) and technologies.	Assessment of evidence obtained from one or more of the following: • approved in-service experience • approved training ship experience • approved simulator Training, where appropriate • approved laboratory equipment training	Setting and Operating the navigation aids conforms with accepted principles and procedures and to manufacturers' recommendations The frequency and extent monitoring of navigation equipment and systems conforms to manufacturers' recommendations and accepted principles and procedures

correction	Inland AIS, -ECDIS, Electronic Reporting and Notices to Skipper, FIS (Fairway Information Services), TI (Traffic Information services), TM (Traffic Management services), CAS (Calamity Abatement Services), ITL (Information for Transport Logistics), ILE (Information for Law Enforcement), ST (Statistics), WCHD (Waterway Charges and Harbour Dues)	Knowledge tests about technical details, operating principles, limitations, sources of error	Errors are detected and their negative effects prevented by appropriate decisions and actions.

An Example:

Function: Wheelhouse operation – Navigation at the Management Level

Competences addressed by wheelhouse operation simulator for navigation at the management level

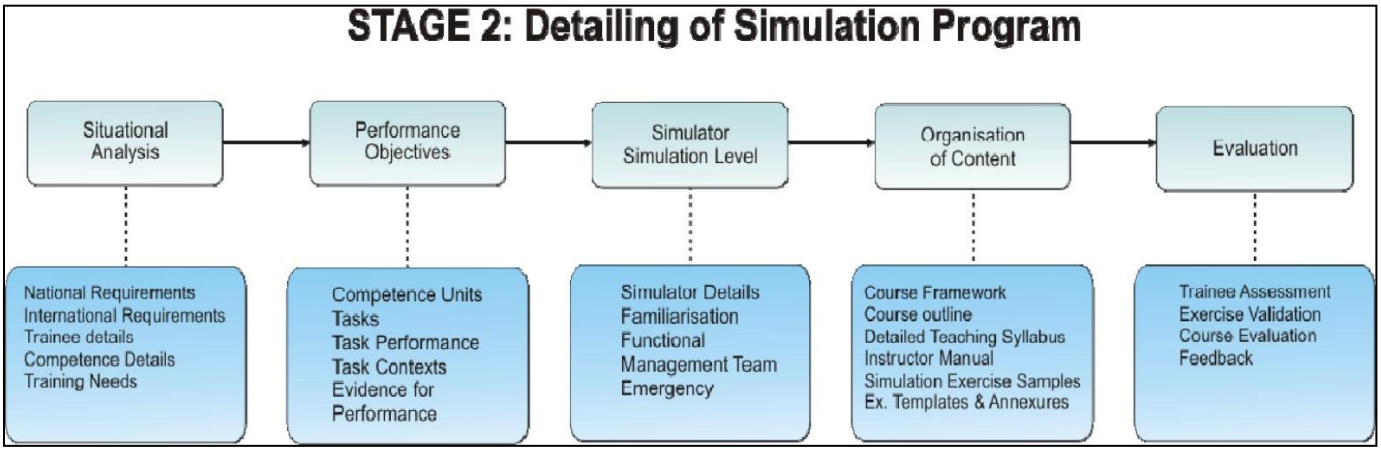
Competence	*Class A*	*Class B*	*Class C*
Plan and conduct a passage and determine position	A	B	
Manoeuvre the ship	A	B	C
Use external communication systems	A	B	
Use of RADAR to maintain safety of navigation	A	B	C
Operate Inland-ECDIS and use different information for navigation	A	B	C

5.2. Detailing the Simulator Programme

One can now refer to EDINNA course manuals 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.



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 situational analysis is possible to be developed for the different units of competence for each function across different levels and category. The Platina Competence tables and EDINNA course manuals 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	
Number of Trainees per course	
Number of Trainees per Simulator	
Qualification	
Experience	
Prior Relevant courses	

Competence	EXAMPLE
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 Example: Model Course "Navigation on Inland Waterways"

The boatmaster sails and manoeuvres ensuring safe operation of the vessel in all conditions on inland waterways.

5.5.1 Competence Tasks

Function & Level	**Navigation at the management level**
Unit of Competence	Navigate and manoeuvre using modern electronic navigational aids
Competence Tasks	
1.	Inspect the modern electronic navigational aids, set and adjust turn indicator, RADAR, GPS, Inland AIS, ECDIS before taking over the navigation of the vessel.
2.	Take over the navigation of the vessel.
3.	Use information generated by help of modern electronic navigational devices for manoevring the vessel.
4.	Respond to changes in environmental conditions.
5.	Information exchanges (Inland AIS / VHF radio) and consider for navigation.
6.	The frequency and extent of monitoring of navigational equipment and aids conforms to manufacturers' recommendations and accepted principles and procedures, including Principles to be observed in navigational procedures.

