ISO 9000:2000 Quality Management System
and Problem Based Learning in Met

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ABSTRACT

Seafarers are the core element of the shipping industry and demand for competent and well educated seafarers has been growing. Due to the global nature of the shipping industry, structured, standardized, internationally accepted, monitored and assessed education and training are vital elements to meet this demand and expectations of the shipping industry.

The STCW convention, adopted by IMO in 1978 and revised in 1995, defines standards for training, certification and watchkeeping for seafarers. According to the STCW 95 convention, all MET shall be monitored by the administration through a quality management system**.**

STCW requires that all activities relating to training, assessment of competence, certificates, endorsement and revalidation are continuously monitored through a quality standards system and the STCW Code A-I/8 states that an independent evaluation should be conducted at periods of not less than five years.

Dokuz Eylül University School of Maritime Business and Management has been implementing ISO 9000:2000 quality management system for three years in order to meet the requirements of STCW Code A-I/8. With regard to that fact, a detailed process has been applied to all stages of the education and training. In addition to that, School has started to apply Problem Based Learning (PBL) system. PBL is a learning method based on the principle of using problems as a starting point for the acquisition and integration of new knowledge.

This paper attempts to introduce the quality management system and its application within the Problem Based Learning system concerning the STCW Code A-I/8 requirements in School of Maritime Business and Management.

1. Introduction: STCW and Quality Requirements

Seafarers are the core elements of shipping industry and it is widely quoted that 80 per cent of maritime transport accidents are due to human error. For nearly two decades, the international maritime community has shifted from the approach, which seeks only technical solutions to safety-related problems, to focusing on the role of human factors in maritime safety. On the other hand the demand for competent and well-educated seafarers is growing day by day. To

meet the above-mentioned demand and expectations of the shipping industry and the international feature of the shipping industry, structured, standardized, internationally accepted, monitored and assessed maritime education and training has gained importance.

The STCW convention, adopted by IMO in 1978, defines standards for training, certification and watchkeeping for seafarers. In 1995, Convention was completely revised and updated to clarify the standards of competence required, introduce qualification requirements for trainers and assessors, provide effective mechanisms for enforcement of its provisions and allow greater flexibility in the assignment of functions on board ship.

This convention reinforces the criteria for eligibility of seafarers and requires proof of the effectiveness of measures introduced to satisfy the intentions of the convention. It seeks to establish a baseline standard for the training and education of seafarers throughout the world and, by placing an emphasis on quality control and competence-based training,

The STCW seeks to ensure the highest standards for functions and processes relating to a mariner's competence. To do this, all training, assessments of competence, certification, endorsement and revalidation activities regarding STCW certificates must be monitored by a quality standards system (QSS).

Under the section A- I/8 "Quality Standards" of STCW Code; Parties are required to ensure that all training, assessment of competence, and certification activities are continuously monitored through a quality standards system to ensure achievement of defined objectives. An "independent evaluation" of the knowledge, understanding, skills and competence acquisition and assessment activities, as well as of the administration of the certification system, is to be conducted at intervals of not more than five years. The evaluation must be conducted by persons who are not themselves involved in the activities concerned to verify that (IMO, 1996);

- Internal management activities comply with planned arrangements and documented procedures, and are effective in achieving defined objectives;
- The results of the independent evaluation are documented and brought to the attention of those responsible for the area being evaluated; and
- Action is taken to correct deficiencies.

Section B-I/8 of the STCW Code that provides guidance on applying a quality standards system to training and assessment activities states that each party should incorporate the following key elements (IMO, 1996):
- An expressed policy regarding quality and the means by which such policy is to be implemented
- A quality system incorporating the organizational structure, responsibilities, procedures, processes and resources necessary for quality management;
- The operational techniques and activities to ensure quality control
- Systematic monitoring arrangements, including internal quality assurance evaluations, to ensure that all defined objectives are being achieved,
- Arrangements for periodic external quality evaluations.

