Problem Based Learning in Maritime Education

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ABSTRACT

Problem Based Learning (PBL) is a learning method based on the principle of using problems as a starting point for the acquisition and integration of new knowledge. PBL has been successfully applied at a number of disciplines and various academic institutions internationally. Objectives of PBL are to develop knowledge, skills and attitudes of the students through a "Student Centred" approach. PBL is believed to aim at creating a great deal of changes in the creativity of the learners.

Dokuz Eylul University School of Maritime Business and Management (SMBM) has decided to adopt this student centred education system. The school aims to provide education to those who will assume positions in the administrative, managerial and technical bodies of the domestic and international maritime institutions. The Deck Department's curriculum is in compliance with the IMO's STCW'95 conventions. Through utilizing the PBL approach, SMBM aims to provide the shipping industry with decently qualified and skilled personnel meeting all the requirements.

The overall results aimed through PBL seem to greatly comply with the expectations of the shipping industry for managers in general and the merchant fleet for deck officers in particular. The aim of this paper is to give basic principles of PBL, highlight the practices of SMBM and discuss the necessary steps to carry out this completely new system to the best possible extent.

1. Introduction

The overall aim of education is believed to provide the learners with certain proper knowledge, desired skills and profound attitudes. And the fundamental of education, in broad sense, has got to be structured in compliance with the targeted needs of the learners. This means that as the needs change, the relevant education system has to change so as to meet the new terms.

The recent rapid advances in technology have increasingly changed almost all aspects of human-life and thus accelerated the required changes in teaching and learning approaches. Particularly since the last quarter of the 20'th century, it has been clearly seen that a means of transferring knowledge from an instructor to the passive learner can never cope up with the outstanding changes in needs. Thus it has become inevitable for the learner to take an active role in and shoulder the greatest part of the responsibility in teaching learning activity. He / she has been placed at the center of the activity so that the whole activity can proceed under his / her control, based on his / her specific needs and preferences. Since the learner neither can nor does need to be loaded with all sorts of knowledge available, he/ she should himself / herself determine the limits of the knowledge needed. He / she should decide on the learning objectives and also on the way to access those objectives. Through practicing the mechanism of self-appraisal, he / she should be able to correct and improve himself/ herself. In other words, he / she should actively take part in learning activities and eventually become a life-long learner. The instructor's and/ or the education institution's role in this activity should be confined to act as an efficient facilitator rather than a knowledge-conveyor (Paker and Kalkan, 2002).

Maritime industry has been facing many developments in recent years. These developments have led the shipping companies to get involved in horizontal and vertical integrations with the other organizations. Container shipping has been characterized by the emergence of powerful alliances and other forms of co-operation such as mergers etc. (Heaver *et al*, 2001). In doing so, carriers believe they can fulfill their integrative promise by consolidating their operations and by sharing previously confidential assets (Sheppard and Seidman, 2001). Technological solutions

including bigger container vessels and high performance Information Technology (IT) also have been introduced within the shipping industry. 7 to 8 percent of the ships deployed within the Asia-Europe trade were post - panamexes in 1995. However, this figure has increased up to 45 % by 2000 (Lloyd's List, 2002) Technological advances such as vessel automation and Global Positioning Systems(GPS) have made operation of these mega carriers less expensive than that of older vessels (Sheppard and Seidman, 2001). On the other hand, new services such as round-the-world, pendulum, and integrated global network have been introduced by the liner shipping companies, and transhipment concepts have gained popularity with respect to the major trunk lane concept. In addition to that, expectations of shippers have been changing and differentiating in terms of customer service level and costs. In order to meet the expectations of the shippers, transportation and logistics packages have been offered by the transport providers in terms of "one-stop shopping" and "total logistics providers" approaches (Tuna, 2002).

These changes in maritime industry and shipping have inevitably increased the need for qualified human resources. With regard to that fact, Dokuz Eylul University School of Maritime Business and Management (SMBM) has decided to transform its conventional curriculum to the "problem based learning" (PBL) curriculum in order the meet the expectations of the rapidly changing maritime industry in terms of both "maritime business managers" and "deck officers". This paper attempts to review the PBL steps in SBMM.