5.5.2 Task Performance Objectives

Function & Level	**Navigation at the management level**
Unit of Competence Competence Task- 1	Navigate and manoeuvre using modern electronic navigational Inspect, Setting and adjust turn indicator, RADAR, GPS, Inland AIS, ECDIS
Supporting knowledge/ pre	Understanding of aboved mentioned systems
Performance Condition and context	Aboard vessel, shift changeover, having a inland navigation tankvessel (Loa = 110 m, B = 11,40 m), gasoil loaded, machinery of 750 kW, low Fog at port of Rotterdam, wants to go to
Performance Criteria	1. Switch on modern electronic navigational devices or determine status or condition of turn indicator, RADAR, GPS, Inland AIS, ECDIS, control systems, indicating panels and communication systems. 2. Basic setting of the RADAR and ECDIS (modus) according to the ambient conditions and the manufacturer's instructions. 3. Adjustment of range, measuring range of turn indicator and rudder angle and different filters (FTC, STC, …) between RADAR and ECDIS. 4. Enter travel-related data in the Inland AIS. 5. Check relevant information output of the modern electronic navigatinal aid and take them under consideration for the following manoevres.
Attitude	Inspect, set and adjust modern electronic navigational aids before using the devices for navigation

Evaluation Criteria for Performance	1. Correctly determine status or condition of turn indicator, RADAR, GPS, Inland AIS, ECDIS, control systems, indicating panels and communication systems. 2. Correct basic settings and adjustment of RADAR and ECDIS (modus) according to the ambient conditions and the manufacturer's instructions. 3. Complete and correct entry of the travel-related data into Inland AIS. 4. Check and Report relevant information output of the modern electronic navigatinal aid.

Function & Level	**Navigation at the management level**
Evidence	1. Status or condition of turn indicator, RADAR, GPS, Inland AIS, ECDIS, control systems, indicating panels and communication systems checked. 2. Basic settings and adjustment of RADAR and ECDIS (modus) according to the ambient conditions and the manufacturer's instructions (Checklist) are correct. 3. Travel-related data are complete and accurate input to the AIS. 4. All modern electronic navigation devices are running properly.

5.6 Setting the level of Simulation

The simulation training shall be 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 emergency situations, etc.

A 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 port will require that even subtasks are broken into elements. The tasks may be categorized as follows for setting up the level of simulation (see also Platina Competence Tables):

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:** 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:** 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 non-controllable situation.

In addition to the above categories 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 no wind to stormy wind, no current to high current, low water level to high water level, normal to heavy load conditions, etc.

Setting Level of Simulation						
Function & Level		**Navigation at the management level**				
Unit of Competence		Navigate and manoeuvre using modern electronic navigational aids				
No.	Competence Tasks	Level of Simulation				
		Familiarization & Operational	Functional	Management	Communication	Crisis & Emergency
1	Inspect the modern electronic navigational aids, set and adjust turn indicator, RADAR, GPS, Inland AIS, ECDIS before taking over the navigation of the vessel	☑	☑	☑		☑
2	Take over the navigation of the vessel	☑	☑	☑	☑	
3	Use information generated by help of modern electronic navigational devices	☑	☑	☑	☑	☑
4	Respond to changes in environmental conditions.	☑	☑	☑	☑	☑
5	Information exchanges (Inland AIS / VHF radio) and consider for navigation.	☑	☑	☑		

6	The frequency and extent of monitoring of navigational equipment and aids conforms to manufacturers' recommendations and accepted principles and procedures, including principles to be observed in navigational procedures.	☑	☑	☑	☑	

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 for inland navigation simulators are under construction. An example of brief specifications for a Full Mission Ship Handling Simulator is given below:

The simulator wheelhouse shall be equipped with the equipment and devices for monitoring and control of a real ship engine and steering system, as well of the necessary modern electronic navigational devices to simulate the real operation environment on board. The subsystems shall be possible to be operated by buttons and switches, PC-Keyborard/mouse or touchscreens on the local control panels in the simulated wheelhouse. The simulation models in real time mode shall be able to display various parameters at the monitors or control panels as well as the radar picture, Inland ECDIS, AIS-data and so on, similar to a real wheelhouse. The interfaces between the systems and interdependency shall be simulated. The simulator shall be able to simulate the sound of environment. So all activities, that are normal on board to use modern electronic navigational aid, should be possible on the simulator (see also chapter 3.2.2). The following list is a compilation of the most important activities for navigate and manoeuvre using modern electronic navigational aids

1. Safe navigating and manoeuvring should be possible in the wheelhouse 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 watched and if necessary recorded. It should be possible to view these at the instructor station.
4. Trainees should be able to check GPS data
5. It should be possible to change GPS accuracy, to simulate RADAR errors, radio communication failures etc.
6. Trainees should be able to enter and retrieve relevant data/information of the inland AIS

7. The instructor should be able to send text messages via AIS and to manipulate AIS data of traffic vessels

8. VHF Communication ship-ship and ship-shore must be possible
9. RADAR and Inland ECDIS has to work
10. RADAR overlay and Inland ECDIS must show the same area (also the sight system)
11. If the instructor changes the weather conditions, it must be possible to change the radar settings
12. It should be possible to operate the engine and the rudder in different modes
13 The main parameters of vessel manoevres (speed, rudder angle, rpm mainengine, turning rate etc.) must be displayed.

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 EDINNA/PLATINA 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. 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 vessels. 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 Navigation of an inland navigation vessel
Function	Navigation at the management level
Competence Unit	Navigate and manoeuvre using modern electronic navigational aids
Task / Objective	Inspect the modern electronic navigational aids, set and adjust turn indicator, RADAR, GPS, Inland AIS, ECDIS before taking over the navigation of the vessel
Scenario	At port … of Rotterdam
Context	Normal routine navigating and manoeuvring, changing to bad weather conditions (fog, rain) and failures in the electronic navigational devices
Initial condition	All Parameters normal, light fog
Duration	One and half hour

