Could Introducing Simulation Into Mandatory STCW Short Course Programs Be an Innovative Approach to Assessing Competence?

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This paper presents an argument that while the International Maritime Organisation, (IMO) has identified a number of critical factors, including human failures, which continue to cause disruption to worldwide shipping operations. The paper further accepts that there is supporting evidence that IMO amendments to conventions such as Safety of Life at Sea, (SOLAS) in 2002 have gone some way to improving ship-board conditions and operations, and the 2010 amendments to the mandatory training components of the Standards of Training and Certification for Watchkeepers Convention, (STCW) are likely continue this record of improved performance. The paper also identifies and argues that there is a risk for maritime training and education institutions, (MTE) that unless they are prepared to apply a higher level of assessment when determining an advanced seafarer's level of competence to deal with significant on-board emergencies, this emerging trend of declining emergency response incidents may well be reversed. Supporting this argument is a 2013 review, produced in collaboration between Allianz and Cardiff University acknowledging that while there is evidence of reduction in occurrence of fire emergency on-board, the subject still remains a high risk factor when compared to the likelihood of other disruptive events occurring. The paper presents an argument that in order to prevent a return to past events a MTE will need to become innovative in their approach to training and assessment, achieved through the introduction of simulation into the STCW mandatory short course programs, specifically those that deal with emergency situations.

Keywords: **:** mandatory, STCW short course, advanced seafarer operations, development, skills and knowledge, innovation, realistic assessment.

1. Introduction

Since the late 1950's the world maritime industry, through IMO, has come to realise shipboard safety is heavily reliant on a competent and well trained crew. In 1969 it was agreed that in order to consistently achieve this on as large a scale as possible an international standard for training and certification should be developed. This resulted in the development of a draft STCW Convention coming into existence in 1978.Unfortuently the 1978 STCW Convention was lacking in terms of providing a standardised approach to training of seafarers, and with so much of the detail and subsequent requirements being open to interpretation by the signatories to the Convention. The IMO identified with the United States that a review was in order, and this decision coinciding with the 1992 grounding of the MV AGEAN SEA, was to be the turning point and IMO decided a larger scale review was in order and it needed to take into account the role human failure played in maritime casualties. Attention needed to shift from standards of construction and equipment and start to focus on training, people, and operations.

This paper is not intended to question any STCW review or Casualty investigation, but uses events of the past as a means of identifying the emerging conclusion that human factor failures are significant contributors to casualties within the world maritime fleet. This conclusion forms the basis of an argument that even though the STCW has been reviewed over many years it is only recently, within the last 8 years, that the IMO has come to identify that the level of standardisation is still open to interpretation, and the development of training and education differs between member states. It is evident that the IMO realises there is an immediate need to raise the quality and effectiveness of the combined training and education of seafarers [1] in order to meet the demands of our moderns fleet and attempts to do this through the introduction and entering into force the amended STCW 2010. The paper identifies with a few simple emergency incidents on board that outline possible causes, and with

this, introduces a concept that may address some of the many short falls in the ongoing development of the modern advanced seafarers.
In order to identify and support this concept this paper seeks to analyse current reviews and amendments to the STCW convention and code and seek to define through interpretation what is meant by the acronym STCW. It is through this interpretation that MTE's will better understand the complexities that have been created, but not addressed, even though at subsequent meetings of IMO and relevant committees it has been highlighted the convention and code needs to account for and reflect the modern shipping fleet and the changing operating environment a ship's crew find themselves working within [1]. By having a better understanding of key terms such as Standard, Training and Certification it is proposed MTE's will become better informed and able to adapt and ensure the required managerial and operational level of learning is applied into the program of learning and teaching to support and prepare the shipboard officer of today, and tomorrow.
In Australia the regulatory authority for maritime certification, training endorsement and approval is the Australian Maritime Safety Authority, (AMSA) and they have responsibility for ensuring the STCW requirements are implemented as required and they undertake audit, inspection, detention, and legislative control to ensure this is the case. AMSA recognise the Maritime Training Package as meeting the requirements of the STCW for certification purposes for all short duration safety related training programs. From this point forward within the paper Vocational Education and Training; (VET) is described as being the means to provide the curriculum and syllabus used to direct the training and education requirements of the STCW. So when competency is discussed or assessment it is taken from the Australian VET context.

