New Technologies & Teaching Methodologies to meet The Future Needs of the 21st Century Seafarers

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Abstract:

Maritime education and training can benefit from the use of new technologies and teaching methodologies. A new paradigm on learning, riding primarily on the wave of information technology, provides many new ways e.g. computer-based drill and practice, simulation, knowledge capture, expert systems, visualizations, online social learning, constructivist learning, mobile learning, dynamic perspective generation in learning etc. All these tools make teaching and learning more exciting and help create the development of new skill sets in maritime training. The paper argues that such approaches could make the future seafarers adequately competent for the needs of the future shipping industry. Some case studies conducted at the Singapore Maritime Academy are used to illustrate the potential of these strategies. The paper further questions the continuum of traditional curricular approaches, which, it is claimed, could hinder the competency needs of the 21st Century seafarers.

Keywords: *Maritime education, new technologies in education, competencies, MET institutions, training, sea farers.*

INTRODUCTION

Shipboard working practices are changing rapidly just as the work practices ashore. Maritime professionals, who mostly learnt their professions in the pre-computer age, are certainly trying to cope with this enormous change, which requires additional skills in handing information technology usage in every sphere of the work arena. On the other hand, the new generation of seafarers, who are now being trained in various Maritime Education and Training (MET) Institutes, are following competency-based curriculum as prescribed by the STCW 95 Convention. This curriculum is a recast of the content from STCW 78 era to include the competency paradigm. Hence, we rarely see the inclusion of specific proficiencies in the areas of new technologies in the curriculum revisions, which are put forward regularly as requirements for keeping abreast of the changes in the industry.

In this present conference, where we discuss the human resources at the disposal of our future Master in the 21st century, I argue the adequacy of these practices, as they could make our Master a weak leader with his subordinates remaining ill-

trained in the use of information technology and feeling insecure in decision making when dealing with the use of such technology.

Use of simulation technologies for learning, effective presentation for disseminating information, trend analysis on data for more accurate decision making, use of databases in efficient management, use of Internet (when available on board) to seek answers to various day-to-day queries, sharing knowledge in a web-based forum, developing knowledge-bases for use as expert systems for competent judgment and learning new skills using CBT or interactive programs through the Internet are possibilities which are already being explored.

Thus, a need to train our future seafarers in information technology cannot be over emphasized. Muirhead (2004, p. 145) stressed the requirements for 'a continuum of technology development for MET Institutions' and named the following five main functional areas for emphasis.

- Computer systems
- Multimedia support
- Simulation systems
- Communication systems, and
- Educational delivery.

This paper provides a glimpse of this continuum of technology-based modules and projects, which are being undertaken at the Singapore Maritime Academy to realise this thrust to empower our future maritime officers in the essential skills required to tame these technologies.

Case studies done at the SMA include areas in inquiry-based learning, on-line social learning, mobile learning, on-line assessment, development of PDA-based expert systems and drill and practice-based formative learning environment (see Chatterjea, 1996; 1998, 2000, 2001, 2003, 2005). For the sake of brevity and constraint of space only three case studies on *inquiry-based learning*, *on-line social learning* and *mobile learning* are discussed below.

Inquiry-Based Learning

This approach was taken in the last semester for a 3rd year Diploma in Maritime Studies module on ship construction. This is a sandwich course where the students spend their 2nd year at sea. As these students had already sailed on ships, it was decided to tap their experience by allowing them to develop their inquiring attitudes, which is essential in analysis and examination of knowledge.

The subject was divided into various topics and each topic was handled in two consecutive classes (Tuesday & Thursday of each week of the term). The students were grouped with four students per group. Each student group was given two sets of hard copies of the topic on day one. During the entire lesson, they were asked to go through the topic and develop a suitable question per group for the topic, which would make meaning to them. The idea was to sieve out the main issues in the topic, which they thought were important. As there were six groups working, there

were possibilities of six view points of the subject area in hand. The students were told that we were working towards multiple perspectives from the core topic given in text format as hand outs by the facilitator. They were to submit the questions by the end of the one and half hour lesson and were graded on the quality of the questions generated.