Sample Instructor Worksheet	
Briefing	Make sure that the trainee is able to : - Ensure that the persons in the wheelhouse are apparently fully capable of performing their duties effectively - Understand the navigational aid and are able to operate and adjust the navigation devices including: · the nature of all work being performed on machinery and systems, the personnel involved and potential hazards · the condition of each device of the navigational aid · the condition of monitoring and operation console equipment and which equipment that is manually operated - Initiate relevant communication via VHF radio or Inland-AIS and Inland-ECDIS - Understand the charts and other information given by radar and other navigational devices - Understand effects on navigational devices and systems of potentially adverse conditions resulting from bad weather, bad GPS data, errors and failures. - Understand the motion of the vessel as a result of engine power and rudder effects under consideration of wind and current.
Action	Start the simulation and let the student - take a round view in the wheelhouse - switches on modern electronic navigational devices or determine status or condition of turn indicator, RADAR, GPS, Inland-AIS, Inland-ECDIS, control systems, indicating panels and communication systems. - Makes the basic settings of the RADAR and Inland-ECDIS (modus) according to the ambient conditions and the manufacturer's instructions. - Adjusts range, measuring range of turn indicator and rudder angle and different filters (FTC, STC, …) between RADAR and Inland-ECDIS. - enters travel-related data in the Inland AIS. - checks relevant information output of the modern electronic navigational aid and take them under consideration for the following manoeuvres - perform the maneuver For the second trainee: Call the trainee and inform him that the weather is going to worsen with increasing to heavy fog.
Debrief	After the exercise has been carried out the handling procedures for setting, adjustment and data entry as well as the information ouput of the navigation devices and the resulting manoeuvre 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	
Switches on all electronic navigational devices		
Makes the basic settings to all electronic navigational devices		
Inspects all electronic navigational devices, noting conditions and any deviation from normal		
Observation (Observes, notes and, where necessary, checks)	0-8	
GPS data		
Information of the Radar chart		
Information of the ECDIS Chart		
Inland AIS data of traffic vessels		
Reports	0-10	
Evaluates relevant information output of the modern electronic navigational aid, take them under consideration for the following manoeuvres and report the resulting manoevres directly to traffic vessels and VTS by VHF radio or AIS.		
Records	0-10	
If satisfied with basic settings and the adjustment of the equipment, **accepts responsibility,** takes over navigation of the vessel and starts manoevring	8	
Total Marks	**100**	
Remarks and Observations of examiner:		

5.12 Course Feedback Form

Course Feedback Form	**Score Count**					
Session/Topic Question	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.						
SIMULATION						
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						
The Instructors were knowledgeable.						
The quality of instruction was good.						
The presentations were interesting and practical.						
The instructors met the training objectives.						
Good training aids and audio-visual aids were used.						
Class participation and interaction were encouraged.						
Adequate time was provided for attendee questions.						
B. Staff were interested and addressed attendee's concerns.						

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

1.13 Sample Instructor Worksheets:

Objective: Familiarization with simulator and WheelhouseEQ	**Duration:** 3 Hours	**Issued by:**	**ID:**
Exercise Area: River rhine Km 765-795	**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: 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 wheelhouse equipment and virtual environment ➢ Try out hand steering and familiarize with different steering modes ➢ Try out main engine and thrusters ➢ Become familiar with all wheelhouse equipments ➢ Become familiar with virtual world ➢ Tick off familiarization checklist ➢ If any doubts should be clarified with open-minded behaviour

Performance Criteria
➢ familiarization with wheelhouse 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 : river rhine	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: 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 stop in loaded condition
- Repeat above manoeuvre in ballast condition
- Record time, position,heading and other relevant data
- Describe how trim affects the pivot point during turns

PERFORMANCE CRITERIA

- Plot the manoeuvre from recorded data
- Compare loaded and ballast conditions
- Remember needed time and space of manoeuvres
- Information in the manoeuvring information booklet can be used when planning a manoeuvre
- 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 (name)**

START INFORMATION	
Location: river rhine, , Krefeld, downstream	Date: DD/MM/YYYY Time: Day

OWN SHIP		
Type: ChemTanker 110 m * 11,40 Draft: 2,80 m	Starting position: km 770,0 Heading:	Speed: 20.0 km/h full ahead
TARGET SHIPS		
12 ships of different types on pre-determined routes along the passage both directions		

WIND	CURRENT	SEA STATE
Wind Direction: S Wind Speed: Force 4	Current Direction: follows river Current Speed: 6,4 km/h	Sea State: 0,5 m 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 the rule for sailing by radar

THE TASK
• Make out a passage plan on paper • 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 revailing conditions • Acquire targets • Choose the appropriate range • Carry out Trial Manoeuvre to assess for action • Take appropriate actions for collision avoidance

INSTRUCTOR NOTES

- Brief the trainee about the exercise.
- Discuss rules in detail and briefly refresh other rules applicable to the situation.
- Select trainee 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 range
- Correct sequence and selection of targets
- Correct application of rules
- Optimum tuning of radar for changing weather conditions
    - Correct reporting and communications - – Internal information and reporting within the ship and external with AIS targets, traffic vessels,VTS, etc.

6. Effective Interpersonal and Communication Skills

6.1 Introduction

Effective instruction is very much a matter of effective communication. Even if you are very knowledgeable about inland navigation, instructing it to others can be very difficult if you are unable to effectively communicate. Effective instruction can only take place in a situation in which the student and the instructor feel safe. Effective instruction depends on mutual respect and mutual expectance. This chapter provide information about these topics.

6.2 Definition

When providing instruction to students good communication is very important. But what is “communication”? According to Wikipedia “communication” (from Latin *commūnicāre*, meaning "to share") is the activity of conveying information through the exchange of ideas, feelings, intentions, attitudes, expectations, perceptions or commands, as by speech, gestures, writings, behavior and possibly by other means such as electromagnetic, chemical or physical phenomena. It is the meaningful exchange of information between two or more participants (machines, organisms or their parts).

