

# USE OF CMAPTOOLS AT BOTH LOW THRESHOLD AND HIGH CEILING LEVELS AT THE SINGAPORE MARITIME ACADEMY

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**Abstract.** Leveraging on one of the key-objectives of the CmapTools program, the ‘*Low Threshold and High Ceiling*’ (Cañas et. al., 2004), this paper describes two cases of use of CmapTools in teaching and learning. The first case is at the Low Threshold level, when an inquiry-based learning was undertaken at the Singapore Maritime Academy (SMA) for a module in ship construction for pre-sea cadets. The inquiries by students led to additional content and a constructivist approach was taken to develop an *advance organizer* (Ausubel, 1960) using CmapTools. This advance organizer was later used by students to prepare for their summative assessment. The second case is presently in the process of implementation at the SMA and it is hoped that the application is targeted towards the *High Ceiling* as a complete course structure is planned to be delivered via a CmapTools interface. The course deals with the training in engineering for adult learners, who are already chief engineers on diesel ships and who will be further trained for certification in handling LNG carrier in steam propelled vessels burning boil off gas from the LNG cargo. The aim is to reduce the training time to about a third of its normal duration by use of CmapTools-based *advance organizers*.

Category/Categoría: *Poster Paper*

## 1 Introduction

Use of computer-aided learning is not new and as is well known among educators, the paradigm shift expected in teaching and learning with the advent of information technology did not quite materialize (Eisenberg et. al, 2002), perhaps a parallel to those days when radio and television were to have revolutionized classroom proceedings (O’Hagan, 1998). Tradition of classroom teaching followed the old medieval model (Francis, 2001; McLeod, 2002) irrespective of the changes in the outside world.

However, the developers of CmapTools claim to have one of its key objectives as “*Low Threshold and High Ceiling*” (Cañas et. al., 2004). This was less frightening and I was intrigued to probe a little further. At the Singapore Maritime Academy, where we train nautical officers and marine engineers to serve on board merchant ships to become eventually Masters and Chief Engineers, CmapTools was chosen as the effort required for an initial trial appeared small and yet the potential for time investment looked promising. This paper describes two projects, one of which was a pilot effort in using CmapTools in an inquiry-based learning program for pre-sea cadets. The idea was to develop an *advance organizer* (Ausubel, 1960) after going through the process of inquiry. This would then serve as resource material for preparing for their semester test. As this project was well received by the students, a second more ambitious CmapTools project was then planned for an up-coming course, which was meant to train senior engineers to be proficient for the running of LNG carriers, propelled by steam plants using boil-off gas from the LNG cargo. This second project is now being implemented at the Singapore Maritime academy.

## 2 Inquiry-based Learning

This approach was taken 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 could be useful 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 one 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 their 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.

## 2.1 Developing an Advance Organizer

The next step was to organize this work into an *advance organizer*, which could provide a *subject overview* as well as an *access platform* for various resources. Here, in Figure 1, the concept *Hull Material* has the resource *06steelsect*, which represents the existing material on Steel Sections, and the remaining material by Group A to F were new learning material, developed by students. These were direct outcomes of the student inquiry and thus appending of the existing knowledge with new learning material developed in constructivist classroom processes.