2. Problem Based Learning: Literature Review

Problem-based learning (PBL) has been among the curricular innovations most discussed in higher education over the last 30 years. Since it first came to prominence in the late 1970s, problem-based learning (PBL) has provided an increasingly important voice in the on-going debate on how we might organize teaching and learning in the universities (Harland, 2002). Several studies have shown that PBL is a successful approach compared with more traditional curricula with regard to intrinsic motivation and long-term retention of learned knowledge (Wiers*et al,* 2002). PBL restructures traditional teacher/student interaction to emphasize active, self-directed learning by the student, rather than didactic, teacher-directed instruction (Maxwell et al, 2002). It is characterized by problem-orientation, interdisciplinary work and self-directed learning and focuses on inter-personal and professional skills (Driessen and Vleuten, 2000).

As the term itself suggests PBL is a means of learning which is basically based on a problem. The problem stands for the stimulating aspect of the learning activity. In other words, it raises certain desire, wonder, and interest in the learner. The idea behind this philosophy must be that learning is inspired towards what is needed to be uncovered, what attracts interest and what creates certain desire and enthusiasm in the audience. It is commonly accepted that one is most likely to try to learn what he/she has questions in mind about, finds mysterious and interesting, threatening or useful, etc. (Paker and Kalkan, 2002). Therefore, in order for any learning activity to take place, there must be at the stage a motive, desire and interest, i.e. intrinsic motivation. These incentives are raised by the problem, which must be designed in accordance with the specific goal aimed. The problem also serves a challenge to students' reasoning or problem-solving skills as an organizer for their learning. The only way to discover what you already know, what you have really stored in your memory, is to work with a problem." (Dolmans and Schmidt, 1994) Another important function the problem serves is to encourage self-directed learning skills. "When students discuss a problem, they ask themselves whether or not their knowledge and skills are adequate to deal with this problem. This provides them with both a sense of direction and the depth of study that needs to be undertaken. Through problem discussion, students identify their own learning needs and formulate these as learning issues. These issues are listed and serve as guides for what they should learn during self-study. The main advantage of encouraging self-directed learning skills is that students learn how to deal with problems in the future, preparing them to become independent, life-long learners." (Dolmans and Schmidt, 1994)

As Dolmans and Schmidt (1996) make it clear, the problems which students tackle in small groups under the supervision of a tutor consist of description of a set of phenomena or events that can be perceived in reality and these phenomena have to be examined by the tutorial group in terms of their underlying principles, mechanisms or processes. " They rightfully also claim that this style of learning increases retention of knowledge, improves problem-solving skills, enhances integration of basic science concepts, develops self directed learning skills, and strengthens intrinsic motivation.

As far as the types of the problems are concerned, Barrows (1984) is right to have stated that these problems can be questions to be answered; observations, symptoms, signs or experimental results to be explained; even equations to

be derived. Although the types vary however, certain principles should be kept in mind while designing a problem to be used in problem-based learning. They are, according to Dolmans; Balendong and Wolfhagen (1997) as follows: the content of a case should adapt well to students prior knowledge; it should contain several cues that stimulate students to elaborate; the context should be relevant to the future profession; it should have relevant basic sciences concepts to encourage integration of knowledge; it should stimulate self-directed learning; it should enhance students interest in the subject matter, by sustaining discussion about possible solutions and facilitating students to explore alternatives; and it should match one or more of the faculty objectives.

The essence, or the fundamental base, of PBL lies on meeting the three basic conditions that facilitate learning. The three principles playing a major role in acquiring new information are activation of prior knowledge, encoding specificity, and elaboration of knowledge (Schmidt, 1983).The idea behind the first principle is exemplified in the mentioned article which compares the learning results of a first year student with that of fourth year student both of whom are assigned to read and interpret the same article. The results are found to be in favor of the fourth year students as their more elaborated prior knowledge will enable them to process the new information more easily, efficiently and fruitfully. The second principle, encoding specificity, is related with the resemblance between the situation in which something is learned and the situation in which it is applied. The closer the resemblance is the better the performance. The third principle, elaboration of knowledge, is fulfilled through various means such as answering questions about a text, taking notes, discussing subjects matter with others, writing summaries, teaching peers what has been learned, and formulating and criticizing hypotheses. All in all, the mentioned three principles ought to be complied with in optimizing learning. "Education should help students, in activating relevant prior knowledge, provide a context that resembles the future professional context as closely as possible, and stimulate students to elaborate on their knowledge (Schmidt, 1983).