6.3 Behavioral guidance to effective communication

Literature provide guidance on effective communication. Instructors should:

- speak clearly and understandably;
- make sure that there is two way communication;
- present in a logical sequence;
- emphasize important information;
- monitor his/her’s audibility: aim to vary volume so it aids the content of the message;
- use pace of speech to suit the meaning of the message;
- find the right pitch given the circumstances: to high may seem to nervous, to low boring;
- attempt to pronounce words correctly;
- use pauses to allow students to think about what is said and to allow note-taking;
- use energy and enthusiasm;
- maintain eye contact with students;
- use gestures and movement;
- show confidence;
- use positive motivation;
- use humor;
- be empathic as to communicate care and concern to students;

- use questions.
- listen to trainees.

The afore mentioned clearly show the link between “instruction” and “communication”: instructors are constantly providing information to students using all kind of channels and methods. The aim of providing information is to facilitate the student in learning.

6.4 Communication process

As follows from the definition communication is a process. The core components of which are the sender, the receiver, the message, the channel and the feedback. The communication process entails coding (formulas), sending (both by sender) and decoding (by the receiver). By receiving feedback, the sender can check whether the message was received, understood and accepted. Prudence is called for when formulating (the sender). But also when decoding (interpreting by the receiver).

Figure 1. provides an overview of the communication process as it can take place in the instruction situation.

Instructor (sender)	**Message**	**Student (receiver)**
Thinks of a message	Verbal	Senses (hears/sees/feels)
Puts message into words	Non-verbal	Gives attention
Expresses the message	**Channel**	Receives information (message)
	Person to person	Gives feedback to instructor
	Internet (mobile phone, tablet, PC	
	Simulator	
	Written media	

Figure 1. Communication process

Each part of the process has its unique features.

- For the sender and receiver: culture, gender, knowledge, skills, training, profession, mood, interest, values and norms.
- For coding and decoding: a shared 'language' e.g., a national language such as Dutch, Rumanian, English, French, or German; a standard professional terminology (e. g. RIVERSPEAK) used for f.e. VHF communication.

- For the message: word, gesture, writing, pictogram, sound, message level (content, relationship, expression, appeal).
- For the channel and medium: the human senses, smart phone, tablet, VHF, computer (e-mail, Internet), CD, DVD.
- For the feedback: indication of receipt and interpretation.

Each feature can have a positive or negative effect on the effectivity of the process thus on learning.

6.5 Mishaps in communication

Communication is a complex process. At any stage things may go wrong. For instance the instructor may be unclear in what he wants to express; the instruction situation may be too noisy; the student does not understand the words the instructor is using but gives no indication what so ever about his ignorance. One might imagine a (Monty Python like) very fast talking instructor with a high pitched voice, looking away all the time, seeming unsecure, using technical and non-technical words at random not being very organized in his presentation in a noisy room with dysfunctional equipment not dressed for the situation.

An excellent example of a mishap in communication is an advertisement clip that a language institute put on the Internet. In this film, you see a trainee in the coast guard (no English native speaker) communicating with a ship in distress via VHF. The ship's message is "Mayday, mayday, mayday, we are sinking, we are sinking" and the trainee reacts with:
"…….what ……are you…….. thinking about?"
The film illustrates that besides a mutual language, also training, experience, professional know-how and situation awareness are essential for successful communication.

6.6 Barriers to effective communication

So there are all kinds of barriers to effective communication which instructors must try to minimize.
Examples of "internal" barriers are:

- Voice (intonation, clarity of pronunciation, voice-raising, speed of speech)
- Body language (eye contact, facial expressions)
- Choice of words (technical and non-technical)
- Rank/position, fear/intimidation
- Background/education
- Assumptions/wishful thinking
- Disorganised way of thinking
- Stress/ tiredness

Examples of “external” barriers are:

- Noise
- Work pressure
- Distractions
- Physical location of equipment
- Physical condition of equipment

6.7 Verbal, para-verbal and nonverbal communication

As it is clear from the forgoing, communication is not only by means of words: non-verbal communication is also very important as is para verbal. Non-verbal communication can be body language as in eye contact, body gestures or body contact. But also clothing, appearance, jewelry are examples of nonverbal communication. Para verbal communication includes pitch of voice, intonation and how fast or slow speech is paced.

Comparison of the influence of the three communication modalities shows that nonverbal and para verbal communication are much more important than verbal communication in bringing a message across.

6.8 Questions

Questions are an integral part of effective instruction and communication. A good question is precise and clear. A good question may take many forms: an inquiry, a demand for providing arguments, a request for representation, a request for answering a multiple-choice question, etc.

Good questions are often open questions. They do not limit the answering possibilities of the respondent. Good questions often start with: “What”, “Who”’, “When”, “Where”, “Why”, “Which”, “How”, “Explain”. They are not necessarily limited to reproduction but can aim at the association of ideas or idea applications. They are an invitation to think. Bloom’s Revised taxanomy of learning objectives can be the basis for planning effective questions.

Table 1 & 2.provide sample question stems based on Bloom’s revised Taxonomy for the six categories: remembering, understanding, applying, analyzing, evaluating and creating.