1.1. The Quality Standards Model for Assessment of Knowledge, Understanding, Skills and Competence

As per STCW Code Section B-I/7, (4) the quality standards model for assessment of knowledge, understanding, skills and competence should incorporate (IMO, 1996);

A quality policy: including a commitment by the training institution or unit to the achievement of its stated aims and objectives and to the consequential recognition by relevant accrediting or quality standards authority,

Quality management functions that determine and implement the quality policy, relating to aspects of the work which impinge on the quality of what is provided, including provisions for determining progression within a course or programme

Quality system coverage of the academic and administrative organizational structure, responsibilities, procedures, processes and the resources of staff and equipment

The quality control functions to be applied at all levels to the teaching, training, examination and assessment activities, and to their organization and implementation, in order to ensure their fitness for their for their purpose and the achievement of their defined objectives,

The internal quality assurance process and reviews which monitor the extent to which the institution, or training unit, is achieving the objectives of the programmes it delivers, and is effectively monitoring the quality control procedures which employs the arrangements made for periodic external quality evaluations

1.2. Final Report

At the end of the evaluation, before submitting a final report, the evaluation team should forward an interim report to the management seeking their comments on their findings. Upon receiving their comments, the evaluators submit their final report. The report of independent evaluation shall highlight the strengths and weaknesses of institution indicate the extent of compliance or non-compliance with the requirements of the Convention and the effectiveness of the quality standards in ensuring achievement of defined aims and objectives, define areas of deficient, offer suggestions for improvement.

The criteria for successful evaluation shall include the following items (GL, 2002):
- The training courses shall fully cover the applicable learning objectives to meet the defined standards of competency;
- All training aspects shall carried out under controlled conditions;
- The training institute shall have the resources and technical means available to deliver the course; and
- The training institute has implemented evaluation and assessment schemes to adequately verify that the targeted standards of competency are being achieved.

1.3. Advantages of QSS to MET

An implemented and documented Quality Standards System will enable MET institutions to control their different internal processes and allow them below mentioned advantages,

- Increase efficiency and minimize the risk that obligations to customers (students, parents, employee etc.) are not met.
- Give opportunity to measure management system against international and national standards through third party accreditation.
- Provide a foundation from which to gradually improve internal processes.

2. Quality Management Systems and International Requirements

International Standard ISO 9000:2000(E) states the following requirements for quality management systems of organizations (ISO, 2000): (1) Quality management system (2) Management Responsibility (3) Resource Management (4) Product Realization.

Quality Management System defines general and documentation requirements of this standard. **Management Responsibility** defines management commitment, customer focus, quality policy, planning, responsibility, authority, and communication, and management review. **Resource Management** deals with all resources within the organization in order to improve the quality. This section covers provision of resources, human resources, infrastructure of the organization and work environment. **Product Realization** defines planning, customer related processes, design and development, production and service provision, and control of measuring and monitoring devices. **Measurement, Analysis and Improvement** states that "the organization shall plan and implement the monitoring, measurement, analysis and improvement processes needed (a) to demonstrate conformity of the product, (b) to ensure conformity of the quality management system (c) to continually improve the effectiveness of the quality management system." This section covers monitoring and measurement, control of nonconforming product, analysis of data, improvement.

2.1 Maritime Universities and Quality Management Systems

Regarding the main approach of the ISO 9000 standard, the "organization" receives supplies from the "supplier" and provides "products/services" to the "customer" (ISO,2000:1,2). When the standard is applied to higher maritime education process, the term "organization/products/services" will stand for "higher maritime education process which is provideds by the "university/faculty/school". The term "customer" will stand for the "student, industry, society". The term "supplier" will remind "the physical infrastructure, the learning resources, organization and management of the system" that serve the higher maritime education process.