As there were two classes per week, one on Tuesday and the next one on Thursday, the students were asked to prepare suitable answers to the queries raised by them earlier in the week and present them on Thursdays. The submissions were to be in PowerPoint presentations. The presentations were critically viewed, evaluated and graded by both the peers as well as the facilitator.

The next step was to organise this work into a knowledgebase, which could provide a multiple platform for easier access and understanding. The tool used was IHMC Cmap Tools. Cmap Tools (Cañas, A. J. et al. 2003) is a software suit, which allows users to construct concept maps. The maps represent the understanding of domain knowledge. Large bodies of knowledge could be represented by a series of concept maps. Each concept can be defined by various resources, e.g. images, videos, sound clips, texts or other lower level concept maps. The Cmap knowledge model created for the project is shown in Figure 1. below.

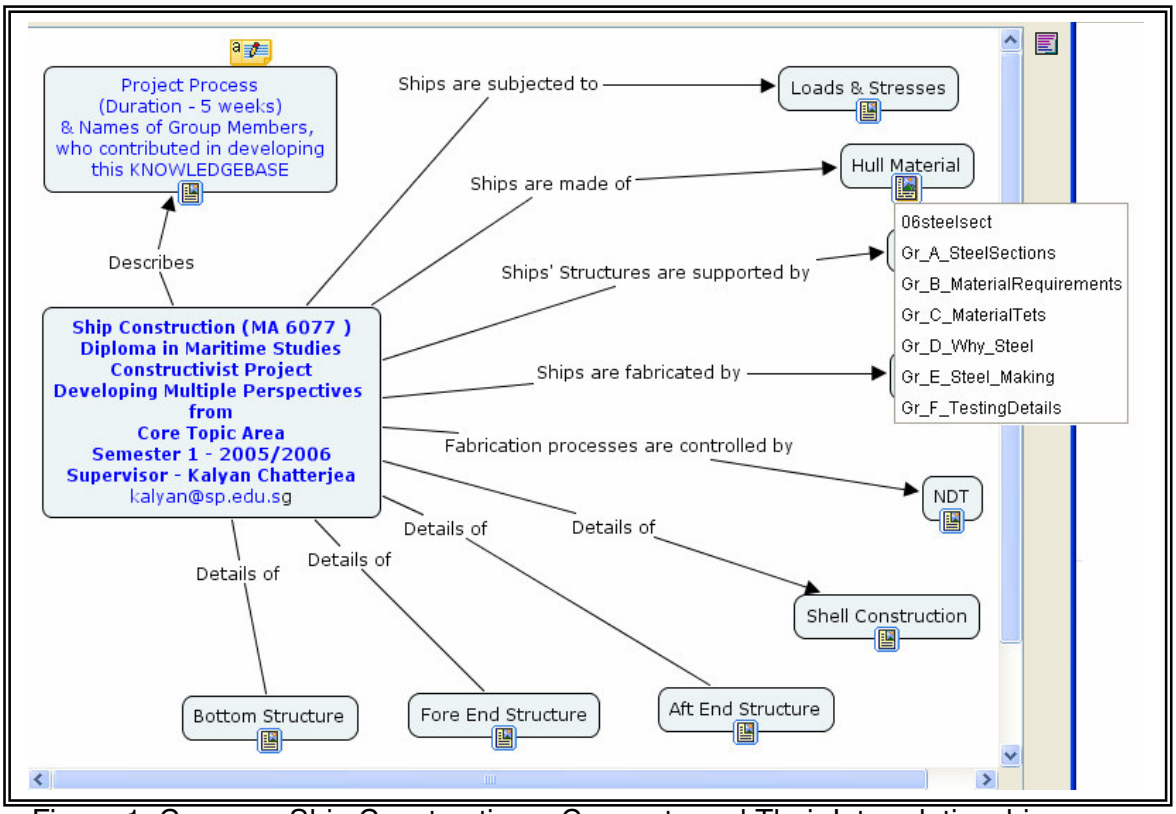

Figure 1: Cmap on Ship Construction – Concepts and Their Interrelationships

The students were given *autorun CDs*, which could be used to access the resources for their future use. In the next run, the knowledge model could be refined

further by producing more resources and more Cmaps, which could define the scope at a lower level.