Table 1. Sample Question Stems Based on Revised Bloom's Taxonomy

Remember	Understand	Apply
Who?	What does this mean?	Predict what would happen if ...
Where?	Which are the facts?	Choose the best statements that apply.
Which one?	State in your own words.	Judge the effects of …
What?	Is this the same as …?	What would result …?
How?	Give an example.	Tell what would happen if …
Why?	Select the best definition.	Tell how, when, where, why.
How much?	Condense this paragraph.	Tell how much change there would
How many?	What would happen if …?	be if …
When?	Explain why . . .	Identify the results of …
What does it mean?	What expectations are there?	Write in your own words …
What happened after?	Read the graph (table).	How would you explain …?
What is the best one?	What are they saying?	Write a brief outline …
Can you name all the	This represents . . .	What do you think could have
…?	What seems to be …?	happened next?
Who spoke to …?	Is it valid that …?	Who do you think…?
Which is true or false?	What seems likely?	What was the main idea …?
	Show in a graph, table.	Clarify why …
	Which statements support …?	Illustrate the …
	What restrictions would you	Does everyone act in the way that
	add?	… does?
	Outline . . .	Draw a story map.
	What could have happened	Explain why a character acted in
	next?	the way that he did.
	Can you clarify. . .?	Do you know of another instance
	Can you illustrate . . . ?	where …?
	Does everyone think in the way	Can you group by characteristics
	that … does?	such as …?
		Which factors would you change if …?
		What questions would you ask of …?
		From the information given, can
		you develop a set of instructions
		about …?

Taken from

https://tpri.wikispaces.com/Bloom%E2%80%99s+Question+Stems+for+Instruction

Table 2. Sample Question Stems Based on Revised Bloom's Taxonomy

Analyze	Evaluate	Create
What is the function of …? What's fact? Opinion? What assumptions …? What statement is relevant? What motive is there? What conclusions? What does the author believe / assume ? State the point of view of … What ideas apply? What ideas justify the conclusion? What's the relationship between? The least essential statements are … What's the main idea? Theme? What literary form is used? What persuasive technique is used? Determine the point of view, bias, values, or intent underlying presented material. Which events could not have happened? If … happened, what might the ending have been? How is … similar to …? What do you see as other possible outcomes? Why did changes occur? Can you explain what must have happened when …? What were some of the motives behind ? What was the turning point? What are some of the problems of…? Can you distinguish between …?	What fallacies, consistencies, inconsistencies appear? Which is more important, moral, better, logical, valid, appropriate? Find the errors. Is there a better solution to …? Explain. Judge the value of … What do you think about …? Can you defend your position about …? How would you have handled …? What changes to … would you recommend? Do you believe …? How would you feel if …? How effective are …? What are the consequences of …? What influence will … have on our lives? What are the pros and cons of …? Why is … of value? What are the alternatives? Who will gain and who will lose?	Can you design a … to …? Can you see a possible solution to …? If you had access to all resources, how would you deal with …? Why don't you devise your own way to …? What would happen if? How many ways can you …? Can you create new and unusual uses for …? Can you develop a proposal which would …? How would you test …? Propose an alternative. How else would you …? State a rule. Adapted

Taken from

https://tpri.wikispaces.com/Bloom%E2%80%99s+Question+Stems+for+Instruction

6.9 Evaluation of effectiveness

Monitoring the effectiveness of communication is important. One indicator of effectiveness can be the feedback of students. One other that of experienced colleagues. But also the use of a checklist in which the afore mentioned behavioral guidance are included can provide some assistance.

6.10 Instructor - student interaction

Effective instruction can only take place in a situation in which the student and the instructor feel safe. Effective instruction depends on mutual respect and mutual expectance.

Instruction room management can provide the circumstances in which effective instructor – student interaction can take place. In preparing for instruction the instructor can create an environment in which learning can take place. Four focus points are:

1. Instructional planning and delivery – Instruction activities are planned and implemented in ways that optimize student learning, as evidenced by lesson objectives based on students' functioning levels; relevant and meaningful assignments; adequate timelines for tasks; clear and brief task directions; the place of the instruction is appropriate for the needs of all students; there are non-punitive provisions made for students who need more time; corrective feedback is provided promptly and positively during guided practice; the goal of social acceptance by peers is emphasized; there is an emphasis on the development of the autonomy, individual responsibility and interdependence of all students; skills are taught in the settings and situations in which they are naturally needed; instructors are actively involved with students in a manner that promotes their independence, learning and interaction with peers.
2. Physical Setting – The physical setting is organized such that it promotes learning and independence, as evidenced by a clean and well furnitured instruction room. Rules, routines and procedures are clear to everybody. Unnecessary and distracting items and influences are removed. All materials are organized and accessible.
3. Scheduling – The scheduling of instruction occurs in a manner that optimizes student learning, as evidenced by clear daily schedules in which there is room for each student for independent work, one-to-one instruction, small and large group activities, socialization, and free time?
4. Instruction room discipline plan – The plan demonstrates responsiveness to problem behaviors, as evidenced by positively stated instruction room rules that are worded in observable and measurable terms and clear criteria and clear consequences for rule violation.

6.11 Respect

Acquiring respect is often the first thing that comes to mind when it comes to effective instructor – student interaction. Without respect students may not be willing to learn. Respect can be achieved if an instructor:

- Behave with assertiveness and self-confidence.
- Have the required operational and management competences (knowledge; professional attitude and skills).
- Use the power that he/she holds within his/her function.
- Know their students and are aware of their needs and abilities.

But there are also things not to do such as:

- Demanding respect.
- Using authority as a means of power.
- Using fear as a means.
- Not listening when you are addressed.
- Being businesslike for no reason.
- Disregarding the input of others.
- Being bossy.