Supplier ——————▶ **Organization/Products/Services** ——————▶ **Customer**
Physical infrastructure, Higher maritime education process Student, industry
learning resources, and the society
organization and
management of the system
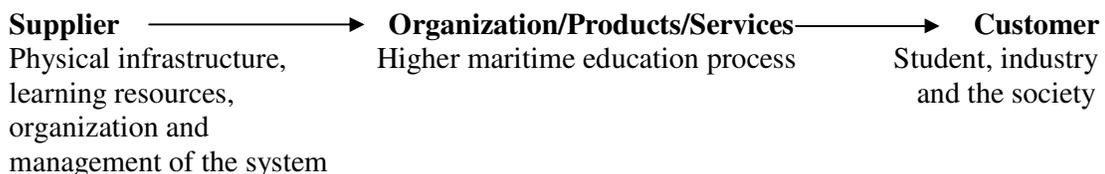
2.2 Background: Quality Management Systems & Maritime Universities

Modelling of quality management cycle for maritime universities have been approached in the context of the ISO 9000 system by the Er study in 1999 and the Er and Sag study in 2000 (Er 1999:108, Er and Sag 2000:41). Dokuz Eylul University School of Maritime Business and Management (DEU SMBM) has also adopted the ISO 9000 system in 2001 and this has been the first application of the system in the maritime business discipline (DEU SMBM 1999).

Sletner's work (2000) explains how the STCW-95 quality requirements have been adopted in higher maritime education in Norway.

Kim has discussed the importance of service quality approach in maintaining the quality of maritime education (2001), Stanca (2002) has analyzed the implementation of quality management systems in Romanian maritime education and training.

The STCW's recommended guidance for a QSS, contained in the STCW Code B-1/8, describes a quality management system paralleling ISO 9000 guidelines. A brief comparison between STCW Convention and ISO 9002 Standards is mentioned in **Table 1**.

2.3 PBL and its Contributions to the Implementation of Quality Management Systems at Maritime Universities

2.3.1 Background: Studies on the Improvements in the Quality of MET and PBL Approaches in Maritime Universities

Starting with the dynamic atmosphere of MET brought by STCW-95, maritime universities initiated working on improvements in the quality of MET and studies have been conducted internationally. The studies have concentrated on the improvements in;

Table 1: Comparison between STCW Convention and ISO 9002 Standards

	STCW CONVENTION	ISO 9002 STANDARDS
Field of application	Maritime Training, certification and watchkeeping	Quality assurance of services
Applicable to	Administration of the certification system; All training courses, and programs; Examination and assessments carried out; Qualification and experience of instructors and assessors	Contractual relationship between customer and supplier
Purpose: **Demonstrate compliance with**	The training, certification and watchkeeping requirements	The customer quality requirements
Means: **Implementation of**	A Quality Standards System (QSS)	A company quality management system
Scheme of certification:	The independent evaluation report	Company audit, Quality system approval
Validity	5 years subject to audit	5 years subject to audit
Compliance:	Mandatory	Voluntary

Source: Adapted from Cauvel, 1997

- learning resources of the educational institute
- learning styles of the students
- necessary changes in the course system,
- qualification of the instructors
- measurements and assessments regarding the outcomes of the MET system.

Requirements of maritime education and the need for the improvements of the system have been increasingly searched in the end of the 1990s. Teel had introduced the concept of "active learning" to the notice of the maritime community (Teel 1998, Teel 1999). In maritime education literature, modelling of the quality management cycle has been discussed in terms of "problem solving and decision making skills" (Er 1999:173). Improving the "cadets' self learning abilities" has been recommended by a study where "a reform is recommended for the cultivation pattern and the course system for MET of the 21st century" (Zhaolin et al 1999:220). The role of the instructors on education has also been a subject to the studies. Kay examined the role of instructors in improvement of the long-term education process (Kay 1989).

