IT-infused Curriculum to Empower the Digital Generation of Marine Engineers

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Sharing the Development of a Pre-Sea Engineering Course

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***Kalyan Chatterjea & Daniel Lim are both instructors at the Wavelink Maritime Institute, Singapore. Both did their Extra Chief Certificates from South Tyneside College, England and had many years of practical experience in the maritime industry*.

The Digital Environment

- **"We live in a digital and mobile world where Google, the Internet and mobile technologies have disrupted traditional classroom learning...Internet-accessible resources are extensions of our memory.**
- **There are over 30 trillion links and 2 billion plus users.**
- **Our students are using these resources from all around the world to learn.**
- **Tomorrow, there will be more and more technologies that thrust information at students, stimulating curiosity and thinking."**

...Prof. K. Ranga Krishnan, Dean of Duke-NUS Medical School, Singapore. (Krishnan, Kamei and Cook, 2013)

Our Learners

- Mostly from
- Generation Y (born 1977-1994) &
- Generation Z (born 1995 – 2012 –frequently referred to as digital natives)

Born in the Digital Era – they express digital behaviour!!

Generation ‘Y’ & ‘Z’ - *Darla Rothman*

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- **They have never known a world without Internet, cell phones, or iPods.**
- **Generation Y (born 1977-1994)**
- **Generation Z (born 1995 – 2012 –frequently referred to as digital natives)**
  - They are tech-savvy and in constant contact with people 24/7 using Facebook or Twitter
  - They want technology that is easy to use and will solve their problems, help coordinate their activities, or provide them with relevant people or information
  - Their brains are affected by Internet use. They find answers to questions in Google and YouTube, but they lack the critical thinking skills to evaluate sources

Generation ‘Y’ & ‘Z’ - *Darla Rothman*

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- **They have never known a world without Internet, cell phones, or iPods.**
- **Generation Y (born 1977-1994)**
- **Generation Z (born 1995 – 2012 –frequently referred to as digital natives)**
  - They have low/no tolerance for being without digital resources
  - They have never had to use a library card catalogue or rummage through shelves to find a specific book
  - They don’t use a wristwatches or alarm clocks because they use their smart-phones for that
  - Instead of reading an article, they want to watch a video (YouTube) that summarizes it.
  - They may never send an email: [that is “so yesterday”]. Why email when you can text, instant message, tweet or FaceBook?

Generation ‘Y’ & ‘Z’ - *Darla Rothman*

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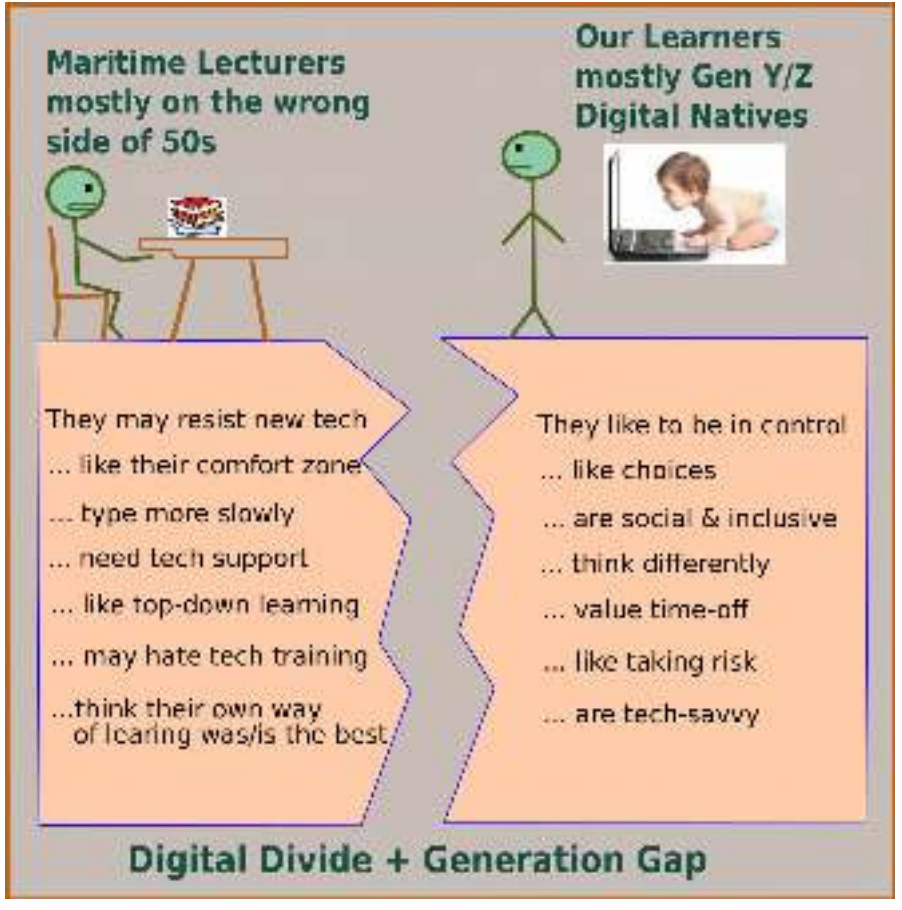
So for our 3-yr Marine Engineering Course, the challenge was to keep these learners engaged when their expectations were so different!!

Maritime Lecturers *vs* Digital Natives



Our initial task was to create a

Digital
Learning
Environment

To bridge this Divide/Gap!

