Adaptation of Problem–Based Learning Method to Requirements of STCW Convention

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ABSTRACT

Problem-Based Learning (PBL) is a student-centered method where students learn by working on real-life problems and activities, with the teacher as coach and moderator. The approach was initially used in medical and health science institutions in early 60's. Soon, thereafter it was adopted by many higher educational institutions in different disciplines.

Compliance with STCW convention is a must in MET environment. STCW Convention seeks to establish a baseline standard for the training and education of seafarers throughout the world and, emphasis on competence rather than knowledge. STCW establish detailed mandatory standards of competence and other mandatory provisions necessary to ensure that all seafarers shall be properly educated and trained, adequately experienced, skilled and competent to perform their duties on a manner which provides for the safety of life and property at sea and the protection of the marine environment. One of the innovations of STCW`95 is to emphasize on competence rather than knowledge contrary to previous Convention.

The education strategy of School of Maritime Business and Management (SMBM) is to provide the students with certain proper knowledge, supported by desired skills and profound attitudes that they will need in their future professional careers and also give them the ability to respond quickly to changes in technology, operations, practices and procedures on board. SMBM accepts PBL a valuable and reliable method to achieve these aims and to comply the requirements of STCW. The PBL at SMBM has been implemented on the requirements of STCW infrastructure after a preparation of two years. In this paper it is intended to share experience of SMBM during the period of implementation of "Problem Based Learning" method to their deck department with a MET approach.

1. Introduction

The rapid developments experienced in technology have affected all industries including shipping industry. Especially easy access to knowledge along with the wider communication facilities

seem to have accelerated the process of this effect. The influence of the recent technological developments has been seen on the shipping-related training technologies as well.

For the last quarter of the century, Problem-Based Learning has been widely adopted as the most appropriate teaching/learning method. This approach seems to support and fulfill the requirements focused by andragogy rather than the principles of pedagogy. In other words, application of problem–based learning in higher education seems to be highly promising as the learners are considered to be grown-ups rather than children. The main point in such an androgogic approach is to be based on helping learners to learn rather than transferring certain pre-determined knowledge to them (Knowles, 1980). The method which adopts this point of view to the most satisfactory extent seems to be problem–based learning.

A student studying in the field of shipping is supposed to keep in touch with the recent developments in this field in addition to acquisition of all the basic knowledge, skills and attitudes related with the field. 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 behavior. It is not possible, in any traditional teaching method, to access the extent to which any of these conceptions has been acquired by the learner. The lecturing type of traditional method which is based on building banks of knowledge and expecting the learners to memorize them has been found incapable of providing learners with the mentioned attitudes and values. Thus, for the last quarter of the century, new and more effective means of teaching/learning have been searched and discussed. The widely accepted response to this search has been "Problem-Based Learning".

2. Problem Based Learning

Among various teaching methods, four models have been favored. The first one was developed in 1925 by Flexner and called "Basic Science", through which learning objectives were set based on the specific fields of science. Another one was introduced by Western Reserve University and the learning objectives were integrated on the basis of the relevant science. The third one, introduced by Calgary University. "Information Processing" focused the learning objectives on the problems frequently encountered. And the fourth one, developed by Mc Master in 1969, called "Problem – Based Learning" aims to encourage learners to produce the learning objectives (Dicle, 2002).

Problem – based learning (PBL) begins with real–world, open-ended, complex problems which students analyze and solve. In the process of solving the problem, students work cooperatively to find and evaluate the resources they need (Enger, 2002). This method enables students to acquire certain skills and attitudes along with knowledge. Enger lists some other advantages of PBL as follows ;

- Ability to communicate effectively, verbally and in writing;
- Capability to think critically by analyzing and solving complex problems;

- Ability to work cooperatively in groups;
- Likelihood of applying content to real-life work situations following college;
- Development of skills of life-long learning.

This form of learning that becomes increasingly self-directed, following the andragogical principles where learners mature from dependent learning, underlaid by pedagogical principles, towards increasing self-directness (Cockerill et al., 1996). However the "positive effect that PBL has on the learning environment is a worthwhile gain in, and of, itself" (Albanase, 2000) Zimitat&Miflin, 2003)

3. Maritime Education and Training

Maritime transportation is a complex and risky socio-technical system formed by technology, environment, people and organizational structures. In this multi-dimensional, multi-disciplinary and flexible environment, aim of MET is not only give trainees basic technical knowledge to perform pre-designed, routine and standardized objectives or briefly "training" but also to improve their critical thinking, decision making and problem-solving skills, leadership, social intelligence, moral motivation or briefly "education" (Kompa,2002).