In 2002 DEU SMBM has adopted **Active Learning** and the student centered **Problem Based Learning-PBL** system. The system has been introduced to the maritime universities and lecturers in international meetings (Tuna et al 2002, Nas and Paker 2002, Paker and Kalkan 2002, Asyali 2003, Paker and Zorba 2003, Kalkan and Yilmazel 2003, Kalkan 2003, Nas 2003, Zorba 2003, Acar 2003, Atilla 2003). In the scope of such an international workshop Rotgans, Furusho and Moore have also mentioned their approaches about the applications of PBL in MET (Rotgans 2003, Furusho 2003, Moore 2003).

2.3.2 Studies on the Contributions of PBL to the Quality of Education

2.3.2.1. Quality of the Supplies

Quality of the physical infrastructure, the learning resources (such as the library resources, learning resources center, computer laboratories), and the quality of the organization and management of the learning system in general will be regarded in terms of the quality of the "supplies". Quality of the learning resources is an important aspect of PBL which is an active learning method and which is based on the independent research and learning of the students. This has been an important area of interest for instructors in different fields (Zanolli et al 2002)

2.3.2.2. Quality of the Organization/ Production/Services

The educational process in PBL is tightly structured and contains a number of key steps; (1)case presentation, (2) identifying key information, (3) generating and ranking hypotheses, (4) generating an enquiry strategy, (5) defining learning objectives, (6) reporting back, (7)integrating new knowledge (Johnson and Finucane, 2000). The starting point for enquiry is a problem or challenge that is presented to a

group of students as a 'real life' scenario. Accordingly, the quality of every element in this process has been a matter of concern for the researchers.

Regarding the educational process in PBL former research has concentrated on the following areas:

- Curriculum quality (Zanolli et al 2002),
- Quality of tutorial sessions, quality of the scenarios, quality of the discussion of the problem, quality of the problem (Zanolli et al 2002),
- Quality of the educational materials, the faculty wide publication of the curriculum documents, intranet delivery of the high volume of regular site access calling for a very direct and transparent navigational structure serving the educational goals of high quality in both content and process (Carlile et al 1998),
- Quality of the students' research (McCourt and Thomas 2001),
- Quality of the students' practical and professional experience (McCourt and Thomas 2001).

2.3.2.3 Quality of the Outcomes of the Products/Services and Assessments with Respect to the Customers/ Students/ Industry/ Society

Former research on the outcomes of the learning process have concentrated on the following points:

- The demonstrated links between students' perceptions of good teaching, clear goals, acceptable workloads, appropriate assessment and high quality learning outcomes (Trigwell and Prosser 1991),
- Assessment of the qualification of the academic staff in MET (Nakazawa 2002),
- Students' perceptions of the quality of the education (Lyon and Henry 2002),
- The student's perception of the nature of assessment is considered to be a primary determinant of the quality of student learning (Lyon and Henry 2002),
- The assessment work in practice at DEU SMBM Deck Department, where PBL has been adopted (Zorba 2003).

3. PBL Application in Assessing Quality of MET in a Higher Maritime Education Institute

3.1 Methodology

Assessment and measurement procedures are covered in ISO-9000:2000, STCW and PBL in different perspectives and dimensions. ISO-9000 quality standard defines "assessment" in general terms within the framework of "monitoring and measurement", "control of nonconformities", "analysis of data" and "improvement". On the contrary, STCW defines "assessment" in specific terms covering "knowledge", "understanding", and "proficiency" of the maritime students. Although STCW covers the specific applications in terms of assessment in MET, it does not attempt to include the assessment of the system by the students. On the other hand, PBL aims to achieve assessment of the maritime students covering "professional", "behavioral", "social", "ethical", "skills" and "communication"

factors. In addition to that, as a student centered education system, PBL aims to achieve assessment of the PBL system by the students.

