Contradictions in the practices of training for and assessment of competency

A case study from the maritime domain

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Abstract

Purpose – The purpose of this paper is to highlight the contradictions in the current maritime education and training system (MET), which is based on competency-based education, training and assessment, and to theorize the failure to make the training useful.

Design/methodology/approach – A case study of education and training in the international maritime domain was conducted. Data sources include historical documents, rules and regulations concerning MET, syllabi, handouts, sample questions, field notes, an ethnographic study in a maritime college and interviews conducted with experienced mariners and course lecturer.

Findings – There are contradictions in the education and training system that do not allow the targeted objectives to be fulfilled. Fundamentally, the assessment system has changed the objectives of the education and training practices from learning skills and knowledge required on-board ships to passing competency examinations.

Practical implications – The practical implication of this research is valuable for the International Maritime Organization, marine administration and maritime training institutes to think over the competency-based system in practice today and how to improve the present maritime training and assessment system in order to achieve its authentic objectives.

Originality/value – This research identified and bridged the gap in literature and research of competency-based training and assessment in the maritime domain and provides practical solutions for improving this system.

Keywords Oceans, Seas, Competence based training, Marine safety, Qualifications, Assessment

Paper type Case study

Introduction

Despite an extensive international education and training system, which requires mariners to continually upgrade their knowledge and skills throughout their working life, there still are large numbers of maritime accidents ultimately attributed to human failure. Mr Mitropoulos, secretary-general of the International Maritime Organization (IMO; a technical agency of the United Nation), addressed the Maritime Safety Committee following a series of recent major marine accidents:

> It is extremely sad and disappointing that accidents [by ships] still happen, in spite of the extensive and thorough work … that IMO has done over the years … Meanwhile and although we have not yet reached the half of the year, I am concerned … for the number of people who have tragically died since the beginning of the year. My assessment is based on the loss of life [some 1,400 in total] in the context of the casualties involving [only] the passenger ferry ships (Mitropoulos, 2006).

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More than 80 percent of maritime accidents are attributable to the so-called human element on-board ships:

> Maritime accidents are not new phenomena, they have been with us for a very long time. We should be clear that the reason why accidents continue to befall ships is, in the vast majority of cases, because somebody, somewhere along the line, did not take proper action to avert a problem, or did something wrong (O'Neil, 2003).

In response to that problem and with the aim to diminish accident rates (O'Neil, 2001), the IMO adopted a convention on the *Standard of Training, Certification and Watchkeeping for Seafarers* 1978 (STCW78) to set standards for training mariners. It turns out, however, that the STCW78 did not prove effective (McCarter, 1999): IMO completely revised the convention and introduced the Competency Based Training system (CBT). Again, even though the training system aims at competencies, the rate of attribution of human element in accidents continues to be high (Alop, 2004).

This study was designed to find out where there might be problematic spots in CBT practice in maritime domain that leads to sub-optimal effects of the training system. Our study shows that there are a number of contradictions within the system that makes – among others – trainees to focus on passing examinations rather than appropriating useful knowledge and developing relevant skills.

We begin by providing a historical background to the problem and the changes in education and training. Following a description of research method, we report on our case study of the different components of maritime education and training (MET) and then proceed to articulate the ways in which assessment practices mediate learning and foci of the trainees. We conclude with suggestions for the improvement of the MET system.

Historical background

Seafarers, including deck officers and engineers, operate merchant ships around the world. Each one has specific, multiple, and varied jobs and responsibilities to perform. The needs of ship-owners – who want to be sure that their employees were well trained, skillful, and reliably operating their ships – resulted in creation of a certification system. Originally individual governments established their own standards of training, certification and watch keeping of officers and ratings, often without reference to practices in other countries. As a result, standards and procedures varied widely (Alop, 2004). But the fact that the merchant shipping historically has been the most international of all industries needed a harmonized single standard of certification.

