Comparative Teaching/ Evaluation Methods in Simulation Didactic Activities

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Abstract. In traditional teaching, the instructor provides information and lectures to the learners. This method does not consider the different learning styles and preferences of individuals. It assumes that all learners have similar learning styles and can learn by hearing or seeing. Didactic teaching refers to a teaching approach where the teacher is the primary source of information and directs the learning process. In this approach, the teacher assumes the role of an expert and imparts knowledge to the students in a one-way communication process, with little or no interaction or collaboration. Simulation didactic activities are an effective way to prepare students and professionals for real-world situations by providing a safe environment where they can practice and gain experience. However, the effectiveness of simulation activities depends on the quality of teaching and evaluation methods used.

The aim is to make a comparative study of the teaching and evaluation methods used in the simulator training which will ensure quality learning.

This study will assist the simulator training when they plan, conduct, and assess their teaching and learning activities in the maritime education and training institutes.

Keywords: Comparative Teaching, Comparative Assessment, Simulation, Simulation Didactive Activities

1. Introduction

1.1. Didactic teaching

Didactic teaching refers to a teaching approach where the teacher is the primary source of information and directs the learning process. In this approach, the teacher assumes the role of an expert and imparts knowledge to the students in a one-way communication process, with little or no interaction or collaboration.

Didactic teaching is often associated with traditional classroom settings, where the teacher delivers lectures and students listen and take notes. The teacher may also use visual aids, such as slides and handouts, to reinforce the information presented.

This approach to teaching has its benefits, particularly in terms of imparting foundational knowledge and skills. It also allows for a structured and organized approach to learning. However, it may not cater to the diverse learning needs of students or allow for active engagement and critical thinking.

In recent times, there has been a shift towards more interactive and student-centered approaches to teaching, such as project-based learning and inquiry-based learning. Nevertheless, didactic teaching remains an important component of many educational contexts.

Didactic training is highly important for the following areas:

Healthcare: Health professionals need to be trained in a practical and hands-on manner for dealing with real-life medical emergencies and procedures.

Military: The main aim of military training is to ensure that combatants can handle combat situations effectively and develop physical skills to meet combat activities.

Technical fields: Active training is highly important in technical fields such as engineering, construction, and other hands-on professions where students need to develop practical skills and knowledge.

Sports: Active training is necessary to develop the physical abilities of the athletes and improve their techniques.

Customer service: Trainees need practical experiments to provide customer satisfaction and. deal with difficult customers

Emergency services: The professionals need to perfect skills and reflexes to enable them to respond swiftly and effectively to any situation.

Ship Operation: Mariners need to gain skills, knowledge, and competence to respond to emergencies at sea which is full of perils.

Didactic teaching is suitable when the introduction of the simulator training as well as debriefing. But active involvement of the lecturer is required for uninterrupted continuity of the simulator training. Active teaching is also required to correct the learner's action immediately when the scenario advance in an undesirable direction.

1.2. Assessment

Assessment is an important part of the learning process as much as learning and teaching [1]. Assessment is a tool to help achieve effective teaching and learning [2].

Assessment is the process of collecting evidence of student learning in order to draw an inference about an individual's (or a group's) current level of attainment [3]. In order to make a correct and valuable assessment the following issues should be considered

- Assessment should be relevant: The assessment needs to provide information
- Assessment should be appropriate: The assessment needs to provide information about the particular kind of learning in which we are interested.
- Assessment should be fair. Assessment needs to provide opportunities for every student to demonstrate what they know, understand, and can do.
- Assessment should be accurate: Assessment needs to provide evidence that accurately reflects an individual student's knowledge, skills, and understanding.
- Assessment should provide useful information: The focus of assessment is to establish where students are in their learning.
- Assessment should be integrated into the teaching and learning cycle: Assessment needs to be an ongoing, integral part of the teaching and learning cycle.
- Assessment should draw on a wide range of evidence: Assessment needs to draw on a wide range of evidence.
- Assessment should be manageable: Assessment needs to be efficient, manageable, and convenient.