2. Recent Casualty History

Allianz and Cardiff University's 2012 report [2] discussing maritime trade over a 100 year history came to realise that while a significant reduction in ship casualties had been experienced, largely due to changes in the conventions and codes covering training, ship build and fit-out, there was still an inherent risk of slipping back to our past, where industry would once again start to observe a more regular pattern of on board emergencies. Examples of this have appeared already, 2008 off the coast of Newcastle Australia a3rd engineer while carrying out what should have been reasonably routine maintanace work received significant burns. To compound this incident, the initial injury treatment was not sufficient. The investigation concluded that a failure to understand the true hazards of undertaking this work, and failure to follow accepted medical practises were factors to this incident [3]. Another example in 2012 occurred in Port Headland Australia where inadequate risk assessment and failure to complete and follow hot work permit procedures, human factor failures led to a significant cargo hold fire [4]. Another incident involving suspected dangerous goods on a large container ship saw a contrast where a wide variety of critical safety actions, considerations and decisions were made in a short space of time. The prolonged nature of this casualty event necessitated the ship board emergency response structure changing many times, but still remaining effective in dealing with a complex and long duration shipboard emergency at sea [5]. So why did these incidents occur. They took place on ships that had competent crews, shipboard work procedures complied with international maritime conventions and codes and companies operated within the constraints placed upon them in this varied and diverse maritime world. The maritime industry has codes and conventions covering training and drill requirements that are followed in line with the required standards. Shipboards crew are trained to the required level, yet we still have casualties. Could it be the education provided, could it be the demonstration of competence required in order to undertake the function required on board, or could it be simply a failure of not exposing the crew to relevant predictable work place situations or emergencies.

To consider this statement it is necessary to analyse the current approach to education and training and identify with the key terms, and come to an understanding as to their place in the structure of ship officer development that supports on-board operations. An early consideration at this point is to provide a definition to key terms such as emergency response, advanced seafarer and what exposure to on-board emergency situations has been provided. Another consideration is to define terms such as

mandatory, short course, realistic assessment and skill and knowledge as these are key terms used to determine competence, which is another consideration. What does it mean to be competent when considering emergency response management and what are the implications of not providing a suitable level of education and appropriate assessment during the seafarer's career path? The paper will look to describe each of these terms and by doing so, identify where innovation may be applied to align with, and support the delivery of short duration and mandatory short course programs.

3. Emergency Response

This paper considered the term emergency response and applying a broad definition considered it to be an event that would cause a ship's normal operations to cease even for a brief moment. The emergency may be general in nature, cargo shifting in deteriorating weather conditions; medical where a crew member may be injured while making repairs to damaged ship structure as a result of cargo shift; fire resulting from cargo spillage and mixing with other cargo material, or survival arising from the previously escalating events that become beyond the crews ability to deal with them. It is this definition that formed the foundation to consider how well we are able to prepare the advanced seafarer with insight to deal with these possible ship board situations.

4. Advanced Seafarer

When considering the advanced seafarer, the paper describes a student that has undergone pre-sea components covering deck or engine departments, attained the required level of sea time (workplace experience in their intended role) and return to the MTE area for continued development to attain the watch-keeper endorsement. At the Australian Maritime College this student is in year two of a potential three year program and is returning for the next phase covering short course subjects in shipboard safety [6]. The student should be well experienced in ship operations by this stage, especially concerning deck or engine-room emergencies and the on-board procedures set in place to contend with these extraordinary situations. To be at this stage of career development the student would meet the prerequisite requirements outlined in the STCW.