Critical thinking that refers to the ability to analyze, synthesize, and evaluate information, as well as to apply that information appropriate to a given context is an important part of MET system. In MET moving learners beyond Bloom's lower cognitive levels of knowledge and comprehension to the higher Bloom levels, where they apply, analyze, synthesize and evaluate is a requirement. These are the skills that are so important for our students to develop in order to succeed in their professional maritime career.

Studies have shown that human factors such as inadequate skills, insufficient competence, poor communication or fatigue are responsible for the majority of maritime accidents. Maritime community and IMO have been striving not only to improve the safety standards on board ships but also to raise the standards of the seafarers who man them. The 1978 International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) was the first attempt to establish global minimum standards for seafarers. But despite its implementation in 1984, the 1978 Convention failed to achieve its goal of higher standards because it did not define its standards precisely and training objectives remained vague. Courses were tended to be academic in nature, classroom based, teacher centered, with assessment based around formal written exams in STCW 78 .The result was a radical revision of the STCW Convention in 1995.

Post STCW 95 the emphasis of training is supposed to be on what seafarers need to be able to do.Courses should be practical in nature, activity based, student centered, with assessment based around the demonstration of acquired skills (Lewarn, 2002).There is a change from the knowledge-based requirements of STCW 1978 to the competence-based requirements of STCW 1995.

Not only the legal infrastructure of MET has been changing and improving but maritime industry itself is also improving.The increased use of advanced technology on vessels makes it necessary to adapt qualifications of maritime personnel to such environment and to identify approaches

which provide for meeting future requirements. And also MET institutions must improve the qualification of seafarers and other maritime personnel so that higher safety, environment protection and efficiency standards can be achieved (Zade, 2002).

4. SMBM and PBL

With regard to that facts and needs mentioned above, 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. The main point which must be emphasized is that PBL does not present a new curriculum but rather the same curriculum through a different teaching method (Wang et al. 1998). After 2 years period of preparation, SMBM implemented PBL method to their Deck Department students starting from the academic year 2002-2003. The education strategy of SMBM is based on providing the students with certain proper knowledge, desired skills and profound attitudes which are not only mentioned in STCW 95 but also required by shipping industry. Integrating a completely different education method to an area where compliance with international standards is compulsory, is a great experience worth of sharing with other MET institutions. According to the experiences the old and new paradigms which reflects the differences between conventional method and PBL method are shown in Table1.(Asyali, 2000).

Table 1: Old and New Paradigms in SMBM

Old Paradigm	**New Paradigm**
Instructor	Facilitator
One academic year is 28 weeks	One academic year is 14 modules
Library	Learning resources center
Courses	Modules
Classrooms	Small groups
Competitive learning	Cooperative learning
Curriculum items	Learning objectives
Carrier of knowledge	Owner of knowledge
Individual roles	Team work
Classroom based	Activity based
Teacher centered	Student centered
Assessment based around formal written exams	Assessment based around the demonstration of acquired skills
One way feedback	Two way feedback
School based learners	Independent learners
Requires the ability to use lower order thinking skills such as knowledge, comprehension, application	Requires the ability to use higher order thinking skills such as analysis, synthesis, evaluation, and creation of new knowledge.
School time learners	Life long learners
Single discipline	Inter-disciplinary, integrated
Knowledge based	Competence based
Problem solving after introduction to content.	Content through the process of problem solving,

5. Implementation of PBL

In PBL method one academic year is consist of 14 modules and each module lasts 2 or 3 weeks. Each module is designed to reach pre-planned learning objectives. These learning objectives are based on STCW'95 requirements, National Seafarers Education And Training Requirements and also the special requirements of SMBM regarding to its education strategy. Major steps of the PBL implementation process in SMBM can be summarized as follows;

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 industry.

2- Determination of the core and supplementary concepts: Core and supplementary concepts are determined according to STCW'95 and National Seafarers Education Stardarts as shown in Table 2.

Table 2: Core and Supplementary Concepts for Deck Department

CORE CONCEPTS	**SUPPLEMENTARY CONCEPTS**
▪ 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

3- Structuring of the four year curriculum and determination of the objectives of the modules,
4- Structural formation of the modules,
5- Implementation,
6- Assessment of the students and the system.