2. Method

In traditional teaching, the instructor provides information and lectures to the learners. This method does not consider the different learning styles and preferences of individuals. It assumes that all learners have similar learning styles and can learn by hearing or seeing. Didactic teaching refers to a teaching approach where the teacher is the primary source of information and directs the learning process. In this approach, the teacher assumes the role of an expert and imparts knowledge to the students in a one-way communication process, with little or no interaction or collaboration. Simulation didactic activities are an effective way to prepare students and professionals for real-world situations by providing a safe environment where they can practice and gain experience. However, the effectiveness of simulation activities depends on the quality of teaching and evaluation methods used.

The aim is to make a comparative study of the teaching and evaluation methods used in the simulator training which will ensure quality learning.

The study is conducted in three steps. In the first step, it is intended to make literature research on the deficiencies based on the related studies and personal experiments of the lecturers providing simulator training in the MET (Maritime Education and Training) institutes. The second step covers the analysis of the problem areas by an expert group that has both professional and MET experience. In the final step, the findings of the second step are categorized, and grouped for further study to formulate possible solutions to be proposed. After evaluating and testing these solutions, applicable courses of action are recommended.

The research questions are based on the following areas:

- Defining problem areas related to simulator training.

- Evaluation of basic issues on teaching at the simulators

- Evaluation of basic issues on making assessments at the simulators

This study will assist the simulator trainers when they plan, conduct, and assess their teaching and learning activities in the maritime education and training institutes

3. Research

3.1. Teaching Methods

Traditional Teaching:

In traditional teaching, the instructor provides information and lectures to the learners. This method does not take into account the different learning styles and preferences of individuals. It assumes that all learners have similar learning styles and can learn by hearing or seeing.

Problem-based Learning:

Problem-based learning is a learner-centred approach where students are given a problem and work collaboratively to find the solution. It is a more engaging and interactive method that encourages students to think critically and apply knowledge in real-life situations.

Team-based Learning:

In team-based learning, students work in teams to solve problems and complete tasks. This method promotes collaboration, and communication, and improves social skills, which is essential in the workplace.

Problem-based training is considered the best method for simulator training in the MET Most of the improved MET simulator training such as BTM (Bridge Team Management, BRM (Bridge Resources Management), ERM (Engine Resources Management) etc. are conducted as teamwork and suitable for Team-based Learning.

3.2.   Active teaching.

Active teaching is an essential aspect of modern education that helps students develop a deeper understanding of different subjects by engaging them in various learning activities.

Active teaching is also used in Medical teaching. De Lorenzo and Abbott [4] propose the application of Adult Learning including a small-group interactive approach, self-directed study, multimedia didactics, and intensive integrated practice of psychomotor skills. Instructors and students were also surveyed at the end of the course as to their confidence in performing four critical skills. Effectiveness of an adult-learning, self-directed model compared with traditional lecture-based teaching methods in out-of-hospital training.

The traditional teaching approaches are generally teacher-directed and where students are taught in a manner that is conducive to sitting and listening. It is true that the traditional expectations and department philosophies often allow us to continue with the lecture-based model with some useful results as evidenced by the past accomplishments of many and this cannot be disputed as much. However it is often argued that the traditional approach may not provide students with valuable skills and indeed some even go as far as saying the traditional method leads to a student not retaining knowledge after exams - they have little or no recall of the body of knowledge learned beyond the end of a semester, for example [5].

Overall, active teaching is an essential aspect of modern education that helps students develop a deeper understanding of different subjects by engaging them in various learning activities [6].

Active teaching is highly important in the following areas: Science, Mathematics, Language Arts, Social Studies, Physical Education, and Fine Arts.

Overall, active teaching is an essential aspect of modern education that helps students develop a deeper understanding of different subjects by engaging them in various learning activities. Active teaching is considered applicable for most of the advanced simulator training conducted as teamwork.

Evaluation and Assessment Methods

Assessment

Assessment is an important part of the learning process as much as learning and teaching (Cross, 2003). Assessment is a tool to help achieve effective teaching and learning (Robinson & Mania, 2007).