5. Short course

When the term short course is quoted in this paper it is to be thought of as a course that run less than a typical semester or durations; under 13 weeks. In the area of mandatory teaching learning and training for STCW endorsement a short course can be 4 days, so short course yes, and short duration definitely. Short course mixed with short duration are a challenge for any MTE today. This all adds to there being an inconsistent approach and interpretation of the requirements of the STCW Convention and code which is largely based around skill and knowledge development with an assessment process to determine competency.

6. Mandatory

Mandatory has to be taken into context in order to understand its intent. In simple terms the word describes a compulsory or necessary component [7]. Applying it to the discussion so far we have the parts of a seafarer education that simply has to be in order to progress or achieve the desired outcome. In an advanced course it is the elements of the program that all providers need to ensure are covered. It is possibly this word alone that causes so many of the issues based around what needs to be covered in the delivery of emergency response training and education.

7. Standard, Training and Certification

When considering Standard it is possible to apply a variety of meanings depending on the intended use of the word. Alternative words that could be used in its place; mean, orthodox, typical, customary, conventional or established [7]. Here lies the first issue the word means many things depending its application. In the broadest sense and to an educational institution it could be applied describe goals or end destinations the student should arrive at by undertaking the study.
Training, another word defined by its intended use. From a STCW context it could be taken to mean teaching or educating [7]. The final word worth defining is Certification, which can be interpreted to mean accreditation, endorsement, official recognition for undertaking the program.

If we pull these together it is possible to suggest the term STCW when considered from the IMO point of view could be defined as the conventional education and official recognition received. For the MTE institution it may describe the education program and instruction that is required to satisfy and meet course requirements. It would also suggest that what is undertaken at one RTO should be similar in nature to another RTO allowing the student to transfer their awards of similar study units between RTO's. For the student it may well be defined as the typical education requirements to attain a regulator endorsement or qualification that allows them to serve on-board. The units studied should be transferable and recognised between providers. But this is not the case and a shipping review in 2013 [8] by the International Chamber of Shipping, (ICS) identified where poor interpretation of what is considered to be mandatory education and training as outlined in the 2010 amendments to the STCW convention and code has largely allowed RTO's to determine and develop revised education and training requirements. The ICS highlighted an example of interpretation where it could be possible for white list STCW flag states to disadvantage their own seafarer's through inconsistent application of the STCW 2010 Manila amendments. The issue as identified was based around the application of training for Electronic Chart Display Identification Systems, (ECDIS). It was found that through poor interpretation a large amount of the world seafarers could be left without suitably endorsed training all because a RTO insisted all deck officers undergoing ECDIS training when the amended requirements of the STCW Convention state otherwise.

8. Skill and Knowledge

Another area that requires interpretation is skill and knowledge because depending on what stage a student is at it can and where the particular statement is applied. In Australia as an example so much of the maritime training, while based around the STCW convention and code is applied in the VET space. When terms such as skill and knowledge are applied within the context of training package material, they can come to mean skill and knowledge the student already has or skill and knowledge they will acquire as a result of taking part in the education program on offer. This is interesting because when considering assessment the student will need to demonstrate skill and knowledge, and this may be along their pathway of completing their program. When dealing with VET, like any other form of assessment it needs to meet criteria and what is applied in a higher education, (HE) stream is just as applicable in VET, other than HE may require a more prescribed demonstration of performance [9]. The key though, is for all education training assessment and application of learning to be demonstrated in a realistic environment applicable to the industry training package material.

9. Realistic assessment

9.1 Assessment

The evidence that is collected by assessors is used to determine whether an individual has reached the required level of competence. This assessment is based on a confirmation, through demonstration and application, of an individual's ability to perform in accordance with expected industry or workplace standards, or the competencies as prescribed in endorsed training packages and for the advanced