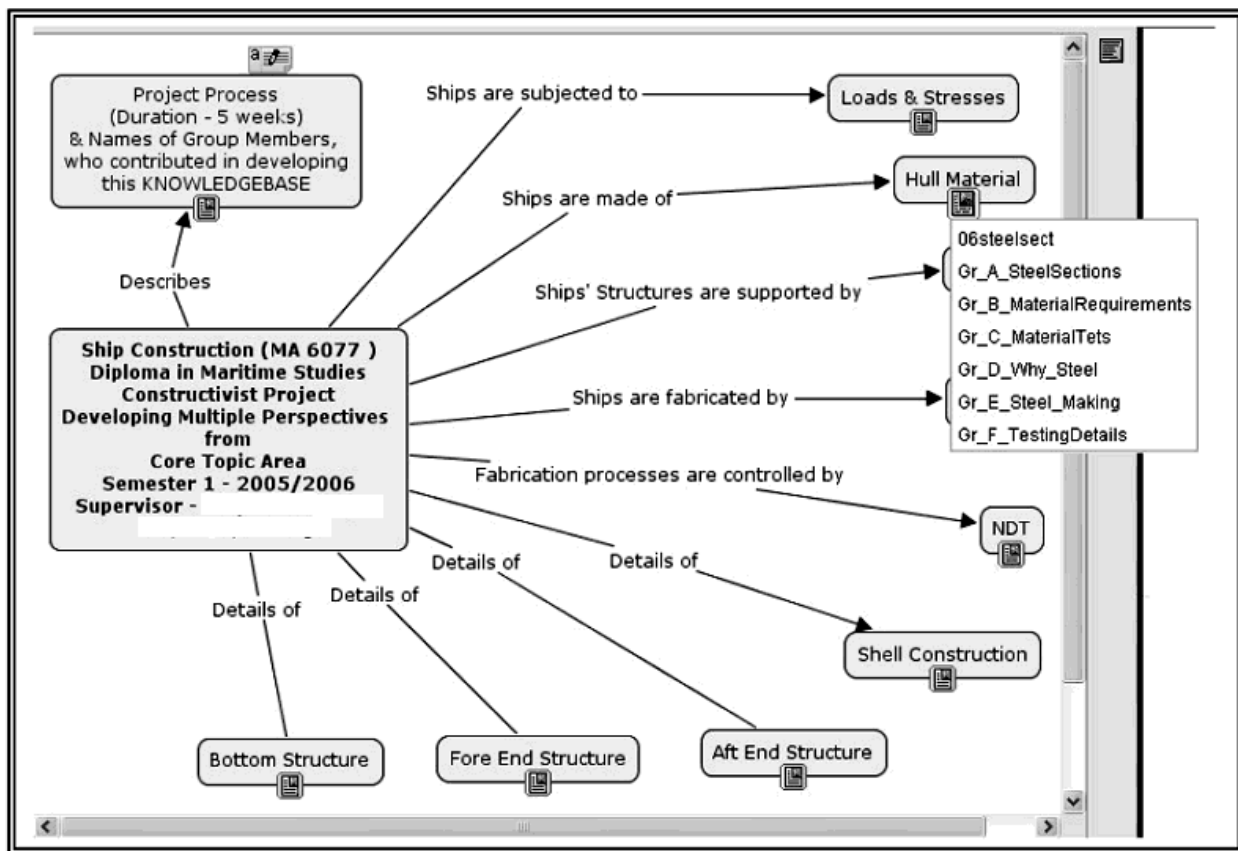


Figure 1. CmapTools Advance Organizer for the Inquiry-based Learning at the Singapore Maritime Academy.

When this course was previously done using the traditional classroom methods, the knowledge disbursed was very modular and student had much less understanding of the relationship between the various topics. However, with the integrated nature of the graphic organizer produced, and with the resources readily available under the various concepts, the students seem to grasp a better understanding of the entire domain. This was evident from their responses in the final summative assessments. The level of understanding achieved in the short module was substantial as subjectively expressed by all the examiners marking their grades. It was also realized that with each run of the module, the existing course material could be dynamically improved and CmapTools could serve as an

updating tool for the emerging knowledgebase. The module is presently going through its second cycle using CmapTools.

### 3 Building on the Advance Organizer

With a positive feedback from the pilot program, described above, I have now embarked on a large project to provide a complete CmapTools interface for an up-coming course in our academy. We have a new problem at hand – shortage of manpower for the new increasing LNG tonnage.