According to Cross [1] [7] [8] there has been much research done about assessment in education. However, different types of training require different assessment methods, which may explain the wide diversity of under-used methods [8]. Assessments should match the aim and the outcome of the training [1]. Miller, (as cited by Asyali [9]) has proposed a framework for assessment. Four levels of assessment for learners have been addressed, and the content is "knows (Knowledge), knows how (Competence), shows how (Performance), and does (Action)"

Asyaİi [9] states that "According to Code [STCW], where simulators are used to assess the ability of candidates to demonstrate levels of competency, assessors shall ensure that":

- Identified performance criteria are clearly and explicitly and are valid and available to the candidates.

- Assessment criteria are established clearly and are explicit to ensure reliability and uniformity of assessment and to optimize objective measurement and evaluation so that subjective judgments are kept to the minimum.

- Candidates are briefed clearly on the tasks and/or skills to be assessed and on the tasks and performance criteria by which their competency will be determined.

- Assessment of performance takes into account normal operating procedures and any behavioral interaction with other candidates on the simulator or with simulator staff.

- Scoring or grading methods to assess performance are used with caution until they have been validated.

- The prime criterion is that a candidate demonstrates the ability to carry out a task safely and effectively to the satisfaction of the assessor.

Evaluation

Assessment leads to the evaluation of the trainees. It is one of the main objective sources for a successful assessment. The evaluation methods are:

Objective Structured Clinical Examinations (OSCEs):

OSCEs are commonly used for evaluating clinical skills in healthcare. They involve a series of stations where learners perform tasks and are evaluated by observers using a pre-defined checklist. Actually, the evaluation of simulator training in MET is in this category.

Self-assessment:

Self-assessment involves individual learners evaluating their own performance based on a set of criteria. This method encourages learners to reflect on their skills and knowledge and identify areas that need improvement. But it is necessary to review the self-assessments of the learners by the lecturer to understand and evaluate their opinions.

Peer-assessment:

Peer assessment involves learners evaluating each other's performance. It promotes collaboration and active learning and provides learners with feedback from their peers. It is suitable for a long duration training but not for short ones due to the limited time assigned for the training.

3.4.   Simulation Training activities

Simulator training is a form of experiential learning that uses computer simulations to replicate real-world scenarios and environments. This approach is often used in fields such as aviation, medicine, and military training to provide a safe and controlled environment for learners to practice skills and decision-making.

Simulator training has been shown to be effective in improving learners' skills and knowledge retention. By providing learners with hands-on experience in a simulated environment, they can practice and make mistakes without the risks and consequences of real-world situations. This can help to build learners' confidence and competence and prepare them for real-world challenges.

Additionally, simulator training allows for the customization and control of learning experiences. Instructors can adjust the difficulty and complexity of simulations, provide instant feedback and assessment, and track learners' progress and performance. This can help instructors to tailor their teaching to individual learners' needs and provide a more effective learning experience.

The STCW Code [10] defines the range of BRM (Bridge Resource Management)/BRM (Engine Room Management) soft skills that seafarers at the operational level should be trained in and assessed for. When using simulators for such training and assessment, there is a need to define and establish relevant criteria in respect of competencies and methods of teaching and assessment defined in the STCW.

Overall, simulator training can be an effective and efficient way to prepare learners for real-world challenges and improve their skills and knowledge. However, like any instructional approach, it is important to consider the specific learning goals, the learners' needs and abilities, and the resources and technology available to determine the best approach for each situation.

Simulation didactic activities are an effective way to prepare students and professionals for real-world situations by providing a safe environment where they can practice and gain experience. However, the effectiveness of simulation activities depends on the quality of teaching and evaluation methods used. This article will explore comparative teaching and evaluation methods in simulation didactic activities.

4. Discussion

4.1. *Comparative Teaching/ Evaluation Methods*

4.1.1. *Large group didactic sessions vs. Problem-based learning:*

Studies have shown that learners exposed to problem-based learning had higher retention and recall rates than learners who received traditional didactic lectures.

4.1.2. *OSCE (Objective Structured Clinical Examinations) vs. self-assessment vs. peer-assessment:*

OSCEs provide objective evaluations of clinical skills but can be time-consuming and expensive. Self and peer assessment promote active learning and feedback but are subjective and may be influenced by learners' biases.