Developing universal standards

It always has been recognized that the best way to improve safety at sea is developing international regulations that are followed by all shipping nations. In 1948 the United Nations established the Inter-Governmental Maritime Consultative Organization (since 1982, the International Maritime Organization (IMO)). The original vision of IMO was to improve safety by improving technical aspects of shipping. It was not until the early 1970s, when statistics showed that the main factor in maritime accidents was and continued to be the human element, that IMO officials attempted to curb accidents by setting standards of training for seafarers (Wilcox, 2000). As a result the IMO created

the *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978* (STCW78). The STCW78 sets qualification standards for masters, officers and engineers on seagoing merchant ships, which signatory countries are obliged to meet or exceed.

At the time, the IMO was a consultative organization and politically with limited power; it therefore left part of the standards to the satisfaction of governments. Sometimes after 1984, many in the field felt that the STCW78 was unsuccessful (Zec *et al.*, 2000) because it included vague requirements that were left to the discretion of each government (Bobb, 2000) and because there was a lack of clear standards of competence (Fink, 2001), which resulted in different interpretations being made. There was also a demand to bring the *STCW78* up to date (Moreby, 1999). Finally from 1992 on – after a series of major human-caused shipping accident with disastrous consequences (environmental pollutions and loss of lives) and faced with demands for action from politicians, press and public – the IMO decided to review the Convention.

In 1993 the IMO embarked on a comprehensive revision of STCW78 to establish the highest practicable standards of competence. On 1 February 1997, the new amended *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1995* (STCW95) entered into force. It laid out greatly improved seafaring standards through competency-based training (CBT). The training mandate of STCW95 is outcome based; it requires that candidates for licenses demonstrate their ability to perform the task for which they are going to be certified. It means applicants for competency certificate are expected to show that they are able to "do" what they are trained to do (Hardin, 2000).

Competency-based training

The competency-based movement has been around from 1960s onward in the USA in the performance-based vocational teacher education (PBTE) movement. However, its origin can be traced further back to the 1920s, the idea of educational reform linked to industrial/business models centered on specification of outcomes in behavioral objectives form (Burke, 1989). It has been noted that the idea of CBT is not new; it is ancient, as we look back at how job training was carried out hundreds of years ago (Blank, 1982). It is a way of returning to a personalized, individualized approach to transfer of skills from master to novice. Competency-based education and training, sometimes modified by adjectives such as "performance-based," "outcome-based," or "criterion-referenced/validated" was riding a new wave in the 1980s and 1990s especially in Europe. In some countries CBT integrated into the national education system (Lewarn, 2002a) such as the National Vocational Qualifications system in England, followed by Scotland, Wales, Australia, and New Zealand (Kerka, 1998).

Competency-based training is based on explicit behavioral or outcome-based statements (Smith and Keating, 1997). This means that it relates to everyday life out-of-school requirements of performance and reflects outputs rather than inputs (Fletcher, 2000). There are mainly two concept of CBT presently in practice, the US and UK model. The UK standards or competences are considered as units of assessment of workplace activity, whereas in the US model it is the use of competencies within the learning process that takes priority. The US model is related to a training program, whereas in UK it refers to training and assessment in the workplace or in a job-like environment – although the focus in the USA has also now shifted to the on-the-job

training (Fletcher, 1991). IMO adapted the UK standards model of CBT for its STCW95 (Winbow, 2005).

Competency-based education is perceived by some as the answer, by others as the wrong answer, to the improvement of education and training for the complex contemporary world; and proponents of CBT promote it as a way to improve the correspondence between education/training and workplace requirements (Harris *et al.*, 1995). It makes as clear as possible what is to be achieved and the standards for measuring achievement. But there is no necessary bifurcation between competence and education (Wolf, 1995). Competency-based training is perfectly compatible with the learning of higher-level skills, the acquisition of generalizable knowledge, and understanding and development of broad based courses (Burke, 1989). For its opponents, CBT failed to integrate learning and human action (Hager, 2004). From this perspective, it is thought to be excessively reductionist, narrow, rigid, atomized, and theoretically, empirically, pedagogically unsound, and therefore "largely unsuitable for the teaching and learning which goes on in higher education institutions, whether this occurs in general/academic or professional/vocational contexts" (Hyland, 1994, p. 336).