Developing LMS with a Core Knowledgebase

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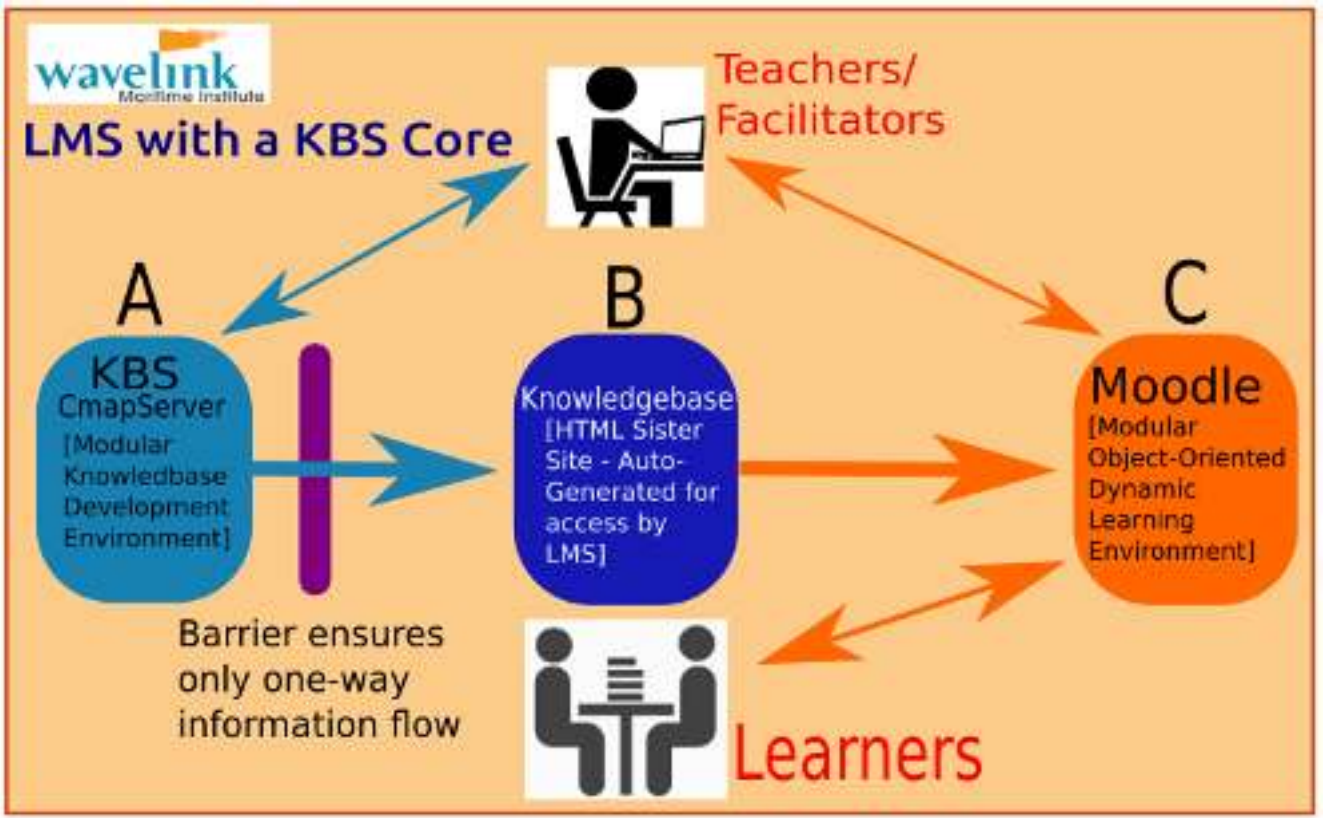

A

A maritime Knowledge-base Server (KBS) was developed using CmapServer software.

The server software allows concept-maps to be developed to represent a domain knowledge.

Concepts can have resources like documents, slides, graphics, video clips etc.

Digital Learning Environment at WMI

Developing LMS with a Core Knowledgebase

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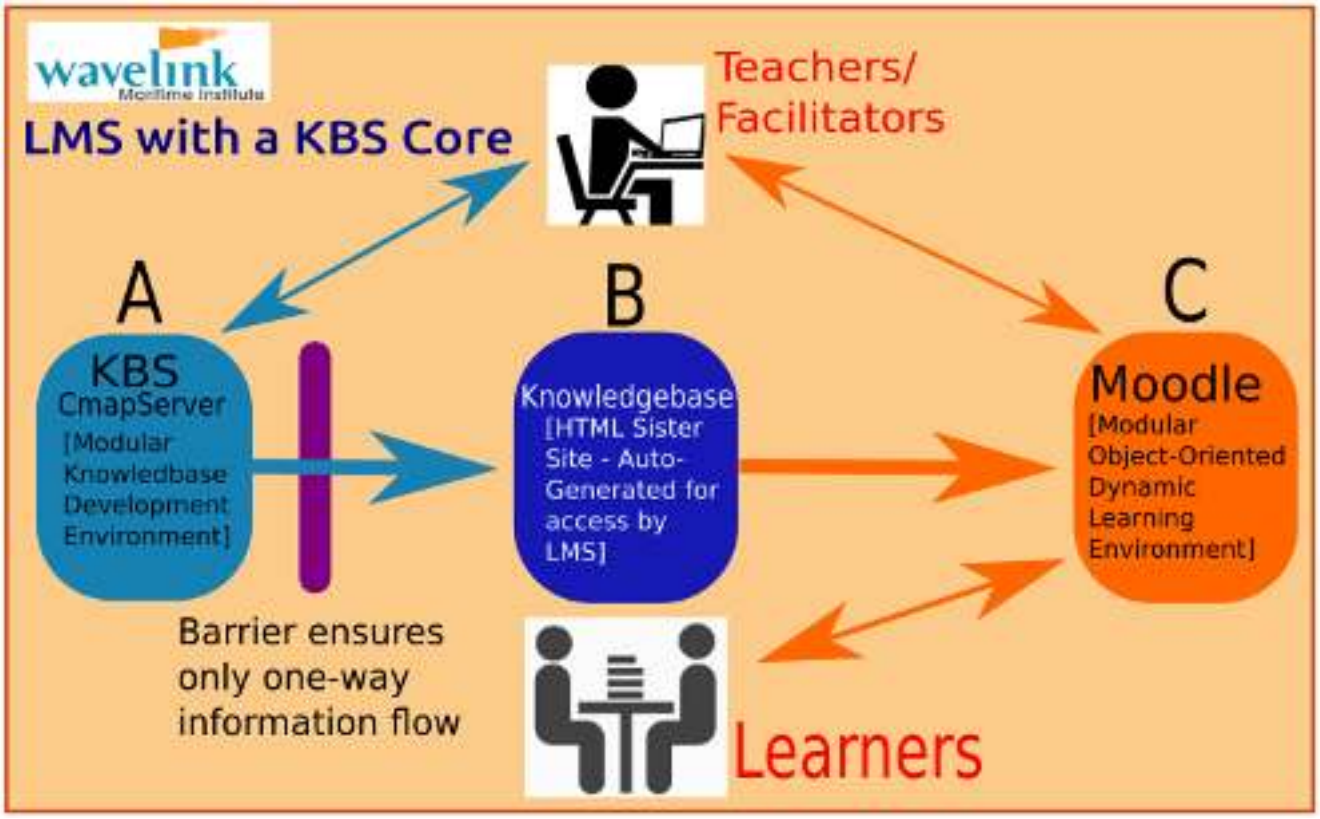

B

Concept maps on CmapServer are also automatically saved as an html file, which can be read on any browser.