seafarer the applicable tables outlined in the STCW convention and code [10]. The process of assessment involves the gathering of layers of evidence that provide an understanding of the individual's knowledge and skill and their ability to apply the same in workplace environments. Consideration at this point would be given to ask is a four day period is sufficient time to gather enough evidence that is valid, sufficient, current and authentic. It is not possible to move past this argument without a closer look to the assessment requirements as per typical standards [9] The first criteria is that assessment must be valid by providing a process of evidence gathering that relates to the performance standards the assessment is being conducted against and reflects the dimensions of competency [11]. The assessment process must provide sufficient evidence to meet all facets of the unit of competence or the standard being assessed against. This is to allow the assessor to make a judgement about competency. Another criterion to consider is that no matter what process is used to collect the evidence it must be current and applicable to the operating area the student will go into. The final criteria are based around authenticity. This is where the assessment process must be such to ensure all evidence gathered is the work of the person being assessed. Once these criteria are introduced and satisfied the focus can shift to levels of assessment. Typically assessment within VET is staged along the students' journey until an end point where a final stage of assessment may be conducted to determine whether a suitable level of competence has been reach. To achieve this, the following is an analysis of ways assessment needs can be applied

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9.2 Types of Assessment

Formative assessment is conducted at various points throughout the learning program. This may involve questioning, undertaking written quizzes, or assessors watching a student undertake a task. Formative assessment is a critical part of the learning and teaching process, it produces evidence that enables the assessor to provide feedback to the individual about how they are going or to highlight strategies that the learner may employ to address any identified improvements. Formative assessment also allows those delivering to ensure the teaching methodology used is allowing the learning to occur. Summative assessment tends to occur at the completion of a course of unit, it should determine that all specified learning requirements have been met to enable an assessor to confirm competency [12]. If a method of assessment used is reliable, valid, authentic, current and applicable then the use of summative assessment should allow for any assessor no matter what organisation they are employed from to arrive at the same assessment outcome decision.

If the STCW is truly a global standard, a reliable assessment tool should allow the same outcome from one approved RTO to another allowing recognition of training undertaken in other flag states. After all the International Maritime Organisation's (IMOs) Maritime Safety Committee (MSC), scrutinise and approve Flag Sate Authorities documentation for the meeting of this standard. As discussed previously and identified in [8] this is not the case and currently flag state interpret the requirements based largely on what they consider to be valid and in the case of Australia endorse training package material that does not necessarily allow assessment to reflect the industry required operating level of the advanced seafarer.

10. Competency

10.1 Definition

Competency is defined as the ability to do something well or efficiently [6]. The Standards of Training & Certification for Watchkeeping (STCW) Code at Part A identifies methods for demonstrating competency and the minimum standard to be achieved by the seafarer [10].

A number of the mandatory STCW courses are undertaken across the globe in a short course format. Currently at the completion of these courses students will have been assessed and deemed either competent or not yet competent. What does competence mean and how do now know when an individual has achieved the required level of competence? As a definition the word suggests a consistent application of knowledge and skill to a standard of performance that would be required in the workplace [12]. An individual having been deemed competent suggests they have the knowledge

and skills to meet the performance standards required in the workplace or industry, in routine and non-routine situations. In the case of advanced seafarers competency needs to more than the ability to apply knowledge and skills to meet workplace standards, there should be an expectation that such individuals are able to operate with a higher level of knowledge and skills. This enables them to meet challenges presented, through analysis, problem solving, innovation, conflict resolution and decision making. When determining competence the assessor must consider all dimensions of competency and not simply be satisfied with the observation of individuals performing a giving task or answering questions. The previous comments regarding a differential between VET and HE apply in this context. HE assessment would have a clearly described and prescribed performance criterion that the student would need to have satisfied prior to a determination being applied [9].

10.2 Dimensions of Competency

There are four dimensions of competency that assessors should consider during the collection of evidence to make a judgment of competency these include: "task skills, task management skills, contingency management skills and job role/environment skills [11] Across all four of the dimensions a fifth, transfer skills is embedded.