Core and supplementary subjects are divided into sub-subjects. Then sub-subjects are matched with each other according to their relation to form a basket of learning needs and then learning objectives for each modules are defined. For instance in module five, twelve sub-subjects are chosen within seven different discipline (physic, basic navigation, coastal navigation, magnetic compass, COLREG, communication, introduction to Business). Learning objectives and their distribution to supporting PBL activities for module 5 are shown in Table 3.

Table 3: Learning Objectives For Module 5

Curriculum Items	**PBL session**	**Presentation**	**Practice**	**Professional skill**	**Independent study**
G10- Chart Corrections	*	*	**	*	
G11- Navigational aids, lighthouses, buoys		*	*	*	
G12- Depths and depth measurement	*		*		*
I1 – Position lines and position fixing I2– Method for position determination in coastal navigation			*	*	*
D3– Light		*			*
D4– Sound		*			*
H5– Parts of magnetic compass , errors and corrections	*		*	*	*
S2– COLREG 72 application and rules				*	*
AF1– Morse code AF2– Ability to transmit and receive signals by Morse light				*	
X- Information Systems for Business Decisions, Management Information Systems, Information Technologies	*	*			*

6. Creating PBL Scenarios

For triggering the learning needs a scenario is created which is formed around a specific problem. PBL Scenarios are created from real experiences, accident investigation reports, common daily routines in professional life, emergency situations that are faced or near-miss accidents etc. They sometimes need some modifications in order to fulfil our learning objectives. Cases are embedded with links to desired learning outcomes. The problems are created to be very close to real life. Students become highly motivated when they know that the problem is something that a real practitioner had to solve. The problem should (1);

- Be relevant, current, and interesting (e.g., base on current events, student interests, professional goals, legal requirements, etc.)
- Based on deep and broad information in several disciplines - so that the sum of the problems covers the in sum, cover all the essential material in the curriculum,
- Include the human dimensions and social context of the problem, (social responsibilities, professional values and ethics etc.)

- Be as uniform as possible from scenario to scenario. In order to decrease the confusion that students experience. They don't have to learn the format each time. It is useful to consider including each of the following components in each case:

  Introduction: An opening paragraph summarizes the problem, gives the context and relevance the students' interest .This is the most important part of the scenario.

  The body of the case: A rich description of the situation as it would be viewed by the person solving the problem.

  Learning objectives: Pre-determined learning objectives are embedded in the scenario. At the end of the session 1 and 2 it is aimed to reach all the learning needs. Generally it is not supposed to be found any learning objective at the session 3.

  Resources: Different kinds of learning resources like a chart, a dictionary, international load line chart are provided to students especially for freshmen in the PBL session. These sources are generally limited because in PBL sessions it is not aimed to reach all relevant resources

  Guiding questions: After every part of the sessions there are some guiding questions for directing them to intended paths. Instead of asking direct questions like what is load line?, "What do you think the reason is?" type questions are preferred.

- Be of appropriate complexity. Complexity of the scenario is mainly depending on the amount of pre-determined learning objectives and also to the decision how deeper will be gone in the module.