So. learners can access these via Moodle learning-management server

Hence, the domain knowledge, which is developed by teachers remain secure in the KBS (Item -A)

Developing LMS with a Core Knowledgebase

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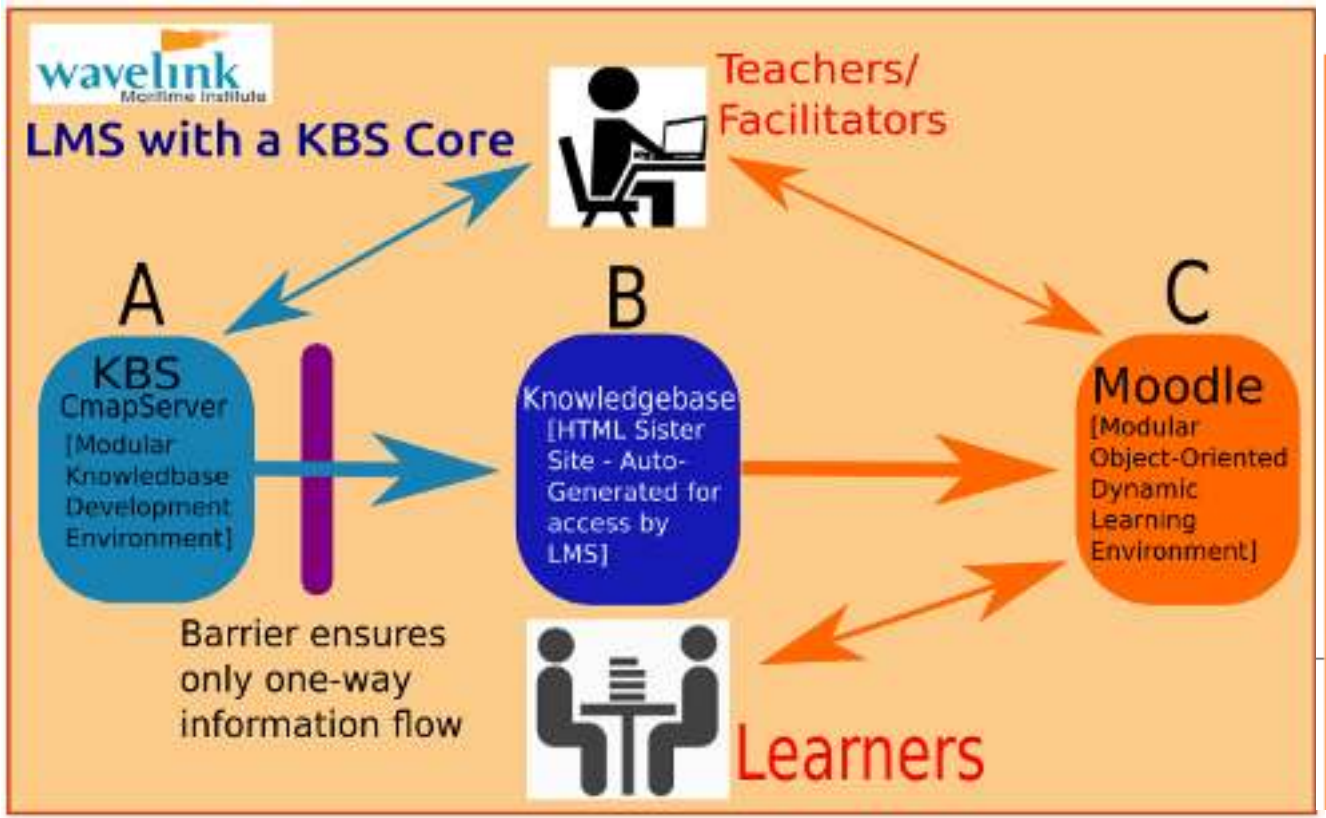

C

The virtual learning environment chosen is Moodle, which is an open-source course management system.

Moodle is a constructivist LMS allowing collaborative engagement of learners.

Moodle is widely used world-wide. Help videos are available for most topics on YouTube!

Digital Learning Environment at WMI

Conceptual & Procedural Knowledge

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- Knowledge is seen as combination of **conceptual & procedural knowledge**.
- Camps are combination of **concepts and their relationships**.
- So, **Exploratory Learning Environments** (ELEs) are created, allowing students the choice of exploratory learning.
- This reduces control over the learners' learning styles and behaviour.
- Concept maps also support **procedural components**, which guides students in problem solving based on standard operating procedures (SOPs).
- Some examples from our courses will illustrate these points.