The following is an analysis of the four dimensions of competency starting with Task skills. The assessor would consider how well small outcomes have been captured along the way. As an example the assessor may look to consider the students ability to perform each section of a task in a correct, efficient and safe manner in addition to the completed task which may be the required outcome overall. When Task Management is considered it is the capturing of the students ability to manage a series of tasks leading to the completion of a required activity, such as; prioritising a sequence of interconnected tasks, meeting deadlines to allow for progression, communicate efficiently with team members, and delegation etc. The third dimension is Contingency Management which is the ability of the student to react to problems when undertaking a task or whole workplace activity, these may include: equipment failures, a necessity to modify routine, unforeseen occurrences, difficulties with persons on board and/or clients etc. Finally Job role/environment is the ability to meet the requirements of the working environment whilst performing typical work activities. In cases of emergency response it can require demonstration of ability to working with other crew members while complying with the safety management system, policies and procedures. The other embedded dimension is that of transfer skills. This is the ability to transfer their knowledge & skills and apply it to other situations.

10.3 What Does a Competent Individual Look Like?

In a broad sense a competent individual is one who has demonstrated their ability through application of knowledge and skill in both theory and practical environments. The person should be able to come back at any point in time and reaffirm they have retained that competence level, basically demonstrate competence over a range of activities and time line. The assessment process usually concludes that they are able to apply "specified skills, knowledge and attitudes to effectively take part or perform tasks expected in the workplace. This application is considered to be consistently applied over a reasonable time period [11]. Upon completion of a mandated short course, can the individual be assessed as competent, or have they merely been through a process of attending and participating in a course promoted as meeting the requirements of the STCW, and approved by the maritime authority of the flag state. In Australia this would be AMSA. The IMO recognised in 2014 that it had to ensure model courses reflected a uniform and consistent approach to competency that would allow approved RTO's the ability to deliver the required level of training. It recognised the STCW even with the 2010 amendments could still be applied in such a manner that one RTO required a higher level of demonstrated performance especially around short course programs [8]. Unfortunately in Australia the IMO Model course is not used as a basis of measuring the training package material as meeting or exceeding the standard level of education and training required. AMSA did have for a period of time approved model short courses that mirrored the IMO model course. It is worth noting at this point that the IMO model courses concerning shipboard emergency response training are outdated in that they

do not reflect conventional and contemporary shipboard response practises, and currently a number of these are being reviewed or re-written.

11. Innovation

11.1 What is Innovation

In the modern era, innovation and training is widely acknowledged to improve business productivity and reduce the cost of conducting business. It is a management tool that usually includes staff training which aims to change behaviours, lead cultural change and work practices or to increase productivity within an enterprise. This model is best described as training for innovation.

Innovation like so many of the terms described before is open to interpretation but could come to be excepted as meaning introduction or implementation of a new or significantly improved good or service, operational process, organisational managerial process or marketing method. For something to be an innovation, it needs to be new to the organisation. It can either be developed by the firm or be introduced to the firm. Innovation does not need to be something completely new in design or application.

11.2 Innovation in Training

Using the definition above, it can be interpreted that introducing innovative training into the classroom and workplace could conceivably improve learning outcomes in regards to operational processes. New processes of training, new ways to deliver learning opportunities and maximising the potential for learning should be the key goal for any learning strategy. The classroom is suggested as the place to try innovative approaches to knowledge learning and skill application as a seafarer's time on board being correctly mentored is decreasing, due largely to decreasing crew numbers as a more modern complex fleet is introduced. These ships are designed to do more, carry more travel further all with less crew and with the advancement of more complex systems of automation and computer there simply is no time available to effectively train a deck officer in real place and real time situations.