When using simulators for such training and assessment, there is a need to define and establish relevant criteria in respect of competencies and methods of teaching and assessment [6].

4.2. *Results from previous studies*

Typically, university lecturers in mathematics and engineering are often not trained in non-traditional classroom methods. Some have argued that even if they included non-traditional teaching in their universities in fact they may not be in reality using the so-called non-traditional methods and goals. They argue that lecturers are often lacking the underlying philosophical knowledge of the non-traditional goals and objectives, and therefore they are not in a position to implement such methodologies and assessment techniques, in reality, even when they say they are [5].

Issenberg et al. [11] made a study on the effectiveness of simulation technology in medical education based on the respective literature. The significant advantages of the use of simulator technology in teaching are assessed by the results of this study. The number of reviewed scientific studies in the literature and "sequence of importance as a percentage" are shown in the following table.

Subject	Number of the articles	Supporting (%)
Provide feedback	51	47
Repetitive practice	43	39
Curriculum integration	27	25
Range of difficulty level	15	14
Use of multiple learning strategies	11	10
Capture clinical (condition) variation	11	10
Controlled environment	10	9
Individualized learning	10	9
Defined outcomes	7	6
Simulator validity	4	3

In accordance with the results of this study, "Provide feedback, Repetitive practice, Curriculum integration" are found the important advantages of simulator training. It is clear that these advantages are also valid for other sciences.

4.3. Lecturers/teachers' Opinions on Effective Simulator Training

To examine the problem areas an expert group has been established which consists of 5 maritime lecturers who hold MSc/Ph.D. degrees having both teachings in MET institutes using simulators and sea experience. They are fully well aware of the procedures and applications of sea training at simulators.

The resume of the literature study is provided to the group to update them on the latest information on the subject. The group has agreed to work on the following areas.

- Defining the problem areas related to simulator training

- Evaluation of basic issues on teaching at the simulators

- Evaluation of basic issues on making assessments at the simulators

4.3.1. Defining the problem areas related to simulator training

The factors affecting the effectiveness of simulator training may be introduced in relation to simulator lecturers, simulator specifications, scenarios, and trainees.

The lecturer's specifications:

- Sufficient experiment on the profession which is taught
- Competent in the use of simulators
- Understand the simulation: it is essential to understand how it works and the principles behind it. The instructor should be familiar with the simulator's capabilities, features, and limitations, as well as the scenarios that it can replicate.
- Establish clear learning objectives: It is crucial to define the learning objectives for the simulator training and communicate them clearly to the learners
- Provide adequate instruction and guidance: Instructors should provide adequate instruction and guidance to the learners before they begin the simulator training
- Capable to apply active teaching and assessment methods
- Expertise in creating realistic scenarios fit to purpose
- Flexible to change the flow of the training as required

- Give timely feedback: Feedback is essential in simulator training. Instructors should provide timely and constructive feedback to the learners, highlighting their strengths and areas for improvement

The simulator specifications:

- The simulator should be capable to reflect essential elements of a realistic scenario such as area, meteorological, and hydrographic conditions, a sufficient number of targets to support the scenario, etc.
- Operation consoles should not be complex to handle by the trainees:

Scenarios:

- The scenarios should be challenging but achievable, and they should allow learners to practice a range of skills and decision-making in a safe and controlled environment.
- The hardness of the scenario should be arranged to the knowledge level of the students.

Trainees:

- Trainees should be familiarized before the training to fully understand how they operate the system. This includes explaining the simulation's controls, functions, and scenarios.
- The number of trainees participating in training should not exceed the limitation of the simulator spaces
- Learners should be well aware of the outcomes of the training
- Adequate instruction and guidance should be provided to trainees by the lecturer
- After completing the simulator training, instructors should encourage learners to reflect on their experiences and debrief with them. This helps learners to consolidate their learning, identify areas for improvement, and apply their new skills and knowledge to real-world situations.

4.2.3. Evaluation of basic issues on teaching at the simulators

In simulator training, the key element is the teacher. As it is understood, the teacher needs to establish a very close relationship with the students in simulator education, which dictates the use of the didactic education method. The instructor must have complete competency in didactic training.