3. Problem Based Learning Process in SMBM

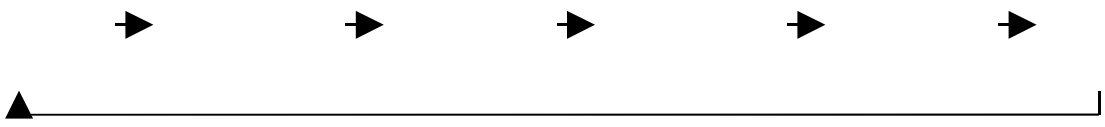
Dokuz Eylul University (DEU) was founded in 1982. DEU is a multicampus university dispersed throughout the city of Izmir at various locations offering undergraduate and graduate degree programs of study research in 10 faculties, 5 schools, 5 vocational schools, and 5 institutes, serving a total of 36,000 students.

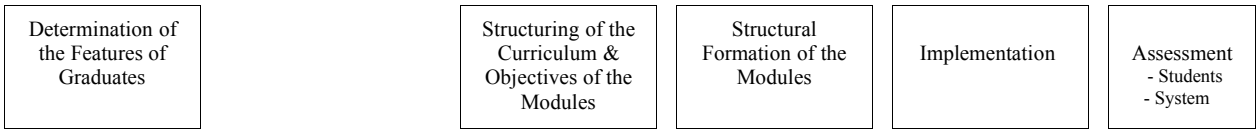
School of Maritime Business and Management has two departments; Maritime Business Administration and Deck. Graduates of the Maritime Business Administration take part in the maritime industry effectively and have the opportunity to be employed internationally. Current curriculum of the department covers logistics, transport and maritime transport majors on business administration discipline. The aim of the Deck Department is to educate oceangoing masters. It is verified by the Turkish Prime Ministry Undersecretariat of Maritime Affairs that the department's curriculum is in compliance with International Maritime Organization's STCW'95 Convention. Graduates are granted the right of taking the "Oceangoing Chief Officer Exam".

Led by the Faculty of Medicine six years ago, Faculty of Law, Faculty of Arts and Sciences, Faculty of Theology have adopted PBL learning approach in Dokuz Eylul University. SMBM has decided to implement this new approach in its curriculum for both departments starting from the academic year of 2002-2003. PBL approach will be implemented after a two year of preparation period. This section summarizes the major steps taken during this process.

Major steps of the PBL process in SMBM can be summarized as follows; (1) Determination of the features of the graduates, (2) Determination of the core and supplementary concepts, (3) Structuring of the four year curriculum and determination of the objectives of the modules, (4) Structural formation of the modules, (5) Implementation, and (6) Assessment of the students and the system.

Figure 1. Major Steps in PBL





3.1. Determination of the Features of the Graduates

The first step of the "Problem Based Learning Process in SMBM" was to determine the features of the graduates. Features have been determined in terms of **"knowledge"**, **"skills",** and **"attitudes"** with the participation of the lecturers of SMBM, representatives of the shipping and logistics industry, and former graduates of the School. Separate brainstorming sessions have been organized for both "Maritime Business Administration "and "Deck" departments. All contributions proposed by the participants have been recorded and classified in order to determine the features of a "maritime business manager" and "deck officer". Needless to say, this stage has helped to develop the objectives of the departments.

3.2. Development of the Core & Supplementary Concepts

Having determined the features of the graduates, core and supplementary concepts in terms of **"knowledge"** have been developed for both departments. Core concepts of a department refer to the vital subjects that a graduate ***has to know*** in his/her business life. Supplementary concepts, on the other hand, can be defined as the subjects that help the implementation of the core concepts. Lecturers of both departments have determined core and supplementary concepts after a series of meetings (See **Table 1**).