11.3 Acknowledging learning styles

But for an innovative training program utilising simulation to be successful it must be able to recognise one of the most difficult aspects of teaching short duration programs, and that is the inability to cater to all the various learning styles a student may poses. Fleming [13] discusses ways to understand and utilise different learning styles, referring to them through the term VARK or Visual, Auditory, Reading, Writing and Kinaesthetic, or put another way watching, hearing, researching and recording along with practical application. This concept is not new with much of our current teaching centred on classroom theory followed by practical application. In today's classroom it is the mix of theory and practical that at times does not balance out well with the required demonstration of competence. It could even be suggested that in order to attract and retain students, programs have come to concentrate on the classroom teaching so much that the critical element of student learning through practical demonstration, has been pushed further back. Grey [14] even considers this in his observation that today's ship's officer is spending more time in a classroom or simulator environment developing their knowledge and skill of ship's operations, that actual on the job mentoring is fast being lost. It is recognised that many reasons exist for this change; crew number reductions, a result of the ultra-modern vessel; insufficient numbers of mentors on-board, and shorter sailings between ports means less time to spend developing up the junior officer even if mentors were available.

It could be argued that Crowch [15] discussed this change in another way where he argued that due to the complex nature of today's international trading vessel man is not keeping pace with machine, and computer had stepped in to fill the gap and is capable if not making decisions well in advance of the human operator; hence error steps in misunderstood or misread warning signs. This then leads to a

consideration to what role innovation can play in the whole development process of the advanced seafarer student. It is known that while innovation in training has the potential to create both major benefits, it is also possible to create deficiencies. It is therefore important to question the need for changing training practices. There is no question that innovation can play an important part in maximising the value of training but then the costs do need to be balanced against the needs of the enterprise.

12. Simulation

12.1 What is Simulation?

Simulation can be described as the replication of a real world situation. In terms of Maritime training and assessment the IMO Intersessional Working Group (ISWG) describes simulation as 'a realistic imitation, in real time, of any ship handling, radar and navigation, propulsion, cargo/ballast or other ship-system incorporating an interface suitable for interactive use by the trainee or candidate either within or outside of the operating environment, and complying with the performance standards prescribed in the relevant parts of this section of the STCW Code.' [16]
Simulation in maritime training is currently used by many Maritime Training and Education institutions to replicate real on board environments and training scenarios such as ship handling pilotage, oil spill management, propulsion plant, electrical power plant, radar and navigation, dynamic positioning and crane handling. As emerging technologies are being developed, simulation is being used to train and assess seafarers within other aspects of a maritime situation such as launching, recovery and handling of lifeboats and rescue boats, firefighting and cargo handling. In certain circumstances simulator training is mandatory under the STCW convention. Electronic Chart Display and Information Systems, (EDCIS) enables the trainee to be placed in a realistic navigational environment that requires the student to analyse the situation, and make decisions based upon the situation. The complexity and intensity of the situation is easily adjusted to suit the requirements of the training.

12.2 Why Simulate?

Using simulation in training and assessment is useful for a variety of reasons. Training activities can be commenced relatively quickly and repetition of an exercise is simple. There are logistical constraints of training Deck Officers on board real vessels, manoeuvring in the vicinity of others within a port not being feasible from a time or cost constraint perspective. In this scenario, simulation in Ship handling using a full mission bridge simulator is invaluable and now assessment method of choice for many MTE's. The other very important benefit of using simulation is that it also enables emergency incidents to be trained for, without imposing any risk to personal safety, equipment or the environment. Crowch [15] discusses a dynamic operating environment as opposed to more stable surroundings. He suggests that aims are different in this dynamic environment due largely to the shipboard officer needing to maintain control over a variety of conditions in a short time frame as opposed to the stable environment which affords time to seek a long term solution. A critical factor here is the ability to make timely decisions based on knowledge, one of the key tools expected of any emergency response officer whether they are land based or ship-board; understand the situation, evaluate options and respond.

12.3 Levels of Simulation

There are different levels of simulation that vary in the degree of complexity and technology. Full mission simulators that look and respond like the real operating environment and interact with other operating stations are the highest and most realistic of simulators. More basic levels of simulation include small operator stations with less realism and at the most basic level a single computer or laptop that gives limited realism, however, is useful for decision making skills for the trainee and conducting theoretical assessment.