Referring to inquiry-based learning Joe Exline (2004) stated the following with respect to traditional delivery of education:

> Unfortunately, our traditional educational system has worked in a way that discourages the natural process of inquiry. Students become less prone to ask questions as they move through the grade levels. In traditional schools, students learn not to ask too many questions, instead to listen and repeat the expected answers.
>
> Some of the discouragement of our natural inquiry process may come from a lack of understanding about the deeper nature of inquiry-based learning. There is even a tendency to view it as "fluff" learning. Effective inquiry is more than just asking questions. A complex process is involved when individuals attempt to convert information and data into useful knowledge. Useful application of inquiry learning involves several factors: a context for questions, a framework for questions, a focus for questions, and different levels of questions. Well-designed inquiry learning produces knowledge formation that can be widely applied.

Thus, at the end of the module one could claim that some additional knowledge formation was made possible by the process. Quoting Joe Exline again, he said,

> Inquiry implies involvement that leads to understanding. Furthermore, involvement in learning implies possessing skills and attitudes that permit you to seek resolutions to questions and issues while you construct new knowledge.

This methodology of teaching is different from traditional classroom-based teaching, where all the answers come from the teacher and the students remain passive recipients of knowledge from a single viewpoint. The inquiry-based learning attempts to engage the learners in active learning and basic course material could be dynamically improved with each run of the module.

On-line Social Learning

The module "Shipboard Training & Assessment", selected for this case study, is an outcome of regulatory requirements, spelt out by STCW 95 amendments.

The "Shipboard Training & Assessment" module is considered by our maritime students as somewhat subjective in nature and they find it different from the more objective types of modules they are familiar with e.g. thermodynamics, navigation or naval architecture. To effectively 'cover' details of STCW Convention, its related codes, theories of learning, techniques of competency-based assessment and the like in the classroom situation calls for high level of motivation on part of students as well as the instructor. Hence, the module is not an easy one to conduct, particularly, when one tries a didactic approach, which assumes that students can assimilate the module content while passively listening to the instructor's presentations.

The assumption behind such an instructional approach is that the ability of the students to understand the content depends largely on the clarity of the presentation. This view of instruction is inconsistent with cognitive research findings as there is good likelihood of students misinterpreting incoming information, particularly, when they try to accommodate this new knowledge with the existing

constructs of the knowledge domain they are already having in their mind (Mestre, 1994). Hence, instead of a deductive method, I opted for an online interactive approach.

In the next few paragraphs, I describe how the programme was initiated to an apprehensive group of students and how eventually a sustainable learning community was established.

The module "Shipboard Training & Assessment" was originally taught as a classroom-based module. As the majority of the students in the module were foreign students having minimal exposure to computers, most of them had to be literally coaxed to use the computers to communicate. To switch to an online mode the participants needed extensive support. The initial problems encountered were mainly access-related. One frequent problem was incorrect usernames and passwords as new students were signing up for the module; their names were not yet registered for the course and were, therefore, rejected by the system. Another common problem was 'I wrote my comments and I entered in the Blackboard[1], but somehow, my input is not uploaded on the discussion forum!' These were not too difficult to solve but I had to spend a lot of time in ironing out these obstacles on a continuous basis.

In a completely asynchronous environment, these could possibly lead to a complete break down of the course, as our student group was unfamiliar with online mode of learning and needed a lot of persuasion and assurance to get them going in this new medium.

To supplement the online mode, a few short presentations (in PowerPoint format) were made in the class and they were also made available on the Blackboard. Instead of a completely asynchronous environment, a weekly one-hour face-to-face class was organised, where these presentations were made and problems encountered online were discussed.

The students were then asked to go through these presentations via Blackboard and put some reflective entries on any of the related issues on the Blackboard Discussion Forum. To create a non-threatening environment and to entice the students initially, they were assured that all of them would get 10% marks if they provided a single input on any of the relevant issues, which would not even be qualitatively graded. These 10% marks were originally attributed to 'student attendance' in the normal classroom-based module. A further 10% marks were attributed to a short input on the Discussion Board for their entry on their "Critical thoughts on STCW 78 and its 95 amendments". Again they were assured of these marks without any qualitative grading as long as they made these inputs to the discussion board. Originally, these marks were attributed to the tutorials submission for the module.