Conceptual Knowledge - Example

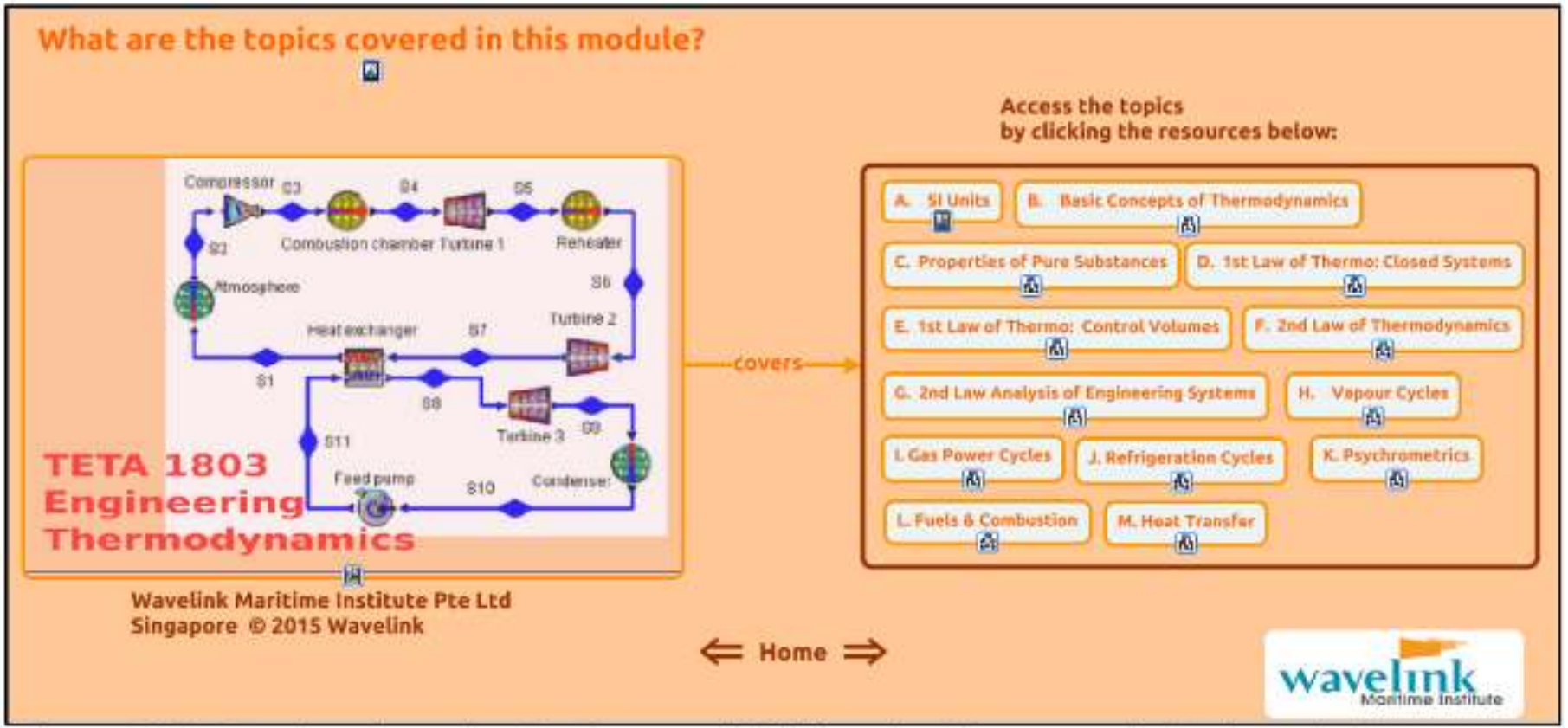

Figure 2. Exploratory Learning Environment (ELE) – allowing more student-control

Conceptual Knowledge - Example

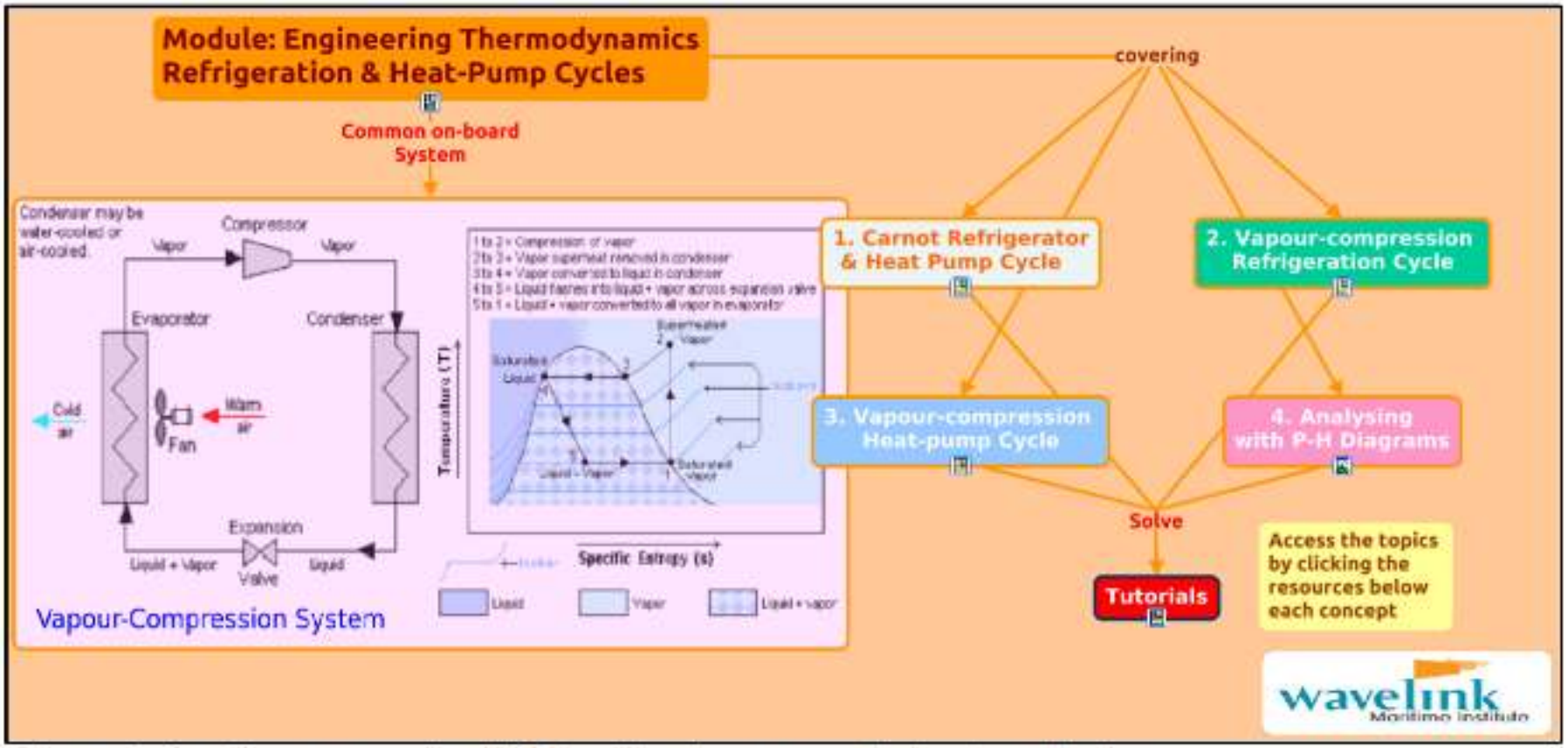

Figure 3. Another example of ELE – allowing more student-control

Procedural Knowledge - Example

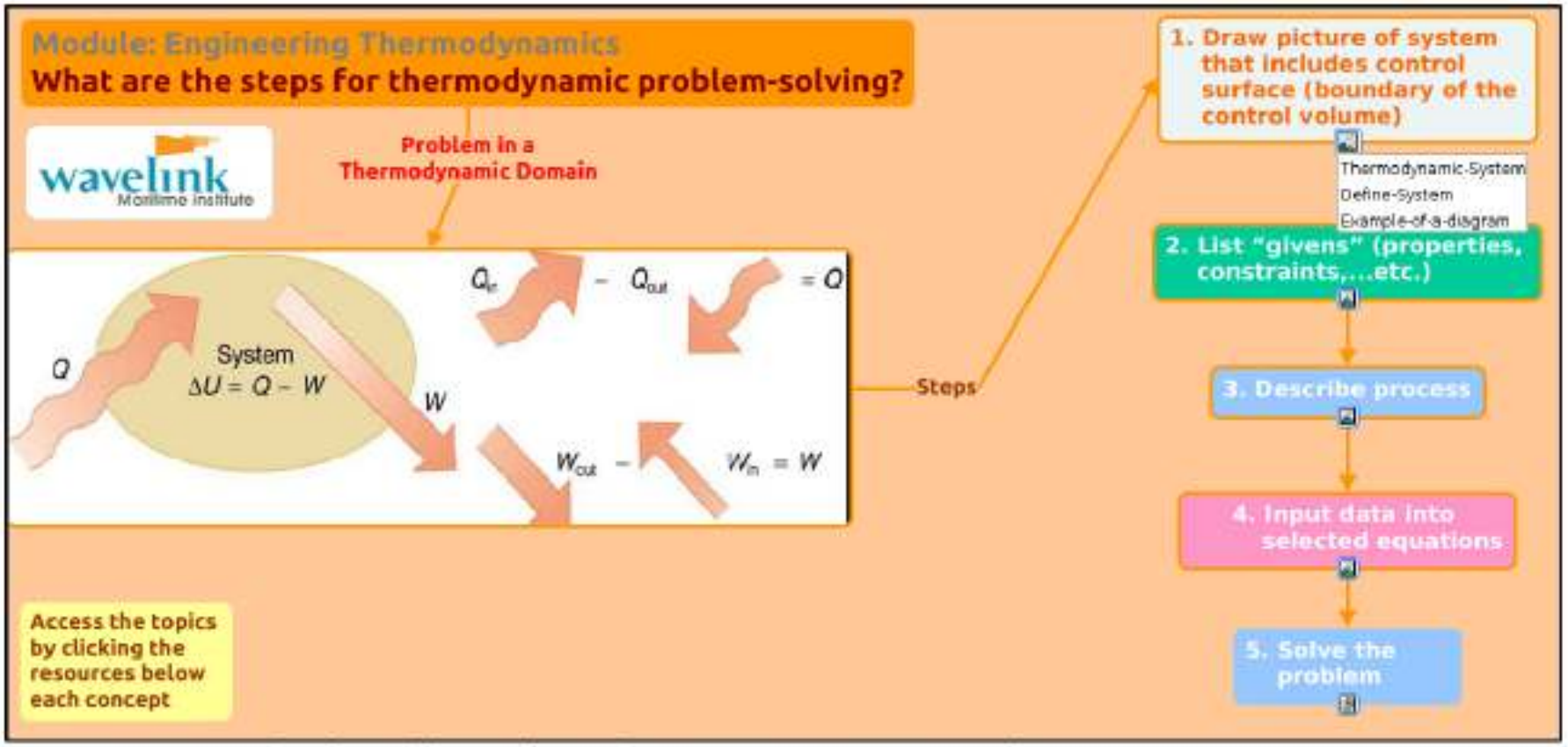

Figure 4. Procedural problem-solving diagram using CmapTools

Moodle CMS - Example

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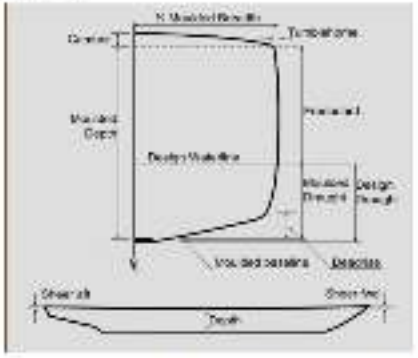
➔ **We use the Book Module in Moodle to provide content**

Hull Geometry

1. Hydrostatic Terms Relating to a Floating Vessel

1.2. Moulded Draught & Freeboard