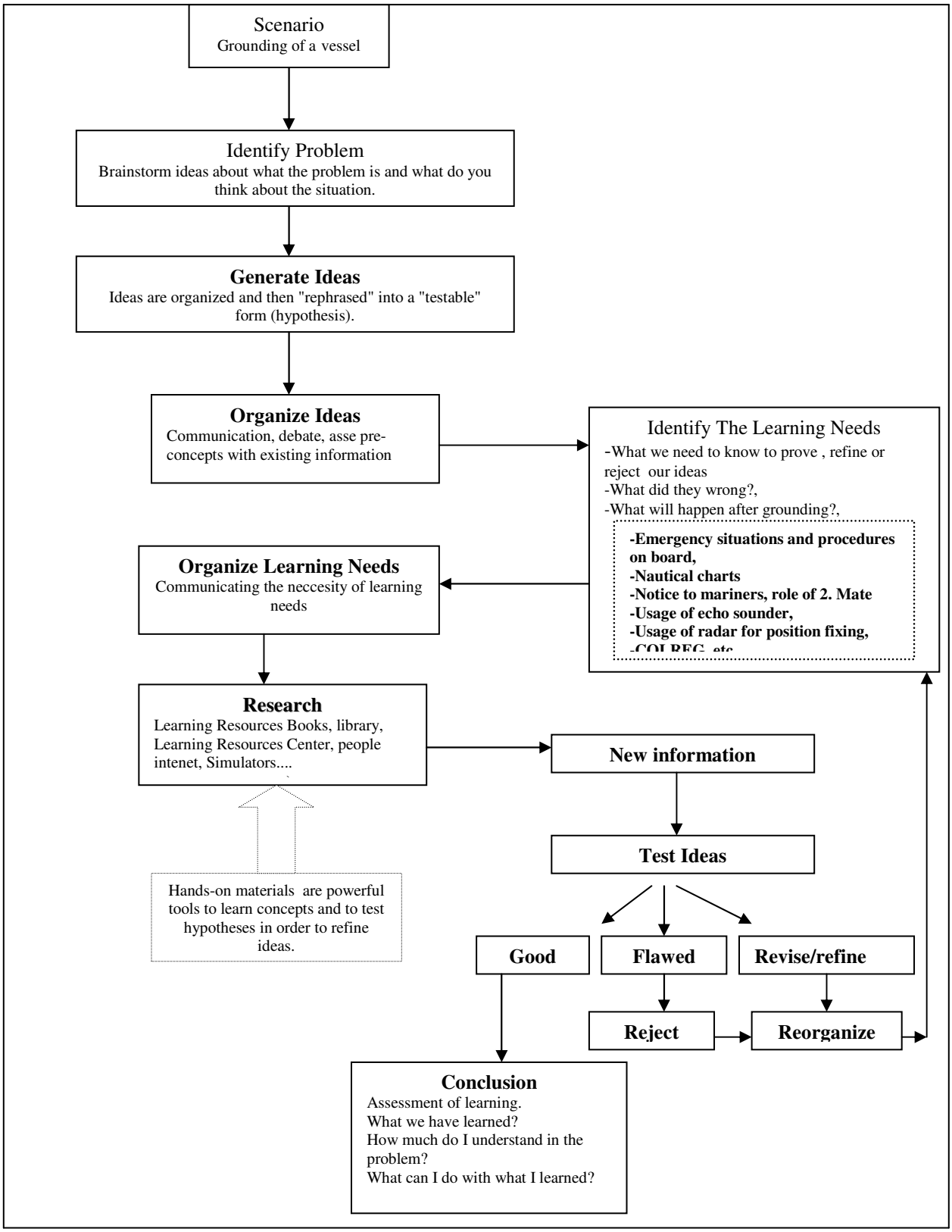
7. PBL Learning Process

In a module there are 3 PBL session. Each session consists 3 or 4 parts. There are 8 students in each PBL session. Students read the scenarios that are distributed to them and they define what the problem is about. After identifying and agreed on learning objectives students go away to research all of the learning objectives which will support them to find a solution for their problem by using all of the resources that are provided to student at our facilities. When the students learn in the context of how it will be used, it promotes learning and the ability to use the information (Albanese,2000).They have 3 to 4 days until the next session. This is the hardest part for students at the first modules as it is difficult for students to find out how much deep they will get into. Not all the information needed to solve the problem is given in the problem, or perhaps even in the textbook. Students will need to do some research, discover new material, arrive at judgements and decisions based on the information learned. The problem may have more than one acceptable answer, based on the assumptions students make.

Cooperative learning concept is widely used during PBL learning process. Cooperative learning situations are those where individuals perceive that they can reach their goals if and only if the other group members also do so. The small group format used in PBL fits this definition. Cooperation is operationally defined by the presence of joint goals, mutual rewards, shared resources, and complementary roles among members of a group (Albanese,2000).

Students can make their researches not only at hardware libraries but also at multimedia library which is called "Learning Resources Center" where they can find all related documents, presentations, visual learning materials, that were loaded to computers only for this purpose. Problem Based Learning Process is shown in Table 4. Also, this process is supported by many different activities like, computer based education, presentations, scientific counseling, practices, social and cultural activities, maritime English, communication skills, field studies, independent learning, professional skills, professional values and ethic, computer laboratory. These activities are located around the PBL sessions.

Table 4: Problem Based Learning Process



Adapted from: Wang,Thompson,Shuler&Harvey (1999),Problem-based learning for science Teacher's Development, AETS Conference, Austin

8. Conclusion

In our one year experience with PBL, we find it an effective tool for fulfilling legal requirements like STCW, national regulations and needs of maritime industry for our first year students. As the students are motivated by the problems they are faced with, they have desire to learn. Students know what they must know, and how and where they will use this new knowledge, skill and competence with integration of PBL and MET. This motivation has a positive effect on their learning process. They now feel that they are the "owner of the knowledge" as they need it, search for it, find it and use it. Instead of being "carrier of the knowledge".

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. 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.

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