In terms of training seafarers in STCW short courses involving emergency response, many of the competencies the student needs to be proficient in are practical skills that require the trainee to physically use equipment and demonstrate practical competencies as stipulated in Chapter VI of the STCW Code[10] Examples include training in personal survival and fire prevention where the trainee must demonstrate activities such as jumping from height into the water, righting an upturned life-raft, using portable fire extinguishers, fighting fire in smoke-filled spaces wearing self-contained breathing apparatus. These skills are important to physically practice as learning is achieved by the body's muscle memory learning the process through doing rather than watching a video or listening to a lecture. The latter does not give the student a feel for the real equipment, such as operating firefighting extinguishers or donning heavy breathing apparatus, feeling the weight and experiencing the possible claustrophobia associated when using this equipment in a smoke filled compartment. There can be no doubt that practically carrying out certain activities using real equipment is the best form of training, however, once these skills have been acquired it prove useful to advance to higher levels of training through the use of simulation. This level of training would focus on the human elements including stress tolerance and human resource management. It has been discussed in recent times that when people are faced with an overwhelming situation such as a major incident they often will not react appropriately and may actually physically and mentally freeze due not being prepared or not having considered what they would do in an emergency situation [17]. Even though ship's officers undertake education and training to deal with on-board emergencies they like so many of their land based counterparts are not tested under extreme operating conditions to understand their actions or inactions. They don't have the opportunity to have this critiqued for improvement and preparedness as people who will be responsible for managing and controlling an on-board event.

12.4 What would simulation of advanced seafarers look like?

Recognising that behavioural inaction may occur at any stage it is important to understand how a potential deck officer will react and identify what corrective actions can be introduced, and monitor whether they improve performance. This would be achieved through the implementation of a suitable enhanced training programme that could use standalone or current computer based simulation programs. Through innovative thinking and the adaption of military approaches that use simulation a range of operating conditions could be presented that would require the student or students on the bridge to identify and deal with an evolving emergency while still maintaining effective control and operations of the ship. As previously discussed military training of bridge officers is conducted in a very similar way. The biggest difference is a merchant vessel does not have missiles or torpedoes being directed at while still trying to refuel or resupply another vessel in less than ideal sea conditions. It is acknowledged a military vessel would have a much larger, and depending on the threat, specialist bridge personnel, but taking this into consideration the setting of priorities, the execution of a plan the channelling of information all remains a common event. The student could be immersed into a simulated cargo shift that then results into a leak which in turn catches on fire. It would be possible to monitor and even measure the student's reactions to the events as they unfold. The scenario could be staged up to introduce other traffic, loss of steerage and a communication failure between engine room and the bridge.

The scenario could require the student to make decisions based against the information before them, it could be voice recorded and videoed for play back during a critique and debrief of the scenario. The event could be reloaded and with amendments run again looking for uptake of corrective actions. It would be envisaged to start with a relatively simple scenario and build complexity as the student developed confidence to the point of a likely scenario is presented. The detail and list of considerations could be as basic or complex as required and this is where maximum value in this type of simulation training would lie. Ability to draw back on past experiences and use them as learning tools is also a reason to apply a build-up level of bridge simulations based around developing emergency response. Reason [18] discusses the need to learn from any past error and it would be possible to load up a series of events that have been investigated and evaluated in terms of what went wrong and why. In today's highly complex operating environment, that forms a ships bridge, it would be possible to measure the human response to the unfolding event, looking for psychological and

physiological reactions and have these evaluated to see how well prepared the student is from classroom based training.
To summarise the ideas brought forward a reflective interpretation of Alainati, AlShawi and Karaghouli,2009 [20] where they discuss the effects of education and training on the development of competency. The operating environment of their paper is different but the key concepts of providing education and training to determine competence is the same. Their conclusion that competency is integral to the success of an organisation, and with constant change in technology the employees of the organisation have to know how to make the right decisions in order to effectively react to any change of circumstance no matter when this may occur supports our maritime training and education environment as discussed and argued in this paper.