These approaches to lure students to the Discussion Board were prompted by my earlier failures to attract students to engage in meaningful online interactions in the

[1] *Blackboard* is an e-learning and course management system that provides instructors with a centralized online repository for course materials and a collection of web-based tools to complement instruction. Further information on *Blackboard* is available at http://www.blackboard.com/highered/index.htm

past, when no such 'carrots' were offered. These extrinsic motivators are important to get things started, particularly when interests are lacking (Hamachek, 1995, p. 282).

The student group was sceptical of the outcome and were not at all keen to accept the online medium as an acceptable learning platform. But the lure of 20% proved to be too tempting and about 80% students gave these initial inputs. What followed was interesting, as some of the issues raised by students triggered further discussion and soon a flood of inputs poured in. It appeared that as the discussion topics became of interest to the learners, they got motivated themselves and no further extrinsic intervention was necessary on the part of the facilitator. As the number of inputs exceeded expectations, the discussion forum became difficult to track individual learner inputs as the 'forum' was only structured to track the various 'threads' of discussion.

A need was felt to have these inputs separated for individual learners to see them as their portfolios of inputs in the module. This prompted the facilitator to organise the students' submission in 47 web pages for all 47 participants, with their own photographs. It was felt important that the learner was given recognition as an individual, where he felt proud to claim ownership of his own contributions. This was very different from the classroom-based approach, where his assignments were only submitted to the instructor alone.

With this emphasis on communicative processes, the focus of the module shifted from content-based approach, where the instructor plays a key role in disbursing these content resources to one of communication-rich, collaborative scenario, where the group members were depending on each other for their knowledge source.

This collaborative approach has been claimed to bring students to a higher achievement level, offering cognitive advantages to the learners. It raises their problem-solving abilities and plays a positive role in enhancing the development of personality traits that are beneficial for future learning (Laister et al., 2001, p. 5).

Adverse effect of this approach could be, firstly, undermining of teachers' control, secondly, difficulties in grading students in collaborative learning, and thirdly, raise concerns associated with collaborative group work (Davis, 1993).

Although the module started on a shaky note, the establishment of the viable learning community was possible due to following reasons:

- It was ensured that the group members had adequate knowledge or support to handle technology related issues.
- There was adequate extrinsic motivation, when 20% of the module marks could be obtained by participating in the asynchronous discussion forum.
- The novelty of this method made the learners curious to join in this new activity of learning through Internet.
- The individual WebPages made the learners conscious of their own image in the public domain and made and effort to improve the quality of their inputs.

- An effort was made on part of the instructor to reduce the stress level in the course and this led to some enjoyment in participating in this new learning environment.

Mobile Learning

To conduct a feasibility study at the Polytechnic, two student projects were conceptualised. The first one, called 'SP AnytimeAnywhere – Living' was meant to provide a supporting environment for the Poly students. It was named by the student group as "SP – In Your Pocket". A PDA-based information system was envisaged, which could provide everyday-information to the students. The scope of the availability of information for this feasibility study is shown in the figure 2, which shows the first PDA screen after entering the programme. The information, which could otherwise be obtained by asking someone or by accessing a desktop at the Polytechnic, was meant to be available to the student anytime anywhere at the palm of his hand. The complete campus map was provided for easy navigation within the Poly for various destinations. The student group suggested this project after recalling their own experience in the first year as they joined the Singapore Polytechnic. They did not have any friends initially and had much difficulty locating the venues and their lecturers.

The second project, called 'SP AnytimeAnywhere – Learning' was the development of a mobile e-learning platform. The scope of the learning content was a two hour e-learning content from a Specialist Diploma Course, which was originally delivered through the Blackboard. The study was meant to find the actual work involved in conversion of the Blackboard content to a PDA-based delivery platform.

The scope of conversion from Blackboard content to PDA screen could perhaps be compared to the task of developing PowerPoint slides from MS Word lecture notes. As we are familiar that we cannot make a PowerPoint slide as heavy in content as a MS Word page, similarly, a PDA page has to be even less in content to be legible on a very small screen. This reduction in content per page is somewhat difficult to develop but perhaps more friendly for learning (the point made by Trifonova and Ronchetti, 2003) as the concepts are very small, focused to the point in context and therefore easier for assimilation when the user has just a small slot of time in-between his other activities . Further, these concepts, being small in size would also lend themselves for the creation of 'learning objects' (see EdSpecs, 2004 - an article for a unambiguous description of 'learning objects') for eventual development of a flexible e-learning system.