The teacher should be in a position to observe and, where necessary, engage directly with the student. This application will control the uninterrupted flow of education and ensure that education reaches its goal.

Simulator training requires didactic training in terms of purpose, scope, and delivery methods. Except for very special cases, the best method applied in simulator training is didactic training. Briefing and debriefing in simulator training can be done with classical training methods, but didactic training is the most appropriate method to be applied after the game flow begins.

Within the scope of MET, training on navigation, navigation watch, cargo handling, communication, electronic navigation, and basic safety applications requires to be supported with simulator training. In fact, one of the purposes of this training is to provide the student with the opportunity to practice this subject. STCW also recommends that this training is mostly done in the simulator.

4.4. Evaluation of basic issues on making assessments at the simulators

Both professional and common (soft) skills can be assessed in the simulator training. Professional skills are related to the outcomes of the training. Only suitable common skills should be selected in line with the scenario.

The list of the Common skills introduced by The College of Central London [12] and applicable scenario types are introduced as follows:

- Managing and developing self (All types)
- Working with and relating to others (only team-based exercises)
- Communicating (when two or more stations exist)
- Managing tasks and solving problems (Advance scenarios)
- Applying numeracy (Scenarios that require math abilities)
- Applying technology (Only for scenarios using technological devices and systems)
- Applying creativity and design (Only for scenarios applying creativity and design)

Lecturers should select a suitable type of assessment method that is in line with the consistency and objectivity of the training. For a fair assessment, grading criteria should be developed. When the assessment is finished students should be provided with feedback to improve themselves. Assessor should encourage students to make self-assess and reflect on their own learning progress and goals.

4.5. Recommendation for lecturers/ teachers

The general recommendations for lecturers/teachers who use didactic teaching methods are as follows:

Use a variety of teaching methods to appeal to different learning styles. This could include lectures, group discussions, hands-on activities, and visual aids.

Be organized and prepared with clear learning objectives, structured lesson plans, and relevant materials.

Encourage student engagement and participation by asking questions, providing opportunities for group work, and allowing for peer-to-peer teaching.

Provide regular feedback and assessments to monitor student progress and adjust teaching methods accordingly.

Foster a positive learning environment that is respectful, open, and inclusive for all students.

Stay up-to-date with the latest research and best practices in teaching to continuously improve and refine teaching methods.

Overall, a didactic teaching approach can be effective when implemented thoughtfully and with a focus on student engagement and learning outcomes.

4.6. Overall Evaluation

Effective simulator training requires careful planning, preparation, and execution. Lecturers should create a supportive learning environment that encourages learners to take risks, make mistakes, and learn from their experiences. By following this advice, instructors can help learners to develop the skills and knowledge they need to succeed in their education or profession.

General recommendations for lecturers/teachers who use didactic assessment methods:

- Lecturers who give training in simulators should have sufficient knowledge about didactic education. In fact, this topic should be added to the training topics of Simulator Trainers Training in STCW.
- In simulator training, the trainer should take a very active role and be able to control the cubbies used in addition to the control room. If this cannot be achieved, more than one trainer should attend the pieces of training
- Evaluating simulator training requires special study and experience. Simulator trainers also need to gain experience in the assessment methods which will be applicable for the evaluation of didactic training.

5. Conclusion

Simulation didactic activities are effective tools for preparing learners for real-world situations at the beginning of the training as well as in the debriefing phase. However, the effectiveness of these activities depends on the quality of teaching and evaluation methods used. Comparative teaching/evaluation methods can help educators choose the most effective methods for their learners and provide them with meaningful feedback that will stimulate continuous learning and improvement.

Active teaching is suitable during the conduct of simulator training which requires the lecturer's involvement with the learners at each step of the scenario. This will also assist the continuation of training as planned.

General recommendations for lecturers/teachers who use didactic assessment methods are as follows:

- Clearly define the learning goals and outcomes for each lesson or topic. Develop grading criteria
- Use a variety of assessment methods that fit to purpose.
- Provide feedback to help students improve their understanding and performance.
- Communicate assessment results with students and use them as a basis for understanding their strengths and weaknesses.
- Encourage students to make self-assessments.
- Make an overall assessment of the delivery method and review/revise the method you used.

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