3. 3 Structuring of the Four Year Curriculum and Determination of the Objectives of the Modules

Conventional four year curriculum has been changed in accordance with the objectives of the School in terms of "knowledge", "skills", and "attitude". Lectures within the conventional curriculum have been eliminated and 14 modules have been constituted for the first year in order to achieve vertical and horizontal integration among the core and supplementary concepts. The objectives of the modules have been determined in terms of knowledge, practical skills, professional implementation skills, field study, professional values and ethics, communication, social, maritime English (See **Table 2**).

Table 1. Core and Supplementary Concepts for the Departments

MARITIME BUSINESS ADMINISTRATION DEPARTMENT		**DECK DEPARTMENT**	
CORE CONCEPTS	**SUPPLEMENTARY CONCEPTS**	**CORE CONCEPTS**	**SUPPLEMENTARY CONCEPTS**
▪ Multimodal Transport ▪ Ship and Fleet Management ▪ Third Party Warehousing and Inventory Management ▪ Cargo Transportation Management ▪ Passenger Transportation Management	▪ Business Administration ▪ Marketing ▪ Finance and Accounting ▪ Operations ▪ Organization and Management ▪ Economics ▪ Law ▪ Information Technology ▪ Transportation ▪ Logistics ▪ Sea Transport ▪ Public Finance ▪ Geography ▪ Marine Sciences and Technology ▪ Tourism ▪ Calculus ▪ Maritime English ▪ Statistics ▪ Seamanship	▪ Navigation ▪ Maritime Safety ▪ Prevention of Marine Pollution from Ships. ▪ Cargo Handling and Stowage ▪ Ship Structure and Stability ▪ Ship Management	▪ Calculus & Statistics ▪ Physics ▪ Medical First Aid ▪ Meteorology ▪ Maritime Business ▪ Seamanship ▪ Ship Maneuvering ▪ Information Technology ▪ Naval Shipping Control ▪ Communication ▪ Ship Engines ▪ Law ▪ Technical Drawing ▪ Electric and Electrotecnics ▪ Behavioral Sciences ▪ Maritime History ▪ Geography ▪ Chemistry ▪ Oceanography ▪ Maritime English ▪ Survey ▪ Shipbuilding ▪ Search & Rescue