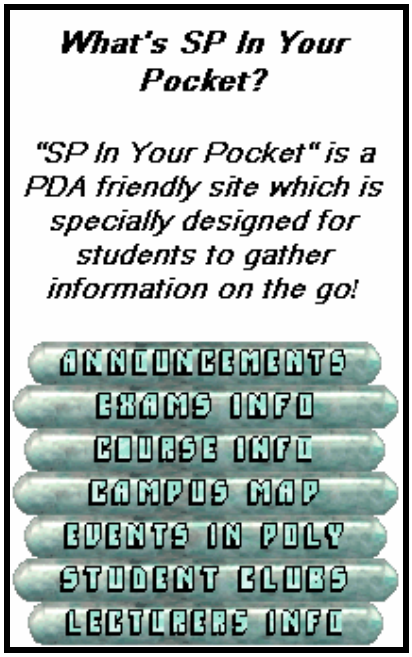

Figure 2: Scope of AnytimeAnywhere - Living

The delivery system was based on the mixed-mode approach, which is a combination of 'pure connection'[2] and 'pure mobility'. The 'pure connection' was provided via the SP's wireless network and the 'pure mobility' was provided via a special server, called AvantGo[3] server (AvantGo, 2000).

Theoretically any web page can be viewed on the PDA screen via AvantGo. AvantGo is a free service (for limited downloads) that enables one to receive the Internet on one's Palm/ Pocket PC PDA without the need to own a modem. But if the pages have not been specifically made for the PDA screen the information is likely to be disjointed. The challenge was to make the content readable, coherent and meaningful on the small screen.

Once the content is made, it is uploaded to a normal web server. A server space was rented at Aplus.net, (http://www.aplus.net/) for the project and the following domain name http://spanytimeanywhere.com was selected for the site. Once uploaded, the working of the AvantGo server is shown in figure 2. When there is a request (normal HotSync operation of a PDA) from user's handheld the AvantGo server optimizes the web content from the site to suit a handheld device (either Pocket PC or Palm). Thus, the AvantGo could be viewed as a translation tool between normal web server and a PDA as it compresses the pages and shrinks large images.

[2] 'Pure connection' refers to the delivery system when the device is always connected to the Internet (through WAP, GPRS, Bluetooth, SP's Wireless Network, etc.). 'Pure mobility' is when no connection is available and so all the data the applications need should be uploaded on the device and used offline.

[3] AvantGo is a free service (for limited downloads) that enables one to receive the Internet on one's Palm/ Pocket PC PDA without the need to own a modem.

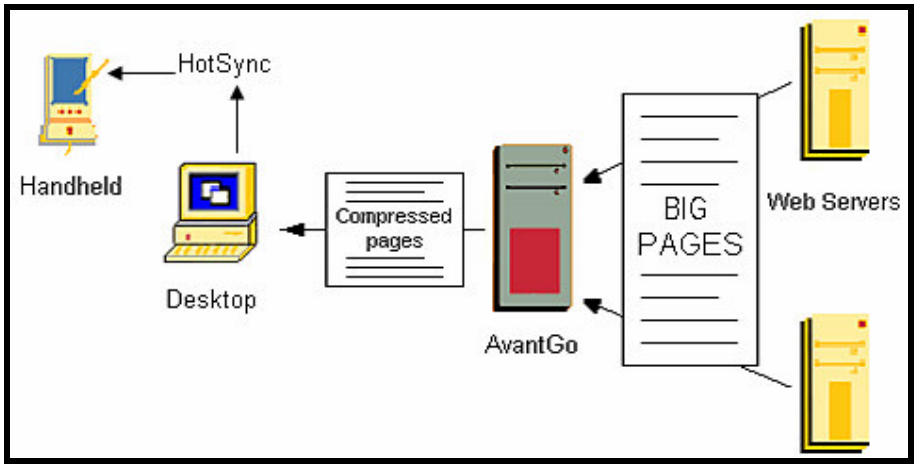

Figure 3: 'Pure mobility' approach through AvanGo

The contents are downloaded to the PDA with the graphics as well as the hyperlinks for offline browsing ('pure mobility') later.