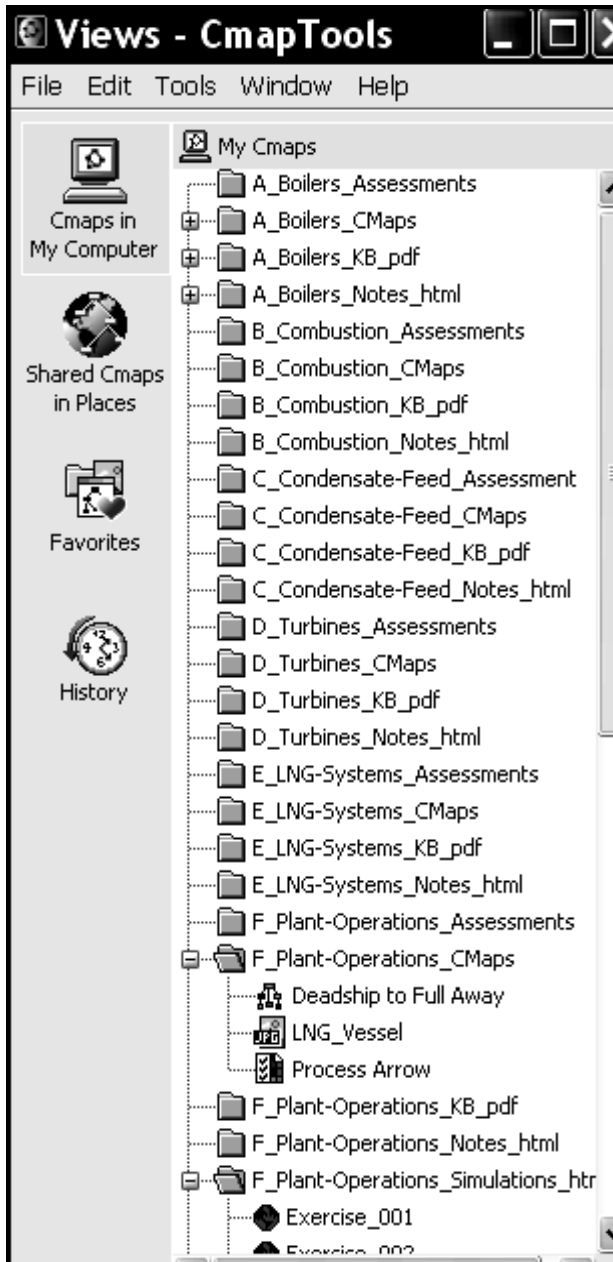


Figure 2. Views – CmapTools: Shows the Domain Knowledgebase

knowledge for the learners and cut down the learning time substantially.

With the emergence of increasing numbers of LNG tonnage, steam turbine propulsion has again become a viable means of propulsion at sea. Steam is the working substance used for these steam turbine vessels with boilers running on LNG boil-off gas from cargo. Central concept in the course is the understanding of the basic steam cycle, a process in which steam is generated in a boiler, subsequently expanded in turbines for work extraction and finally condensed into water and the feed, which is then transported back to the boiler for completing the thermodynamic cycle. The LNG-based steam propulsion will be introduced through a knowledge-base developed with CmapTools. All the content knowledge will be presented using CmapTools advance organizers. The final assessment of proficiency after simulator training will also be done using concept maps.

These certification programs in steam engineering, usually required a time of three months at the college and in those traditional courses (used to run about 15 years back), the LNG complexities were non-existent. Now the shipping companies have asked to produce these certificated engineers within a short period of one month, which surely is a daunting task. It is hoped the CmapTools-based course will be able to reduce the training time to meet this new industry requirements.

#### 3.1 Certification in Steam Engineering using CmapTools

The basic course structure is as given in Figure 2. Topics A to F are to be covered in the course with their General and Specific Learning Objectives. The complete course structure is shown in the Views - CmapTools (see Figure 2). The course is planned with Cmaps, content resources, and extensive time spent on a LNG-based steam plant simulator. Again the simulation modules are integrated using a *Process-based Advance Organizer* made by CmapTools (see Figure 3.).

It is expected that these advance organizers will accelerate the learning and assimilation of domain