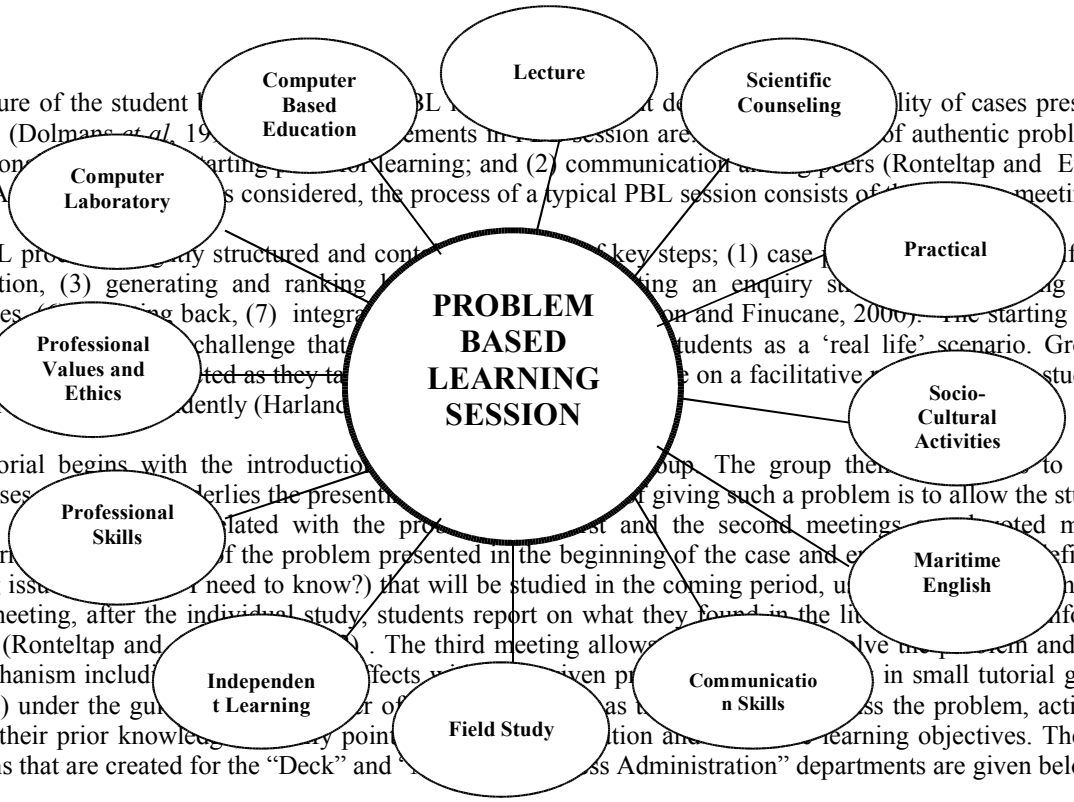
Table 2. Objectives of the Modules

MARITIME BUSINESS ADMINISTRATION DEPARTMENT **Year 1 Module 1**	DECK DEPARTMENT **Year 1 Module 1**
A. KNOWLEDGE • **Maritime Trade:** Introduction to trade, Cargoes traded, World merchant trade, Ship types and characteristics • **Business Administration**: Business and business management, Business environment, Global dimensions of business, Ethics and social responsibility • **Economics:** Definition of economics, Scarcity and choice, Supply and demand • **Calculus:** Sets, Functions • **Law:** The concept of law, Relations with other fields B. PRACTICAL • Practice related with ship and cargo C. PROFESSIONAL SKILLS • Acquiring basic skills related with ship and cargo • Acquiring integration of mathematics skills with knowledge about ship and cargo • Acquiring basic skills on earth geography • Keep in touch with and interpreting sources of knowledge related with world trade • Acquiring skills related with basic law concepts • Acquiring basic skills related with general mathematics D. FIELD STUDY • Visiting the fields related with ships and cargo E. PROFESSIONAL VALUES AND ETHICS • Introduction to ethics in general and business ethics F. COMMUNICATION SKILLS • Basic communication skills G. INFORMATION TECHNOLOGY • Introduction to Information Technology • Information Era and Information Society H. SOCIAL • Acquiring social aspects of trade and business • Acquiring desired aspects of being a good model as individual as well as citizen I. MARITIME ENGLISH • Getting introduced individually • Practicing free conversation (commenting on the sessions) • Recalling, brain storming and briefing (the topics, based on the contents of the module, are to be itemized and discussed)	A. KNOWLEDGE • **Seamanship:** Definition of the ships, Classification of the ships Types of the ships, Structural parts and elements of ships, Cargo Types • **Maritime Law:** Definition of ship, Sea worthiness • **Basic Navigation:** Definition of navigation, Universe, solar system and Earth, Shapes of the earth, Equator, latitude and Longitude, Differences of latitude and longitude • **Physic :** The law of Archimedes, Mass, weight, volume and force Circular motion and rotation, Density, Fluency • **Geography:** Geographic positions of major canals, Trade routes • **Maritime History:** Maritime history B. PRACTICAL • Chart Practice • Life Boat Practice • Latitude and Longitude Differences C. PROFESSIONAL SKILLS • Life Boat structure and parts • Sailing Boat • Mass, Weight, Volume and Force • Trade Routes • Ship Parts D. FIELD STUDY • Visiting the fields related with ships and cargo E. PROFESSIONAL VALUES AND ETHICS • Introduction to ethics in general and maritime ethics F. COMMUNICATION SKILLS • Basic communication skills G. INFORMATION TECHNOLOGY • Introduction to Information Technology • Information Era and Information Society H. SOCIAL • Acquiring social aspects of trade and business • Acquiring desired aspects of being a good model as individual as well as citizen I. MARITIME ENGLISH • Getting introduced individually • Practicing free conversation (commenting on the sessions) • Recalling, brain storming and briefing (the topics, based on the contents of the module, are to be itemized and discussed)

3.4. Structural Formation of Modules

The core of the module structure in SMBM is **"Problem Based Learning Session".** Other activities; lecture, scientific counseling, computer based education, practical, professional skills, socio-cultural activities, professional values and ethics, independent learning, field study, communication skills, and maritime English have been designed in order to meet the learning objectives of the modules (**Figure 2**)

Figure 2. Structural Formation of a Module



The nature of the student l BL t d lity of cases presented to students (Dolmans *et al*, 19 ements in session are of authentic problems in a profession arting learning; and (2) communication peers (Ronteltap and Eurelings, 2002). A s considered, the process of a typical PBL session consists of meetings.