Method

This study was designed to better understand the apparent contradictions that exist in a system of education and training specifically designed to increase the competencies of practitioners – seafarers. This exploratory qualitative study is part of a larger project concerned with what and how people learn as they do move from formal educational settings – e.g., college – into their everyday work settings (Ardenghi and Roth, 2007; Lee and Roth, 2006; Racca and Roth, 2001). The present investigation is based on a case study in a Canadian maritime institute. The research focused on a course presented by the institute for the candidates of second-level watch keeping certificate of competency for ships engaged in near coastal voyages and fishing vessels. There were 16 students attending this nine weeks course. These students had acquired their first level of watch-keeping certificate of competency earlier and after working for some years and acquiring experience on-board ships, they pursued an upgrade to be certified at a higher level. The students were from different maritime industries such as commercial fishing, passenger ferrying, and cargo carrying. They had considerable but varying backgrounds and work experiences.

We attended and videotaped the classes and did interviews with students and the course lecturer. Our data sources comprise field notes, videotaped sessions in the classroom, and interviews. Our interviews consisted of open-ended questions and we encouraged the interviewees to talk about and focus on the topic of their main concerns. The data sources also included documents such as lecture notes, syllabi, handouts, sample questions, Transport Canada's rules and regulations, and copies of the STCW conventions.

Our (authors') combined competency training and experience granted us deeper understanding of the subject matter. The first author brings practical knowledge of the maritime education system, as he has a long experience working as a mariner on-board ship and as a maritime lecturer. The second author has an extensive (published) research work on transfer of knowledge and skills from the formal setting to the workplace and workplace learning.

Practice in maritime education and training

The maritime education and training system is set by an international convention. As mentioned, the original convention – STCW78 – was not successful, so it has been completely revised to meet its objectives. Despite this new set of standards – STCW95 – the attribution of human element in the shipping accident did not decrease. The lack of success of the new convention in reaching its objectives (Chawla, 2006; Wilson, 2007) may be due to the contradictions that our study found in the system. Our study reveals that the mariners trained in this system generally are not convinced that the education that they receive is of much benefit to them. Thus, one mariner stated the issue in a rather typical way:

> It is an education designed to screw you up, not education designed to help you in a working world.

Another participant, a certified mariner, expressed his experience from the system and not believing in himself being qualified, although he was successful in competency exams stated:

> Now I am qualified (air quoting) but really I didn't learn very much, learned a little bit.

These comments from experienced mariners attending a prerequisite course for a second level certificate of competency are not uncommon. The question is this: How has the current practice in maritime education, training and certification resulted in these apparent contradictions between the intentions of the curriculum and the experience of the students?

According to the new standards, each candidate for certification – as officer in charge of a navigational watch on-board ship – should be able to demonstrate the competencies prescribed in the convention. These competencies are to be achieved through a combination of education and training plus practical experience on-board ship (IMO, 1996). To match those requirements, maritime education and training generally consisted of training of skills (in a number of practical short duration courses) and education of knowledge (of defined theoretical subjects) in the college plus a mandatory period of seagoing experience on-board ships. The education and training models are based on interaction and turns of these segments. The maritime administration of each country is responsible, through IMO, for the implementation of STCW Convention and issuing the certificates of competencies. In the following sections we discuss the functions of different sections of MET in practice and elaborate the shortcoming and contradictions in them.

College education

Formal education is designed to provide the knowledge and understanding required by the students to underlay their future tasks on the job. This is also the case with MET: its main purpose is to give the students the theoretical background and the knowledge that they require on-board ship, but in practice it is not doing so. Our study shows why this part of MET does not fully achieve its objectives in practice. The mariners and lecturer in our study did not believe in the idea that knowledge could be transferred to the job. A contradiction therefore emerges between what is expected to be the case and what actually happens during education and training. The main reason for this is the certification system and the way that its competency assessment is arranged by

maritime administration: what is taught for certification assessment does not coincide with what is required on-board ship, so that the students learn to pass tests rather than learn for on-board work.

Education in the college is not a pre-requisite for obtaining a certificate of competency but success in certain written and oral examinations implemented by the administrator is a compulsory requirement. Written examinations are in the form of multiple-choice and long answers and after success in those, students also attend an oral exam. There is no specific requirement from the administration to assess the competency of the candidate for all required tasks through evaluating their performance – while they are actually doing the task either on the job or in a job-like environment. It created a contradiction in the MET system because there is no necessity for the students to develop job-related competency but to acquire the knowledge required to successfully pass the examination.