13. Conclusion

In considering the assessment process for the advanced seafarer it is evident from the material discussed so far that there is a need to apply a more holistic approach to the assessment process, whereby learning activities and assessment tasks are integrated throughout the course subjects. It is further evident that to meet the operating and management criteria outlined in STCW short courses covering emergency response there is a need to ensure realistic and as close to real time incident scenarios are matched up to general ship board operation. It is further evident that if this is to a recognised approach and become learning and teaching practice, it can only be achieved by use of simulation. If simulation was introduced early in the career path of the deck or engine department worker it would quickly set the scene as to what the role is all about. This may allow formative assessment to be applied across multiple higher or vocational education subjects or through pre-course work over an extended period, with the attendance at the short course culminating with summative assessment to determine competence. Unlike other competency based assessments decisions are usually arrived at the conclusion of the learning and teaching, when a decision is made based upon the demonstration by the seafarer of acquired skill and knowledge. Usually the decision is a simple competent or not yet competent, but in the case of the advanced seafarer the decision making is somewhat more complicated, because while the time line is similar to the other short course subjects the level of operation is management and the expected performance outcomes do not necessarily match the students role or function within the staff structure on-board the ship.
By way of concluding the paper the question around innovation and whether it can be applied to short duration programs needs to be considered in terms of what it could do to benefit what is already in place. Recent anecdotal discussion around why the merchant bridge operation differs from the navies bridge operations lead to an enjoyable debate around why the training methods utilised by navy would not fit the operations of a Very Large Crude Carrier, (VLCC). The consensus appeared to be around bridge human resource numbers. In military style operations the number on a bridge could be upwards of 20 staff, all with varying role and responsibility all of which direct towards ensuring the ship in question remains an active part of the fleet it is sailing with. In other words it needed to continue on with its assigned job no matter what the circumstances. When considering the merchant VLCC, while bridge numbers would be reduced the importance of ensuring the ship continues along its chosen route with little to no delay is the same focus; continue to fulfil your role no matter what.

This paper considers the above comments in the context of applying a more realistic and consistent approach to the bridge training on offer. Realistic and consistent in terms of what is being applied and assessed is actually part of their everyday work routine, and part of something that is likely to occur; not some hypothetical approach that has no to very little chance of eventuating. The application of innovation becomes a systematic approach conducted in the first instance in the simulator room and is applied as the student comes to terms with dealing with ship operations under normal conditions a build-up of changing conditions is introduced over a time period that allows the students reactions to be monitored and measured, the outcome of which would allow for critical reflection and critique.

Over a defined time period the students reactions will be plotted against a base line that will show either a changing approach to their reactiveness of the situation to the point where a degree of

competence can be seen and measured through to no change at all and a complete misreading of the situation; will the employee adopt better work practices, is there a benefit to compliance, is productivity increased, or decreased in cases of injury or reduced risk associated with high risk activities. In emergency response there is no doubt practical application plays a key role in ensuring our advanced seafarers have capability to deal with the unfolding scenario. But it could be so much better if they have already been exposed to a range of innovative simulated problems along their career pathway. In terms of being put under pressure and understanding how you will react is no different in merchant navy requirements than it is in military bridge operations. The concept of decision making is the same just slightly different contexts; naval war machine versus merchant super cargo carrier.

Both require the human being to read a given circumstance and react with a set of priorities depending on the requirements of the job. We put our officers of tomorrow on the bridge and give them a range of circumstances that would be commonly dealt with when at sea. We may create a cargo issue juts to give them some complexity. But at no point do we escalate, monitor and measure the decision making and response capability of the student in charge. We don't de-brief after reach incident to see what portion of accountability they are willing to accept for the way the scenario played out. Conversely if this was done as part of the students pathway development; factored into their deck or engine training the current practical demonstration events would take a structured direction where the student is applying true skill and knowledge learnt and could be deemed competent after a more realistic application of skill over time. So the argument of this paper is that a place for innovation, especially around short duration programs does exist, it is a matter of determining what level of complexity could be measured, where and how that would fit in with a program that is competitive and consistent with other RTO's nationally and internationally so as to ensure compliance with IMO requirements.

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