6.12 Behave respectfully

“Do to others what you want them to do to you”. Or: “Use your position as a role model”. Or: ” who does good will face good”.

Behavior is something intrinsic to human beings. A person always behaves one way or the other, and always communicates somehow. In the simulator room, in the class room, walking down the stairs, in front of the school, in the street, in the pub, in any situation where people come together, the conduct of instructors will be observed by others. The instructor will always be judged by the amount of respect that he shows and receives, his correct conduct, whether he is competent, open-minded towards others and can put himself in other people's shoes, has an understanding of different cultures, knows how to respect other people's boundaries, knows how to motivate other people and shape them into a unified whole, strives towards well-being and communicates. It is impossible to avoid this, even by not being physically there. Also this would be interpreted by others.

6.13 Dealing with challenging behavior in the instruction room

Learning means that students have to open them self’s up to new situations, information, practices, behaviors, norms and values. They have to leave their comfort zone. To some this may lead to unsettling behavior such as defiance, anger, humiliation, disruptive behavior,

lack of interest, seriousness, denial, regression, withdrawal, lack of acceptance or other forms of instruction room misconduct.

Literature provide guidance on how to deal with challenging behavior of students. Some focus points are: what are the reasons for this behavior? Is state of the art instruction room management implemented? Is the instruction repertoire of the instructor such that it fulfill the needs of the students? In all circumstances instructors should keep calm, address the student and when necessary, consult with colleagues. In conjunction with these the "SOAR-UP" method CFEP (2004) can be used as conflict management tool. The steps are:

- **S**top the activity and count to "10" before speaking or reacting.
- Think of **O**utcomes: can you use the conflict as a tool to reach the learning goals?
- **A**ssess the situation. Is there a underlying cause? Can this cause be taken away?
- **R**eact to the student's behavior as that of a "third person". This way the issue will be separated from the emotion.
- **U**se active listening techniques and attend to body language. By doing so you confirm the student that you are dealing with the situation.
- **P**repare for the next time you teach this course. In this way it is also a learning experience for you and can help to improve your instruction skills.

7. Conducting a Simulation Exercise

7.1 Introduction

The simulation session must comprises 4 main components:

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

7.2 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:

- Lighting: reflective of the time of day, weather conditions (wind, rain, fog, water flow), 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.

7.3. 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.

7.4. 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

7.5. Understanding the group members

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

7.6. Setting the scene

The comfort level of the trainees 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 trainees 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.

7.7. 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

7.8. 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 at least:

- 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.

7.8.1. 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.

The trainer should know that 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.

7.8.2. 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.

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 trainees 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.

7.9. 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 student for example 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.

7.10. 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 printers, data recorders and logs are some 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.

7.11. 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.

7.11.1. 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 its 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.

7.11.2. 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.

7.11.3. Conducting the Debriefing

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 Debriefing

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 and 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

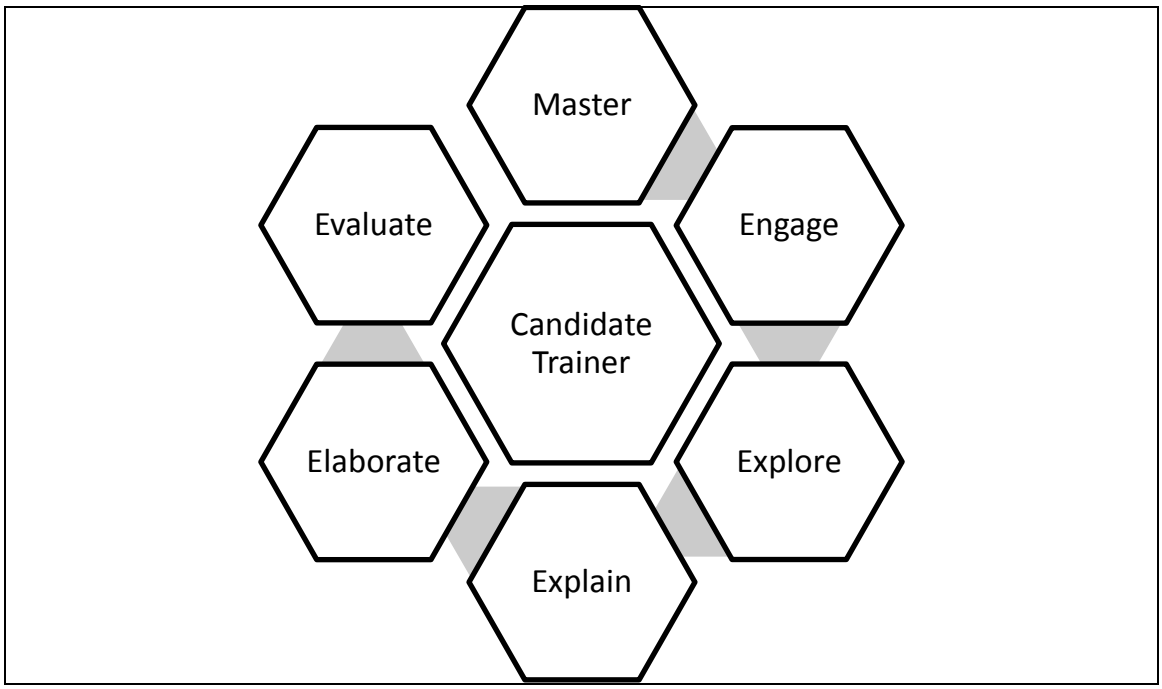
For long-term development or change to take place, more formal structured and documented summary is useful. Ensuring that the students note down individual and personal goals for self-development concretizes the lessons learnt and becomes and form of informal commitment to change. Providing a documented 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.