Students have the choice to attend the courses in the college or to prepare for examination by themselves. Our study shows that the students generally find it easier to prepare through self-directed study. However, for the more difficult exams – mainly those involving mathematical calculation – they prefer to attend college courses. Course attendees' primary concern is passing the exams rather than the acquisition of job-related competencies. As one student (who studied on his own and passed all but one exam) stated:

> So I upon not being able to get the proper amount of knowledge to pass this exam on my own I decided to come to do this particular course just for this one exam.

He articulated his objective for attending the course, which is acquiring the type of knowledge required for passing the test. We found that in general, students' perception of the certification examinations mediates their approach to learning while attending college. Their primary demand of the course lecturer was to prepare them for the exams.

To attract students to the courses, maritime colleges have to consider the objectives of students because they are their clients. Due to that reason they also have to concentrate on teaching the students how to pass the examinations, a fact evident from the comments of the course instructor:

> From here my students after they complete my course they go back to TC (Transport Canada, the administrator) to be examined and to me it is an obstacle . . . I spend way too much getting students to prepare to write examination as data.

For the instructor, the examinations constitute an obstacle, as he believes that the students do not even need to understand the tasks but merely provide correct answers. Our classroom observations reveal that the lecturer put substantial effort into the delivery of information that historically appeared in competency examinations. This was in direct response to students' requests and his desire to have the students succeed. This shift in objectives from the acquisition of job-relevant knowledge and competence to passing examinations is a source for the less than optimal benefits mariners draw while engaging in CBT.

College-based training

In contrast to the educational part, training in the maritime college works more successfully to reaching objectives; but the training covers only part of the skills that

mariners need on-board ships. As a result it does not close the existing gaps between what is learned and what is needed on the job. Successful training in a series of short-duration technical courses in college is a compulsory aspect of the certification system. The training courses generally are approved by the administration. It means that in most cases the colleges have the authority to assess the students for the courses and issue the relevant certificate. This part of the MET most closely matches the criteria set by the competency-based training system, as the main base for assessment in these courses are successful performance of the task in a similar environment to the ship.

For every level of certificate of competency there are certain short courses that the mariners have to take. The duration of these courses – which focus on emergency, safety and other specialized topics – varies, depending on the requirements. The courses are mainly hands-on and consist of theoretical and practical parts. Students in our study generally were satisfied by what they were able to learn from most of the courses. The students are assessed mainly while they are engaging in doing tasks and the assessor has to be convinced that the students are competent in doing those tasks on-board ship. Dave, one of the participants in our study, who attended one of these courses and was satisfied with the result after he applied it on the job, mentioned:

> It was very useful, very applicable . . . I really enjoyed that course I got a lot from it and I used it and it helped me a lot and it kept me off the rocks.

The practical nature of these courses and the direct relation that the students could make between these trainings and the practice on-board ships was a motivating factor for students, who felt that they would be able to transfer the newly acquired skills to their on-board work.

In part, the usefulness of some of these courses derived from the fact that the students worked on simulators, which constitutes an environment closest to the real thing and the associated assessment therein comes closest to the requirements set by the CBT: "The SEN [Simulated Electronic Navigation] course, I got a lot from that. I was really comfortable after having taken the SEN course. We were working on boats (in simulator) and running at night and all of that stuff" (Dave) and "I found, when we did SEN . . . I found it really fun; it was all practical, very useful stuff" (Kim). The short courses are very close to competency-based criteria and provide the satisfactory result. Our analyses reveal that the students are more satisfied by these courses than by other aspects of their college-based education. They actually felt more confident, prepared and competent to do what is required of them on-board ship.

Training on-board ship

Among the mariners, on-the-job training is generally held to be the best part of the system in developing the competency they need to act successfully on-board ship. Whereas there is a great potential in the on-the-job training, our study shows that in practice it is not taken seriously by most of the ships' staff and students and, as a result, the learning outcomes are unpredictable. The main problem encountered was the lack of supervision on and cooperation with the students' learning on-board ships on the part of ships' officers, shipping companies, and training institutes (Lewarn, 2002b).