Many studies can be found including the combination of **STCW – Quality Management-ISO 9000** and **PBL – Quality Management** applications generally in quality management and education literatures and particularly in MET literature. However, researchers did not attempt to combine assessment procedures within the integrated framework of ISO-9000, STCW and PBL. This study concentrates on assessment procedures covered in PBL in MET with the viewpoint of ISO 9000 and STCW-95 in an integrated view in order to reach **"total quality management"** in MET (See **Figure 1**).
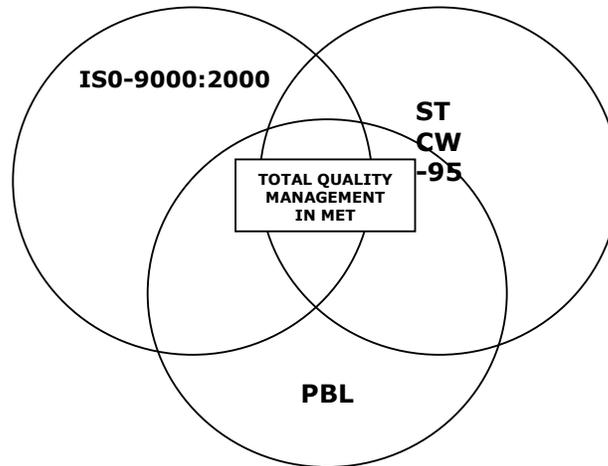

Figure 1: Conceptual Model of the Research

Considering this fact, an exploratory study was achieved through a "**case study"** method in DEU SMBM Deck Department. Processes and experiences were collected through observations and interviews during the one year implementation of PBL in SMBM Deck Department.

3.2 Evaluation / Assessment Applications Aiming Quality of PBL in MET

It is possible to mention a great variety of assessment. The common goal, however, is to evaluate whatever the system in question has provided the students with. This evaluation cannot be confined to evaluating the achievement level of the students. It is to cover the system as well. In compliance with this belief, the assessment work in practice at DEU SMBM Deck Department, where PBL has been adopted for the recent academic year, considers both types of assessments (Zorba 2003).

3.2.1. Assessment of the Students

The main target of assessment is to cover cognitive, psychomotor and attitude-behaviour issues. In compliance with the overall rule "right tool for the right content", different tools are needed to assess these three issues. In assessing the cognitive targets, written and multiple choice types of questions are preferred. The assessment of the

others, motor skills and attitudes – behaviors, requires certain tools of observation (Semin 2002). Considering these points, the tools used to measure the achievement of the deck students can be highlighted as follows:

- **Assessment following each module (Post-module assessment)** : The extent of acquisiton regarding the learning objectives, covering a 2-3 week period of studying, extracted from a three-session scenario is assessed by an exam given et the end of each module. The period of each module, 2 to 3 weeks, is determined by a designated group. At the end of each module, the exam given tests the extent of the acquisition of the learning objectives determined. The level of the knowledge received / gained and the chance for self-evaluation is a part of the target of the exam. A total of 14 tests are given throughout an academic year, and the results of these tests stand for 15 percent of the overall evaluation.

- **Scenario discussion session** : During these sessions, also called "tutorial group sessions", students are graded by the tutor in terms of their ability to use the knowledge, questioning, integrating, communication and self regulation. This serves a kind of in process observation and checking the level of improvements. Each student is evaluated through each academic year by a total of four tutors, who use a detailly designed form while grading the student's performance. The form used has been prepared by DEU School of Medicine and the reliability test for this form, based on Cronbach Alpha, has been found 0,95 (Musal et al 2001). The end result of this evaluation covers 15 percent of the whole credit.

- **First and second student evaluation** : An academic year comprises two terms, and at the end of each term the students take a term exam. The target is the overall achievement / performance. Each of these exams includes both knowledge and skills, so is carried out through multiple choice written test cover the first term while the second test covers the whole academic year.

- **First and second term practice** : Student's performance is tested through the practices carried out through the modules. The activities carried out throughout the modules, fhose related with the Professional skills and relevant practice, are evaluated by the tutor. Each of these evaluations consists of three stages as follows (Yücesoy et al 2002);
  - **Acquiring Skills:** The student has knowledge about the stages and the order, but he/she still needs assistance.
  - **Ability in Skills :** The student knows the stages and applies them.
  - **Effectiveness in Skills :** The student knows the stages and the order, and can effectively use them.