Draught of the ship at any point along its length is the distance from the keel to the waterline. The draught is often restricted by insufficient water depths particularly for large ships like ULCCs.The advantages of large draughts are low resistance and the possibility of installing a large propeller with good clearances.



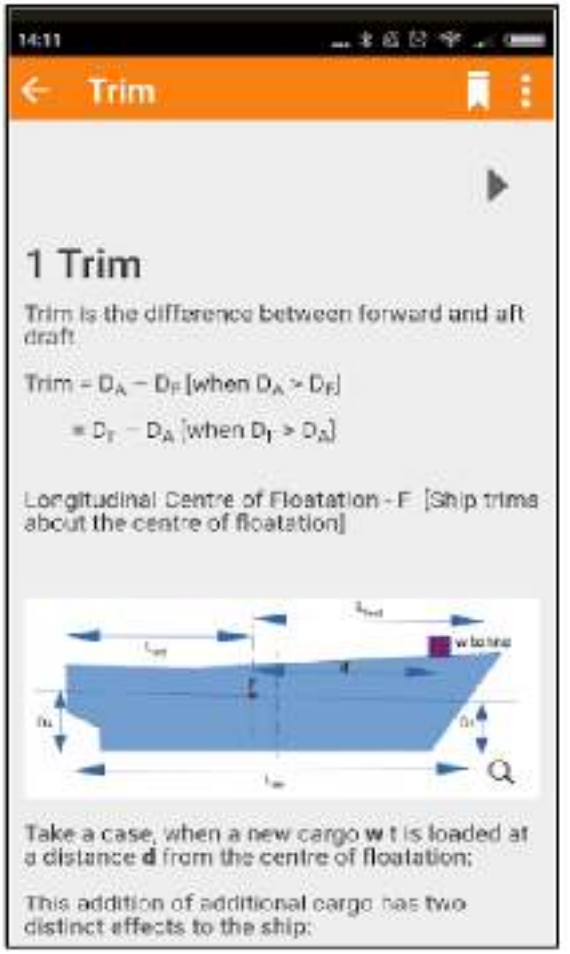
Moulded Draught - It is measured from the inside of the keel plating as shown above.

Freeboard - It is the difference between the depth at the side and the draught. The International Load Line Convention 1966 stipulates the minimum freeboard requirements for ships. On most occasions the freeboard is more than the minimum requirement as in many cases the ship is cheaper to built with more freeboard than the minimum required by the rules.