Working on-board ships for a specific period of time also is a prerequisite for the certificate of competency. Candidates are asked to provide proof that they worked as a mariner for a certain period of time on-board ships before they are eligible for the certificate. The idea is for candidates to spend time in the workplace where they can appropriate the required job-related competencies. There is no supervision of the training of mariners on-board ships and there are no assurances that students actually obtain the required competencies, which compromises the effectiveness of this part of MET.

There is an alternative method to the structured on-the-job training mentioned above. The alternative method stated in the STCW95 (regulation II/1 part 2.2) to the structured on-board training is to spend longer period of time on-board. In this way candidates do not have to provide any evidence of actual in-service training apart from spending specific time on-board ship. In this method there is no supervision on the students' workplace learning and as a result there is no assessment. All mariners in our study had received their on-board training in this way.

The unstructured and unsupervised working on-board ship creates unpredictable training outcomes. There would be no training system in place to control the variables, which affect the acquiring competency by the mariners. Our observations reveal that the mariners do not receive the target level of skills and as a result the competency required. Thus, one of the experienced mariners stated:

> Sea time is not structured at all in any way. I am just a body on-board that do the job that anybody will be doing it. You are not training at work you just learning by yourself and you know, if you are motivated it will workout good and if you are not you can just be a body that is in the mess doing the bare minimum.

Although the STCW95 stipulates that on-the-job training is one of the most important parts of training system, it turns out that in actual practice, this most promising aspect of training is associated with the least predictable outcomes.

Assessment for certification

Assessment is an important part of every training system. It gives an insight to whether the objectives of the system were met and if trainee developed the required skill and knowledge (Lefrancois, 2000). However, as studies in high schools science show, assessment may actually contravene attainment of educational objectives (e.g. Roth, 1998, 2000). Our observations in the present study show that this is also the case in our MET, which leads to an inner contradiction whereby some aspects of the system become impediments to achieving the goal of the CBT as a whole.

After completing education and training in college and on-board ship, an administrator ascertains whether candidates are qualified to receive the certificate of competency. Although STCW95 stipulates maritime certification to be based on competencies, our study reveals an emphasis on knowledge assessment by means of written and oral examinations. This changes the way that the mariners approach learning and shifts their objective from acquiring competencies to memorizing what is required to pass examinations.

Students' perception of assessment shaped their approach to learning. They discussed the examination from the beginning of the course and wondered about the nature of assessment questions, mediated their prior experience of competency

examinations from earlier certificates. Students were concerned about specific issues in the exams. For example, they doubted the validity of the exam questions, considering the questions to be outdated and not to have practical implications for their on-board work. Thus, Kim suggested:

> . . . a lot of the stuff on the exams was like, out dated information, completely irrelevant to what is in practice and even in theory today.

The instructor appeared to be in agreement:

> Quite often the examinations are reflecting history, and have not been up-dated. For example, my student may go down and write an examination for a topic, examination was put together in 1976.

The way that the conventional assessment system is in use today is not even achieving its claimed objective: assessing the knowledge an officer needs on-board ship to act successfully. Because examination questions are drawn from a question bank, they may appear identically across different examinations:

> Yes they were all the same. They haven't changed in thirty years, forty years, you know, they had converted them from imperial to metric. They are that old (Rick).

Our findings are consistent with those of other studies that revealed the severely compromised nature of examinations that reused the same questions year after year (Stutman, 1997). Students' perceptions about assessment significantly influence their approaches to learning and studying (Boud, 1995; Struyven *et al.*, 2005). This affects the whole education and training system as the students aim to pass the exams, knowing that all they have to do is get ready for the set of largely known questions:

> Ian or Pal or any other instructor have to teach you to pass the exams, right they have to teach you the kind of trickery to get you through the exams as well, which is the waste of his time, our time and the industry's time (Dave).

Answering these questions became the primary objective of teaching and learning, leading the instructor to muse:

> So what I am having to do is trying to figure out what TC may want and what I am end up to do is wasting lot of students learning time teaching history instead of teaching today.

He also oriented toward teaching outdated knowledge, because he wants the students to be successful in the certification examinations, rather than focusing on teaching useful, present-day knowledge.