Both the projects groups struggled with the tasks of absorbing the concepts, reading through the voluminous 352 pages of AvantGo Channel Developer Guide (2000) and following the guidelines to develop the PDA compatible web pages. Once the preliminaries are learnt, the texts are quite easy to enter as long as the screen size is maintained. The challenge for the texts is to make the page content meaningful within the small screen area. While the graphics form a different kind of challenge as AvantGo cannot display any image larger than 150 pixels. Normally, a graphic directly converted to this size would suffer from poor quality as the details would be too small to be legible. Solution to this problem is to split the images in to smaller chunks. These image chunks can later be combined while downloading to the PDA. Example of a page is shown below in figure 4.

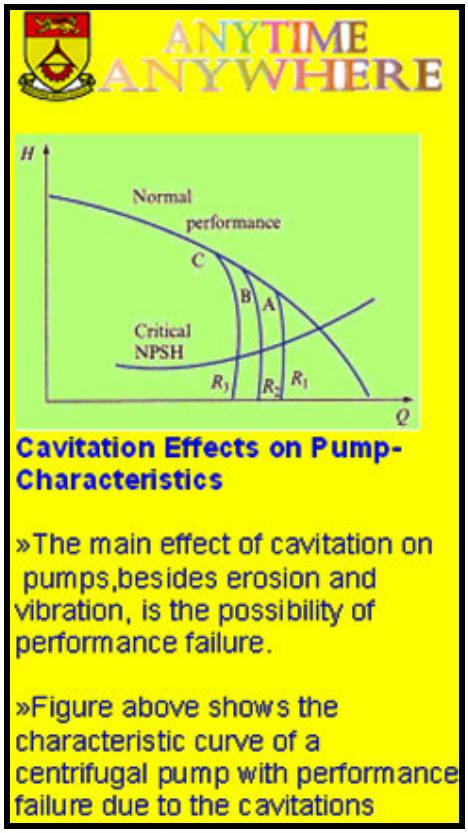

Figure 4: A content page on AnytimeAnywhere - Learning

The delivery mode was also made compatible with the SP's wireless network, which provided the 'pure connection' approach. In both 'pure connection' and 'pure mobility' the results were acceptable.

The two projects were show-cased at the SP INNOVEX2005. A random survey was conducted among the present SP students and the 'O' level students visiting the exhibition during the SP's Courses and Career Fair 2005. The objective was to analyse their reactions to this new mobile platform. Of the 50 students surveyed, 33 showed keen interest and said that they would be very eager to try this out, 9 said they were not interested and remaining 8 were not very sure. However, the usefulness of this new platform can only be established after full scale trials are conducted.

A student project group is now actively engaged in implementing a part of a module for wireless PDA-based access.

Conclusion

> Just as the intelligence of a networked computer cannot be located inside of its processing unit, human intelligence cannot be found from inside of the human head; human intelligent activity is distributed across a network of cultural-historically developed tools and other artifacts, closely collaborating communities, and heterogeneous networks of people and artifacts. The development of tools and practices of creating, elaborating and sharing external representations, which allowed overcoming of natural limitations of human biological memory, has a critical evolutionary, historical, and socio-cognitive role. (Hakkarainen, K. et. al. 2004.)

A decade or two ago, we were comfortable with a sextant or a slide rule and they surely augmented our intelligence. This tool-based augmentation of intelligence is not new to humans. But in this era of information technology, it appears, we are reluctant to embrace this formally.

The case studies, described above, show some of the possibilities of application of these new technologies as they are emerging. The danger is that by not allowing ourselves to be actively involved in the usage of these new tools, the maritime community will lag behind the others, who are more proactive and benefiting their professional groupings' networked intelligence.

Absence of inclusion of these competencies in the area of information technology, as a specific proficiency requirement in our core curriculum, could render our future maritime officers ill-trained for the 21st century and thereby weaken the networked intelligence of the shipboard complement.

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