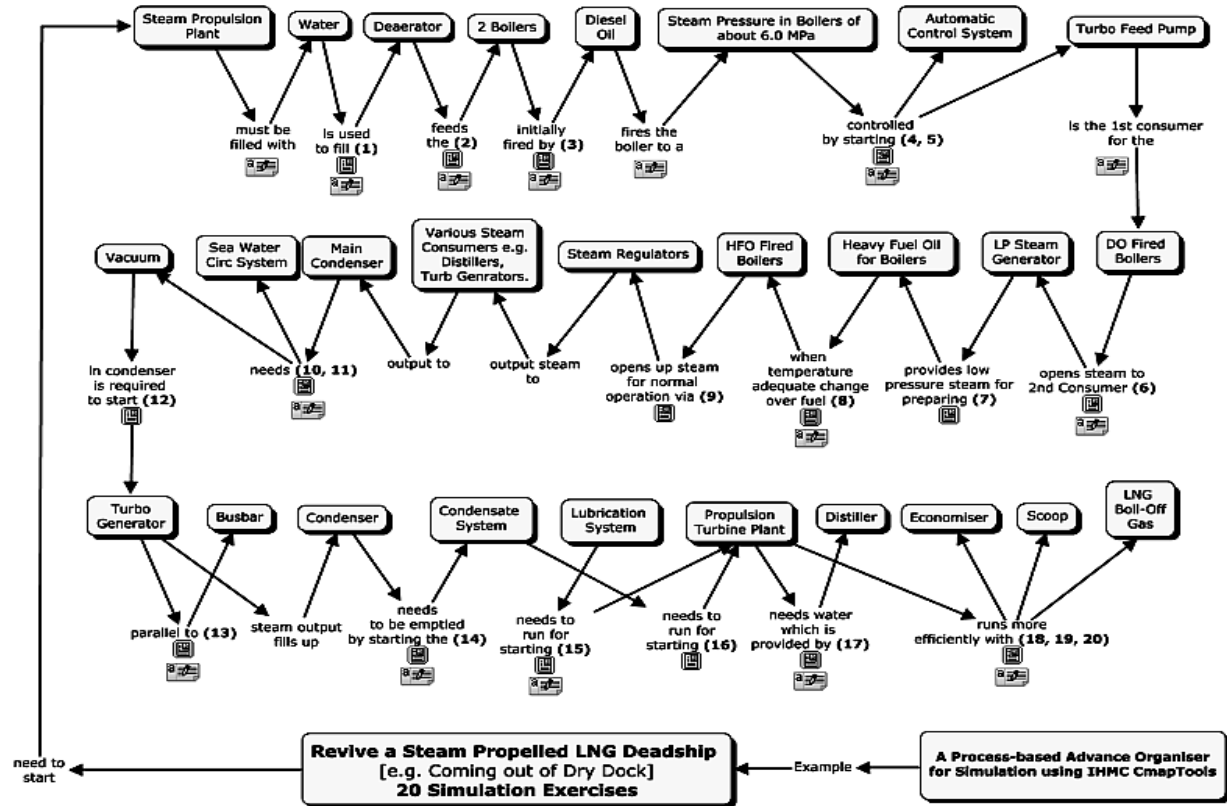


Figure 3. A Process-based CmapTools Advance Organizer for Simulation Exercises

#### 4 Summary

The paper provides a brief description of the development efforts at the Singapore Maritime Academy of two CmapTools-based projects and provides an in-progress report. The potential for CmapTools in teaching and learning seems promising.

#### 5 References

Ausubel, D.P. (1960). The use of advance organizers in the learning and retention of meaningful verbal material. *Journal of Educational Psychology*, 51, pp 267-272.

Cañas, A. J.; Hill, G.; Carff, R.; Suri, N.; Lott, J.; Eskridge, T.; Gomez, G.; Arroyo, M.; and Carvajal, R. (2004). CmapTools: A knowledge modeling and sharing environment. *In Proc. First Intl. Conf. on Concept Mapping*, Volume 1, pp. 125--133, U. of Navarra.

Eisenberg, M. B. & Johnson, D. (2002). Learning and Teaching Information Technology--Computer Skills in Context. *ERIC Digest*. ERIC Identifier: ED465377. <http://www.ericdigests.org/2003-1/skills.htm> (accessed April, 2006)

Francis, D. (2001). A learning revolution. *Maclean's*. p.50.

McLeod, D. (2002). *Lecturers and the learning revolution*. <http://www.ecclectica.ca/issues/2002/2/mcleod.asp> (accessed April, 2006).

O'Hagan. C. (1998). *Like tomorrow, the next generation never comes*. Centre for Educational Development and Media University of Derby, Derby. [http://ifets.ieee.org/periodical/vol\\_2\\_99/formal\\_discussion\\_1298.html](http://ifets.ieee.org/periodical/vol_2_99/formal_discussion_1298.html) (accessed April, 2006)