8. Assessment and Evaluation

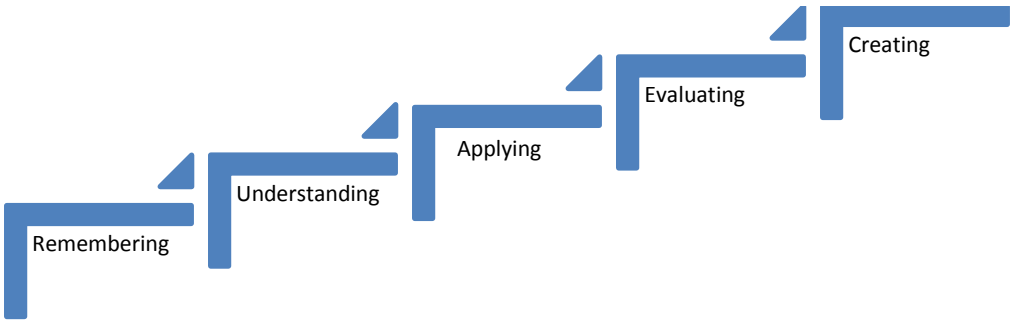
8.1 Introduction

The purpose of the assessment and evaluation of the candidate Trainer is to justify factually the objective conclusion on the ability of the candidate to train learners. The candidate Trainer needs to master competencies and skills that permit him or her to transfer knowledge and practice to others in a simulator driven environment. The candidate Trainer should also possess the ability to observe others and apply empathy to enhance the return on investment after individual training sessions. After completion of a module or a set of training sessions, the candidate Trainer will need to have the capabilities to objectively assess, judge and evaluate learners on their relevant individual skills and competencies. The desired competencies and skills of the candidate Trainer consist in three different domains namely cognitive, psycho-motoric and dynamic-affective.

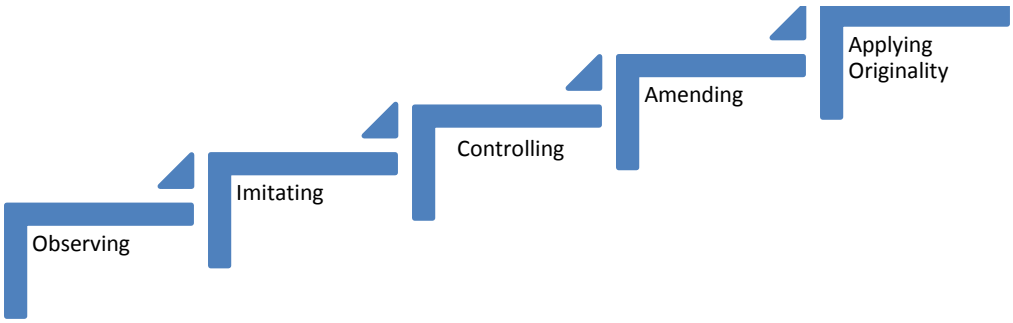


8.2 Skills and competencies

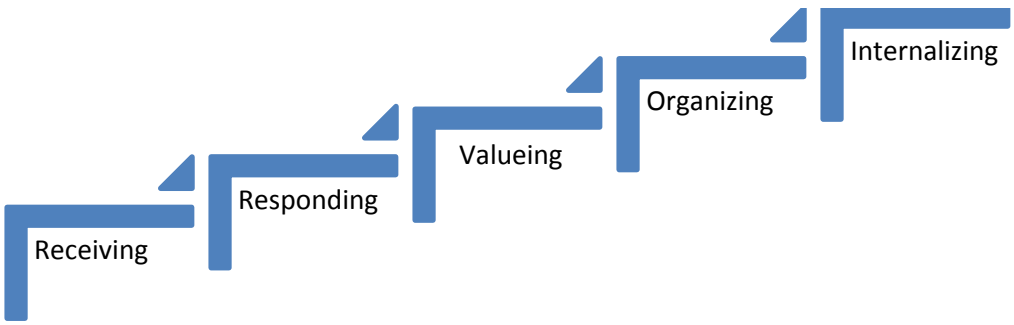
The taxonomy of Bloom provides a recognized classification system for the cognitive domain: the level of knowledge of the candidate Trainer. The first level of cognitive competencies is remembering, and through steps, evolving to evaluating and creating. The desired successful candidate should definitely possess the latter skills.



The taxonomy of Brion allows evaluators to classify the motoric skills of the candidate Trainer. Brion's model describes the lowest level as observing and the higher order of skills as adapting and applying originality.



The taxonomy of Kratwohl is recognized as a taxonomy for affective skills. Also here, different, lower and higher levels, are being identified.



8.3 Evaluation criteria

The evaluation criteria should be related to the desired level of competencies and skills of the candidate Trainer. All three domains, cognitive, psycho-motoric and dynamic-affective, have their value and importance.

For the cognitive qualifications, the candidate Trainer should have acquired sufficient knowledge pertaining to practice on simulators for inland navigation. The knowledge consists in understanding the opportunities and limitations of practical use of existing programs, suggestions for amendments to existing programs and ideas for development of new scenario's.

The future Trainer needs to demonstrate his knowledge pertaining to practice by submitting historical contracts, directly or indirectly, with owners or operators of simulators for inland navigation. The number of hours spent on the simulator, is an objective parameter to measure.