Table of contents

Moodle CMS - Example

- Book Module in Moodle formats itself automatically in mobile format.
- Book is a multi-page resource that allows for the sequencing of information in a book format using main chapters and sub chapters.
- Books can incorporate images, videos, websites, audio and text, and are a useful tool for content creation and management.



Moodle CMS - Example

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- We use a lot of Moodle quizzes in our course.
- There are 16 types of standard quizzes & nearly 50 types of specialised quizzes.
- We use them for formative as well as summative assessments.
- We will share a specialised quiz called ‘Formula-type’

Moodle CMS - Example

The total mass of the reciprocating parts of an IC engine is 315 kg. During the downward stroke at a certain position, the effective pressure on the piston is 5.5 bar and deceleration of the piston is 22 m/s2. If the piston diameter is 250 mm, find the following.
Take 1 bar = 105 N/m2

1) Force on the Piston

N

2) Total Downward Force

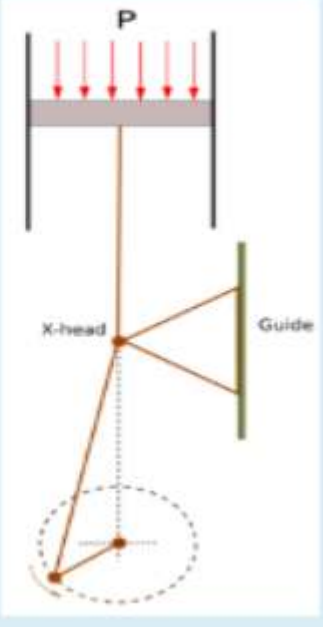
N

3) Force to Decelerate

N

34) Net Downward Thrust on Crosshead

N



Moodle CMS - Example

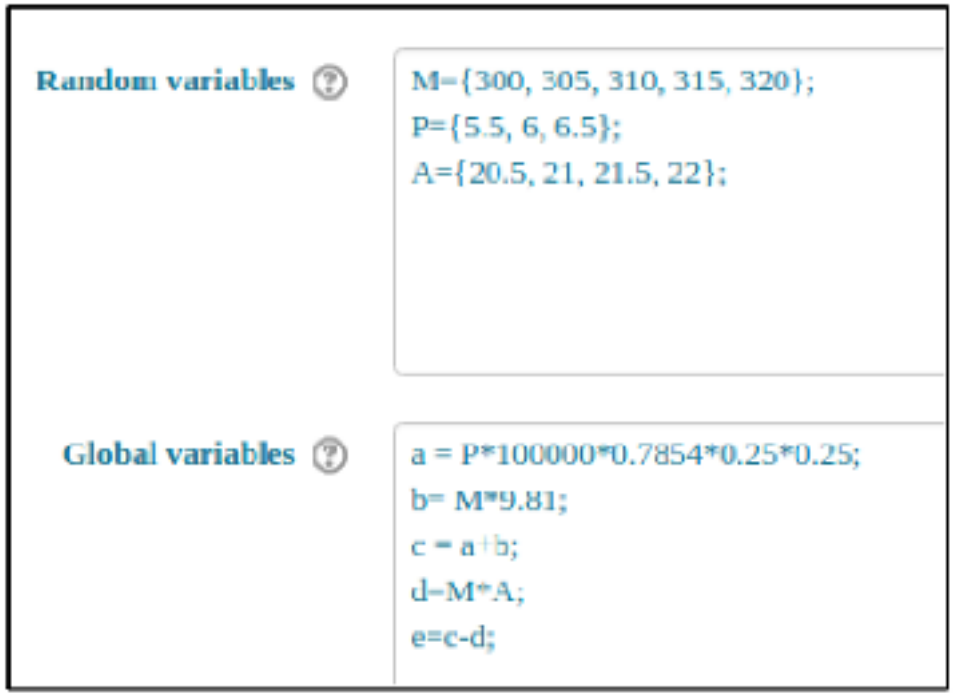


Figure 5. Random and Global variables in Formula Type Questions in Moodle

- Each student gets a different numerical value for M, P & A
- Global variables calculate the answers

Thermodynamics with more thinking!

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- We have used CyclePad simulator for the thermodynamics syllabus.
- CyclePad is used to generate what-if scenarios.
- Need to define system before switching to Analysis Mode.
- The approach reduces calculation load & increases thinking for learners.

Thermodynamics with more thinking!

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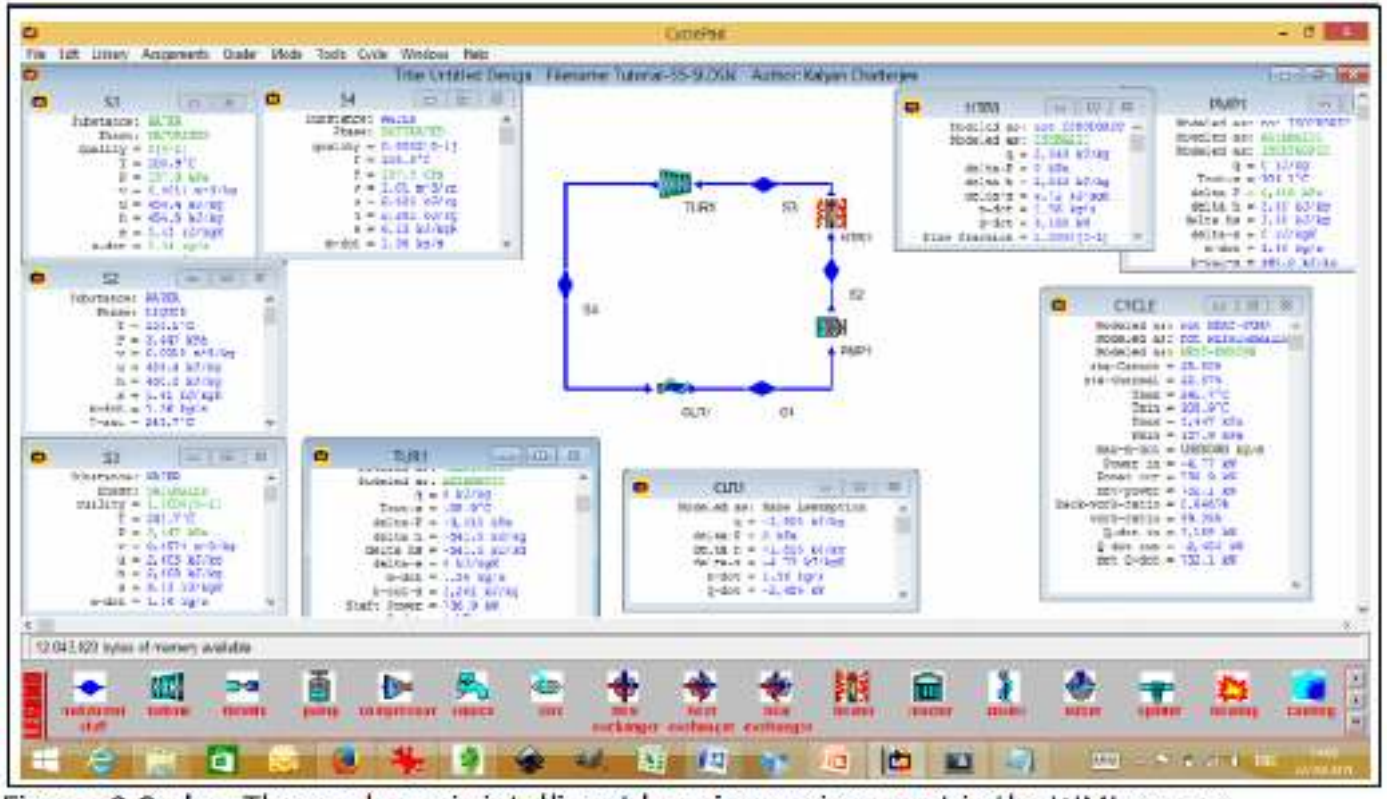