The PBL pro y structured and cont key steps; (1) case fying key information, (3) generating and ranking ing an enquiry s g learning objectives, ng back, (7) integra on and Finucane, 2000). The starting point for enquiry challenge that tudents as a 'real life' scenario. Groups are encour ted as they ta on a facilitative students the freedom dently (Harland

The tutorial begins with the introductio oup. The group the to generate hypotheses erlies the presenti giving such a problem is to allow the students to develop lated with the pr st and the second meetings ted mainly to brainstor f the problem presented in the beginning of the case and e finition of learning issu need to know?) that will be studied in the coming period, u the next group meeting, after the individual study, students report on what they found in the li formation sources (Ronteltap and). The third meeting allows lve the problem and to draw the mechanism includ ffects v iven pr in small tutorial groups (8 students) under the gu r of as t ss the problem, activate and discuss their prior knowled y point tion an learning objectives. The sample problems that are created for the "Deck" and " ss Administration" departments are given below:

Problem 1: Deck Department

"M/V Bayraktar commenced her voyage at 02:30. At 02:45 after passing the Yenikale Narrow and leaving the watch to the 2nd. Mate the master left the bridge. At 03:00 second mate realized that the vibration increased and the vessel was not moving".

Problem 2: Maritime Business Administration Department

"Mete Erkan, the owner of Turkmar Shipping Co. which serving between Turkey and the Mediterranean countries, called his daughter Sema, who is a graduate of School of Maritime Business and Management and has been working for Turkmar for the last six months, and Hidayet Milli, who is the manager of Turkmar, for a meeting on January 2nd. At the meeting, Mr. Erkan stated that the company's profits are decreasing considerably".

3.5. Implementation

All the elements given in **Figure 2** are designed and timetabled so as to complement PBL in SMBM (See **Appendix I**). Module starts with the first PBL session and the students determine their learning objectives at the end of the

session. Before coming to the next PBL session, students attend various activities such as laboratories, lectures etc. Independent learning and scientific counseling allow students to study the learning objectives.

3.6. Assessment

Assessment can be analyzed in two major groups; assessment of the students and assessment of the PBL system by the students. Assessment of the students is achieved at the end of every module and at the end of each academic year. In addition to that, tutors evaluate all students at the end of PBL session with respect to their contributions to the problem solving session. On the other hand, students give feedback both in oral and written forms in terms of the quality of the PBL sessions and the overall system including self-appraisal and evaluating the overall contribution and progress.

4. Conclusion

Rapid changes in the maritime industry have inevitably increased the need for qualified human resources. On the other hand, educational paradigms are rapidly changing and it is therefore critical for the success and development of maritime education and training that these changes are fully understood so that the decisions on how best to meet these changes are made in an informed way (Lewarn, 2002). Considering this fact, Dokuz Eylul University School of Maritime Business and Management (SMBM) has decided to transform its conventional curriculum to the problem based learning (PBL) curriculum in order the meet the expectations of rapidly changing maritime industry in terms of both “maritime business managers” and “deck officers”.

It can be stated that students from PBL curricula regard the learning environment as more nurturing; they find the subject matter more relevant and challenging, and they enjoy the active learning process involved. Students in PBL curricula have also demonstrated greater psychosocial knowledge, better relational skills, and more humanistic attitudes when compared with non-PBL curricula students (Kaufman and Mann, 1999).

As far as the nature of maritime education is considered, PBL curriculum seems to contribute a lot to the quality of educational system. For example, simulation based education in maritime transport is considered as the best example of active learning (Teel, 1998; Teel 1999).

The overall results aimed through PBL seem to greatly comply with the expectations of the shipping industry for managers in general and the merchant fleet for deck officers in particular. The developments achieved through the problem based learning practices of the maritime education will not only help the improvements in the outcomes of the education systems in the industry, but this will also be a great contribution to educational practices in general due to the dynamic characteristics of the maritime industry.

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