Another element residing under cognitive competencies is the knowledge of existing rules and regulations. It does not suffice to submit a certificate or patent, the candidate Trainer should be tested on up-to-date knowledge and interpretation of traffic rules and regulations for the area on which he is going to train learners.

For the psycho-motoric qualifications, the candidate Trainer needs to demonstrate his or her ability to work with the simulator. This should be demonstrated by starting, pausing, influencing, play-back and closing scenario's.

His or her ability to actually or potentially use controls accessible to learners is also key and needs to be evaluated.

For the dynamic-affective skills, the candidate Trainer should demonstrate continuously a high level of competency in translating above cognitive and psycho-motoric skills to the level of the learner.

The way of communicating and the level of empathy are key and require objective assessment.

8.4 Evaluation and scores

The taxonomy of Bloom (cognitive):

- Remembering – score 0 - reproduce knowledge
- Understanding – score 1 - use knowledge analogical situations
- Applying – score 2 - use knowledge in new situations
- Evaluating – score 3 - detect content and context
- Creating – score 4 - composing new idea

The taxonomy of Brion (psycho-motoric):

- Observing - score 0 - see and hear
- Imitating - score 1 - observe, remember and reproduce
- Controlling - score 2 - execution without assistance
- Amending - score 3 - apply in new situation
- Applying Originality - score 4 - creativity

The taxonomy of Kratwohl (dynamic-affective):

- Receiving - score 0 - observe actions and behaviour
- Responding - score 1 - concur or react
- Valuing - score 2 - appreciate with arguments
- Organizing - score 3 - apply hierarchy of values
- Internalizing - score 4 - intrinsic values

8.5 Evaluation method

The candidate Trainer will need to demonstrate the level of match to pre-defined criteria. In turn, all criteria shall be relevant, valid, realistic and measurable. The method of evaluation should be as objective and transparent as possible.

Different criteria should fit in the three domains of required cognitive, motoric and affective values. Allocating scores to each level of cognitive, motoric and affective qualification shall enable a translation into mathematical values. Reference is made to division 4. (Evaluation and scores) of this chapter.

By allocating weight to each individual criteria, the criteria also become measurable. The more important criteria will deserve a higher weight than the relatively less important. Weights shall be set in such a way that failure of desired presence of key competencies and skills, prevent the candidate Trainer to pass. By multiplying the weight of the individual criteria with the score on the competency level (cognitive, motoric, affective), a result will be calculated per criteria.

Adding all results indicates the overall value of the candidate Trainer.

8.6 Assessment criteria

All the questions should be grouped in different categories grouping criteria pertaining to the skills and competencies which the candidate Trainer needs to have

Criteria are:

a. Mastering knowledge

- Rules and regulations
- Software

b. Practical use of simulator
    - Trainer controls
    - Learner controls

c. Communication and interaction
    - Communication
    - Exploration
    - Explanation
    - Elaboration

d. Evaluation and assessment
    - Individual
    - Comparative
    - Objectivity

8.7 Evaluation measurement

a. Mastering knowledge (cognitive)

Rules and regulations: /120

Rules:	weight	4 excellent	3 good	2 doubtful	1 bad	score	maximum
Manoeuvers	5						20
Day/night	5						20
Signals	5						20
Anchoring	5						20
Visibility	5						20
Restrictions	5						20

Software: /108

Scenario's:	weight	4 excellent	3 good	2 doubtful	1 bad	score	maximum
Content	5						20
Difficulty	4						16
Possibilities	3						12
Adaptability	5						20
Goals	5						20
Remedy	5						20

b. Practical use of the simulator (psycho-motoric):

Trainer controls: /120

	Weight	4 excellent	3 good	2 doubtful	1 bad	score	maximum
Control:							
Selection	5						20
Day/night	5						20
Weather	5						20
Failure	5						20
Insert	5						20
Replay	5						20

Learner controls: /120

	weight	4 excellent	3 good	2 doubtful	1 bad	score	Maximum
Control:							
Radar/Ecdis	5						20
Ais	5						20
Communication	5						20
Engine	5						20
Rudder	5						20
Thruster	5						20

c. <u>Communication and interaction (dynamic-affective):</u>

Communication – clarity of: /36

	weight	4 excellent	3 good	2 doubtful	1 bad	score	maximum
Instructions	3						12
Interactions	3						12
Recommendations	3						12

Exploration – level of: /60

	weight	4 excellent	3 good	2 doubtful	1 bad	score	maximum
Empathy	3						12
Anticipation	3						12
Analysis	4						16
Synthesis	5						20

Explanation – clear: /56

	weight	4 excellent	3 good	2 doubtful	1 bad	score	maximum
Content	5						20
Structure	3						12
Objectivity	3						12
Respect	3						12

Elaboration – clear: /36

	weight	4 excellent	3 good	2 doubtful	1 bad	score	maximum
In-depth	4						16
Alternative	4						16
Options	2						8
Learning	2						8

d. Evaluation and assessment:

Individual – assessment of learners: /44

	Weight	4 excellent	3 good	2 doubtful	1 bad	score	maximum
Competencies	5						20
Motoric skills	3						12
Affectivity	3						12

Comparative – assessment of learners': /24

	Weight	4 excellent	3 good	2 doubtful	1 bad	Score	maximum
Knowledge	2						8
Interaction	2						8
Potential	2						8

Objectivity – assessment of learners: /36

	weight	4 excellent	3 good	2 doubtful	1 bad	Score	maximum
Scores	3						12
Evaluation matrix	3						12
Meeting targets	3						12