Figure. 8 Cycle – Thermodynamic intelligent learning environment in the WMI course

Learning Maths / Stability with Programming

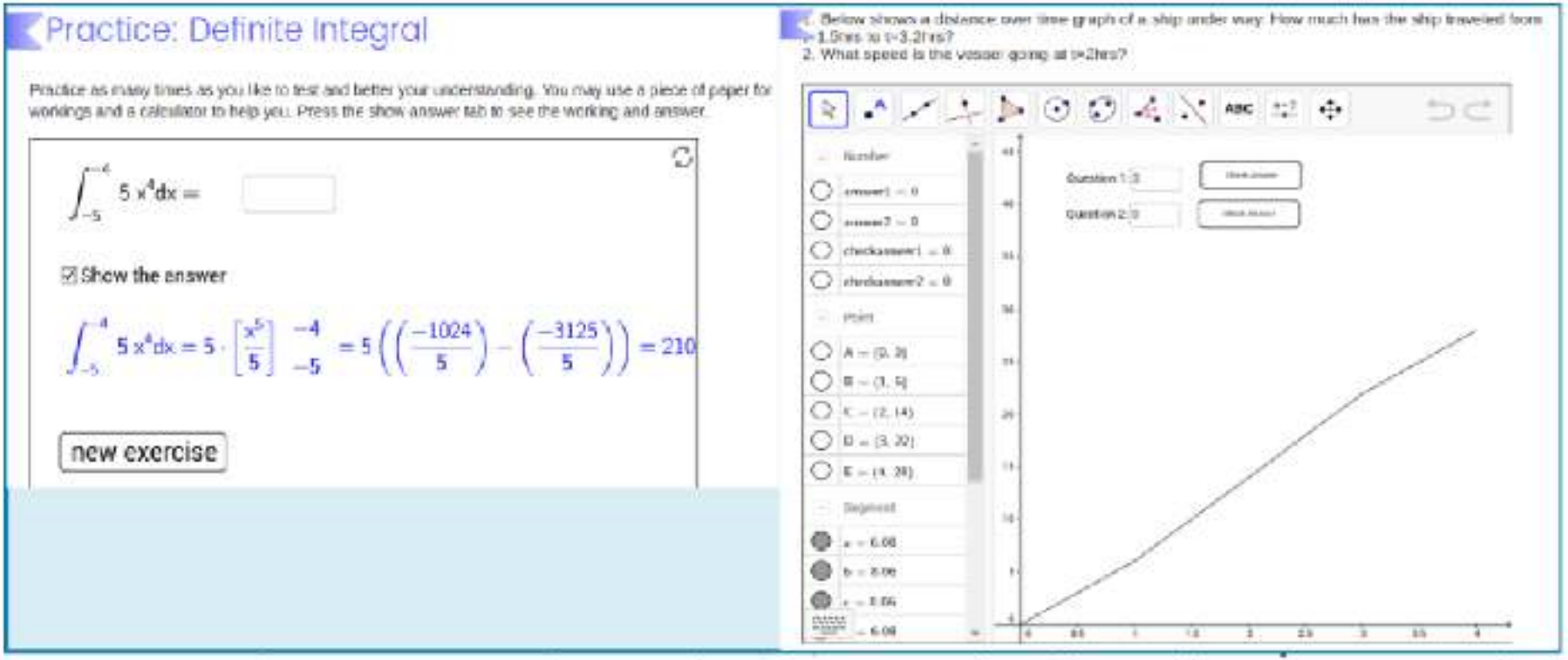

Figure. 9 GeoGebra environment showing a) Definite integral problem & b) Distant-time graph