Students were also very concerned with the practicality of problems expressed in those examinations but their main concern were to know the type of answers that the administration required for specific questions and not necessarily the valid practical answers. The following is part of a conversation happened between students and instructor in one of the classes when they were working on previous competency examinations questions:

> Raymond: is it really possible? It is practically impossible. I cannot believe that Transport Canada still trying to teach that.
>
> Instructor: it is a principal question.

> Raymond: I know but it's … it is completely against all practical sense; it goes against all practicality …

And after a series of discussion between the students about the possible answers, Dave asked the instructor: "For the purpose of Transport Canada which answer would they prefer to see?" The last part of the excerpt demonstrates again that the students' objective was not necessarily to find the correct answer but what is needed to pass the exam.

Students' demand resulted in final sessions of the course being assigned for reviewing the sample questions from the available previous competency examinations' question banks. When the students are under pressures for the score they have to give up or beat the system (Ebel and Frisbie, 1991), teaching the test questions and corresponding answers is one response (Muirhead, 1997). The administrator is informed of this flaw in the system but came up with the solution of creating a new set of questions. This is a temporary solution, as one of the students mentioned:

> Now I understand they are coming up with new questions but twenty years down the road everyone is going to have those questions.

As the students noticed, the solution presented by the administration may not solve the problem but at the most it may postpone it. Inappropriate assessment procedures encourage superficial learning and varying the examination questions may not be enough to fully evoke deep approaches to learning (Ramsden, 1997). It seems that it might not change the perception of students about the examination and as a result it most probably does not affect the way that they approach learning.

Discussion and conclusion

Our study reveals considerable contradictions inside a system designed to improve the education and training of mariners. We are not claiming that these contradictions cause poor competencies and that these cause marine accidents; human error is possible even among the most competent individuals. But mariners obtaining certification without actual competency assessment contributes to the belief that mariners are competent when no (little) evidence has been gathered as to whether this belief is justified and therefore constitutes factual knowledge.

As a way of addressing what is required to make education and training more relevant, we asked mariners who were participating in the course about their suggestions for improving the system. Some suggested that the improvement should mainly come from the administrator, as they were the regulator and also the invigilator. The mariners' suggestions were centered mainly on better and greater supervision and monitoring of sea service – on-board ship training – and examination process. One of the students mentioned that there is a need for supervision on the whole training and assessment process. He even suggested that it might come from a third party who has the authority to supervise the administration, shipping companies and the colleges: "It would have to come from federal government I think because they are the regulator". He then added, "Someone that sort of encompasses all three of those that regulates the colleges, the employers and the examiners and transport Canada, you know, someone who could have a better picture, a better picture of the whole scenario". Other suggestions were focused mainly on two issues, the course itself and the examination. For example, Kim noted:

> Modernize it, like we spend all that time on chart work and sounders and stuff like that but it is all obsolete equipment. Realistically when we all go back to work, we are going to fire up our computerized charting system and everything like that.

These and similar suggestions are directed to the administrators, as they are the ones who provide the course objectives, either directly or through the type of their assessment system.

Our study implies that the IMO and the examination administrators have to do more than just prepare guidelines regarding CBT but they have to arrange a proper transition process to this training concept. The certification system has to be modified as it has direct effect on the way that the maritime institutions and workplace deliver and the students obtain the skills and knowledge required to be a competent seafarer. As a result mariners would learn more than how to be successful in the examinations: they would learn to be authentically competent and perform better on the job. The implication of the competency-based training in its right format will help the students to attain the required competency. To do so, the IMO and subsequently the administrators have to establish authentic standards that seafarers have to actually (demonstrably and evidentially) exhibit to be a certified as competent mariner. These standards have to be detailed and clearly defined so that the students and the trainers know exactly what is expected from them and assessors know what is to be assessed. Assessment might be implemented as a continuous process, whether in the college or on-board ship. The teachers in the training institutes and the mariners on-board ships – responsible for the training of the students – need to be familiar with the competency based assessment technique. They would then evaluate the students for each competency standard that he or she becomes able to do. The cumulative record of the success of ability of doing all the required standard of competency can act as a prima facie evidence for the administrator that the student is competent and eligible for the certificate of competency. The administrator might focus more on supervising and appraising the entire process of training and assessment instead of becoming directly engaged in assessing students for certification.

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