In addition to the above mentioned **Professional Skills, Communication Skills, Professional Attitudes / Values and Ethic Values** are also tested. All these tests, carried out through the whole year are added together and cover 20 percent of the overall evaluation / grade.

At the end of all this evaluation, **Overall Achievement Grade** is gained. The full credit / grade is 100. Those who receive 80 and / or over 80 are entitled to study at the upper level. Those who receive an overall grade under 80, are given the right to sit for a Final

exam. The average of the final exam and the overall achievement grade is to be at least 60 in order for the student to pass the level.

3.2.2. Evaluation of the System

Evaluation of the system is at least as important as that of the students achievement/ performance. In traditional teaching methods, it is difficult for the students present feedback at the end of every activity they are involved in such a feedback giving system enables the system to be improved, updated, and corrected. More important than this is that student feel themselves as a part of the system and they are involved in every step. This belief makes it easier for the students to get adapted to the system (Zorba 2003).

At DEU SMBM, feedback is gained from the students at the end of every activity. Every feedback is used to check whether or not the relevant activity is proper, contributes to reaching the learning objectives, affects the students' improvement. The feedback also is used to evaluate the extent of the efficiency and effectiveness of the teacher while using the teaching aids, the relevant equipment, and the time.

The system of evaluation utilizes not only the feedback from the students but also that of the tutors. Especially the feedback of the tutors on the quality of the scenarios is made use of, as the students' evaluation in this matter can not be adequate. Such scenario evaluations through feedback contribute to bettering the scenarios in terms of the design, improving the perceptions about the learning objectives, completing the missing aspects, correcting the undesirable parts, etc.

4. Contribution of the Assessments in PBL to the Quality Requirements of STCW-95 and ISO 9000 Standard

A cadet studying in the field of shipping is supposed to keep in touch with the recent developments in this field in addition to the acquisition of all the basic knowledge, skills and attitudes related with the field (Zorba 2003).

In other words, the main aim of the teaching / learning activities in this field is to provide the industry with deck officers well-equipped with the ability of questioning, critical thinking, problem – solving and commanding effective decision making and leadership. Besides, the officers, the prospective masters who will be working on the most valuable devices of the industry, the ships, are supposed to be provided with all the attitudes and values which have been established / adopted through the long history of hundreds of years. These values can be regarded in such conceptions as personality, attitudes, interest, skills, knowledge, and behaviour.

PBL aims to assess these values in such a manner as to comply both with the requirements of quality management systems and STCW-95.

5. Conclusion

Overall observations reveal that the students of DEU SMBM Deck Department,who have been exposed to PBL for the last one year are getting more and more able to determine the learning objectives quite reasonable and consciously. Besides, the observations clearly indicate that the students are getting more and more self confident. Furthermore, their ability to tackle problems and reach the means and the sources needed to solve the problems they are exposed to is increasing. Moreover, as in shipping industry and in life on board the ship requires prompt actions and proactive responses, the observable improvement in their abilities in such requirements is quite promising. In addition to these, the use of feedback in improving the system is also observed to contribute to raising certain intrinsic motivation in the students towards getting adopted to the system (Zorba 2003).

All in all, the best means of teaching seems to provide the students with certain critical and independent thinking, question and correct the undesirable outcomes, and the most important of all to teach them how to learn and how to regulate their own learning. The basic role of a tutor is to create in the students certain enthusiasm, cruosity and desire to learn (Alıcı and Gidener 2002).

In higher maritime education, where the cadets have to be approached through the methods of androgogic learning principles, PBL provides an environment of self-assessment for the higher maritime education institute in order to reach superior quality in complying with both the ISO 9000 standard and STCW-95 requirements.

Acknowledgement

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