Learning Maths / Stability with Programming

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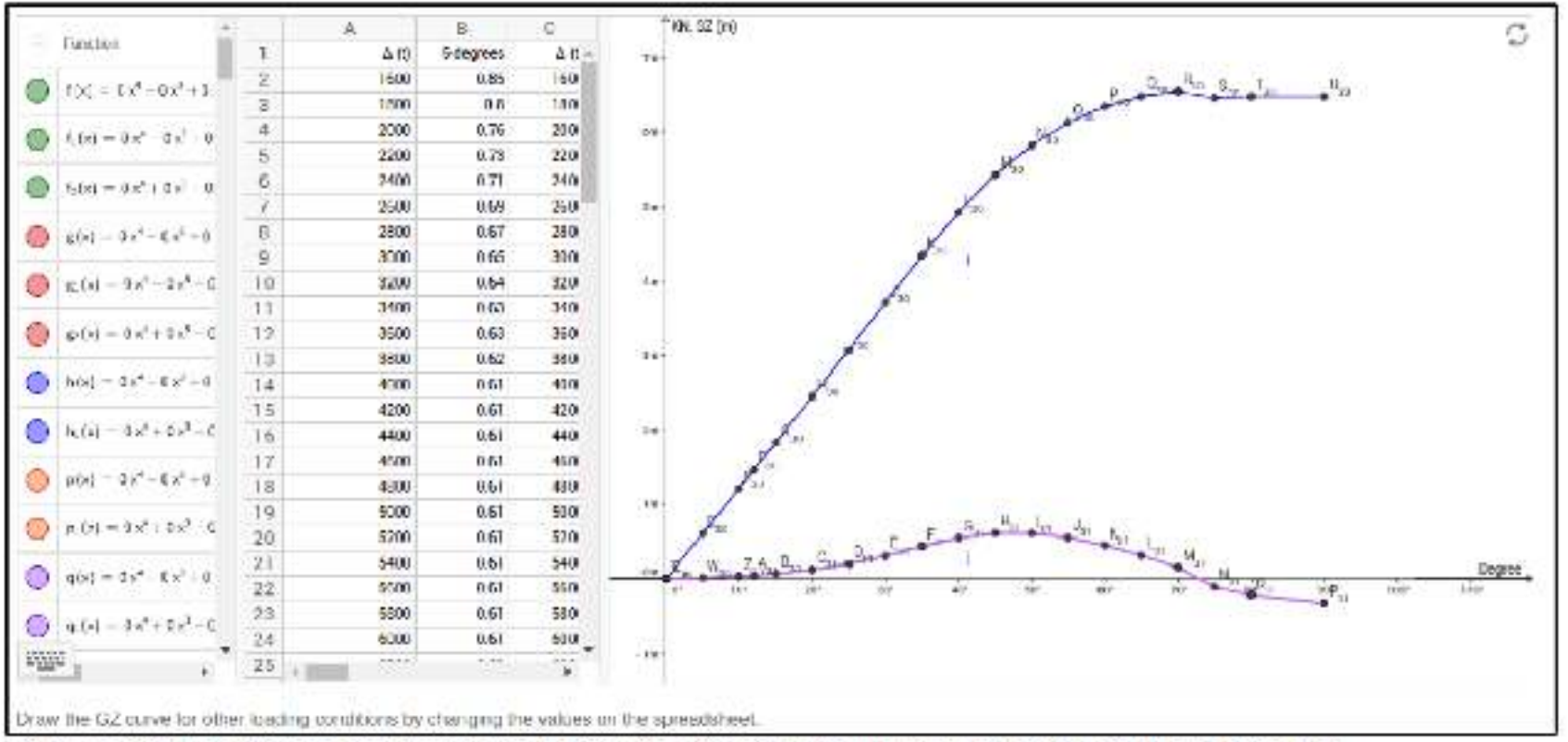

Figure. 10 GeoGebra environment showing KN & GZ curves using ship's hydrostatics

Playing with What-Ifs in Heat Transfer

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https://www.geogebra.org/m/E2jkMuPv

Unedited Feedback from Our Learners

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- **Course is made interesting and understanding was made easy.Table templates was also being prepared through geobegra whereby we can just chang the values on board a vessels and all the calculation then can be achivied easily.**
- **I enjoyed this module very much. The collaboration work has helped us understand and look further beyond the context of the module. Mr(Chief) Kalyan also took the time to elaborate further and relate to his own experience to help us have a better picture and understanding. He has always encouraged us to further improve on our own capabilities and by having to learn to use GeoGebra for this module, we learned more and also honed a new skill. This also enables us to carry around the knowledge, information and software easily even for our DLP period. Overall i find this module very encouraging and a fun environment to learn in as we try to keep up with the advancement of technology.**

Comments received in the Ship Stability Module

Unedited Feedback from Our Learners

- **WMI Moodle E-learning Platform has a positive impact on me as it is available even on the handphone thus making it highly accessible anywhere you are. It did not even crash once when I'm using it thus it is highly reliable.**
- **With the aid of moodle, it has made learning easier and it can be edited on the fly. Well organized as compared to blackboard which was used hardly used in polytechinic and uni.**
- **I enjoyed the non traditional delivery method of the course.**
- **This module have provide me a good knowledge on ship stability. Learning through moddle program provides an easy and better accessibility for my learning experience for this module as previously I have use programs like blackboard during my studies in university which is not very good and reliable program that I would recommend.**

Comments received in the Ship Stability Module

Unedited Feedback from Our Learners

- I liked the usage of moodle to do some of the tutorials and quizzes. It is user friendly and I can get feedback about my performance immediately.
- Module is easy to understand and grasp due to the availability of the e learning platform that is used, the content of the module can be easily accessed anywhere, be it on phone or on the computer, this makes studying easy anywhere, anytime. The platform is also easy to use and navigate and even has a forum where students can discuss their problems with the lecturer in the case of a weekend where there is no class, the students can still get their problems clarified online.
- Excellent course implementation in Moodle and Geogebra.
- Geogebra is an intuitive tool for visualising abstract mathematics and vessel stability physics.
- Moodle is virtually customisable beyond constraint - flexible enough to handle all content and assessment formats eg. searchable ebooks/wikis, mathematical work with random-generated variables, cloze-type recitation etc.

Comments received in the Ship Stability Module

Unedited Feedback from Our Learners

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- ➔ **Moodle has consistently demonstrated strong performance in extensive operational deployment and stress-testing at highest levels of academia (including MIT ; http://www.eclass4learning.com/colleges-universities-use-moodle/), garnering top-level accolades from credible analysts of IT solutions and digital learning, eg. PCMagazine (http://www.pcmag.com/article2/0,2817,2488347,00.asp)**
- ➔ **Moodle in particular is functionally superior by far to even the "Blackboard" fielded by NTU and personally experienced by myself during undergraduate studies there, casting some doubt on the financial/academic astuteness of that (latter) tax-dollar investment. Both Geogebra and Moodle are free and open-source.**
- ➔ **Strongly recommend continued leverage on these elegant and cost-effective platforms**

Comments received in the Ship Stability Module

Unedited Feedback from Our Learners

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- ➔ **Good learning experience on Ship's Stability.**
- ➔ **I pretty much sumed up everything that i need to know for ship stability module. I believe the theory learnt will be beneficial to be put into practical real-life usage. With the ease of GeoGebra, calculations will be made slightly easy.**
- ➔ **Learning over the internet has improve drastically my study methods, i could study anywhere.**

Comments received in the Ship Stability Module

Concluding Remarks

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- With pervasive digital technologies all around us, generation Z is even more demanding than generation Y with respect to information technology usage in educational artefacts.
- The instructors/facilitators need to bare this in mind and try to engage the learners through various interactivity developed innovatively in the online/mobile platforms.
- The present educational IT scene is extremely dynamic and the instructors should have their antennas out to detect digital-behaviour changes in generation Z.

Thank you!