Action Research for a New E-Learning GPS/Surveying Platform

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Outline

- ✓ The Project
  - **Team, Background, Focus Programs and Courses**
- ✓ Geospatial Education at RMIT
  - **Framework, Challenges, Opportunities**
- ✓ An e-Learning Platform
  - **Mind Map, Wiki Online Platform, Multimedia Tools**
- ✓ A Case Study
  - **Methodology, Outcome**
- ✓ Conclusions
- ✓ Demo

Project Team

- ✓ Geospatial Academics
  - **Prof Kefei Zhang**
  - **Dr Gang-Jun Liu**
  - **Rod Deakin**
  - **Dr David Mitchell**
  - **Bill Cameron**
  - **Lucas Holden**
  - **Dr David Silcock**
  - **Dr Hai Xu**
  - **A/Prof Chris Bellman**
- ✓ Researchers
  - **Erjiang Fu**
  - **Ming Zhu**
  - **Yanxi Zhou**
  - **Suqin Wu**
  - **Sue Choy**
  - **Bobby wong**
- ✓ SEH Managers/Consultants
  - **Stuart Whitman**
  - **Hans Tilstra**
  - **Meg Colasante**

Project Background

Stage 1 - 2007 ARTL project

I [illegible]
II Mind map design and flash version development
III Website content development
IV Evaluation

Stage 2 - 2008 ARTL project

I Course scenario design
II Animations development
III Website re-development and integrate the animations with the
IV Evaluation

Stage 3 - 2009 LTIF project

I Industry scenarios design
II Website re-build on RMIT IT system
III Assessment and feedback system development
V Evaluation

To produce work ready graduates who are

better equipped with knowledge and skills

and

able to assist government and business to

solve critical practical problems

and

face global challenges

College funding -
Action Research in Teaching and Learning

RMIT University grant
Learning and Teaching Investment Fund

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Focus Programs and Courses

HE

- Surveying 4
- Geodesy
- Surveying 3
- Geospatial Science Major Project
- Survey Network Design and Analysis
- Grad Dip and Masters in Geospatial Information
- Geospatial Information by Research

TAFE

- Advanced Diploma of Spatial Information Services
- Spatial data requirements
- Data Collection and Validation
- Capture new data
- Validate existing data
- Collate and interpret data
- Monitor spatial components
- Creation of new spatial data
- Design project deliverables
- Research and development

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Geospatial Education at RMIT- A Framework

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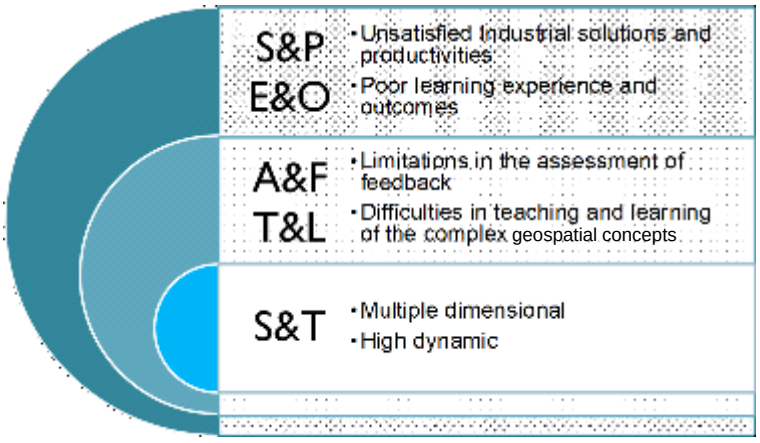
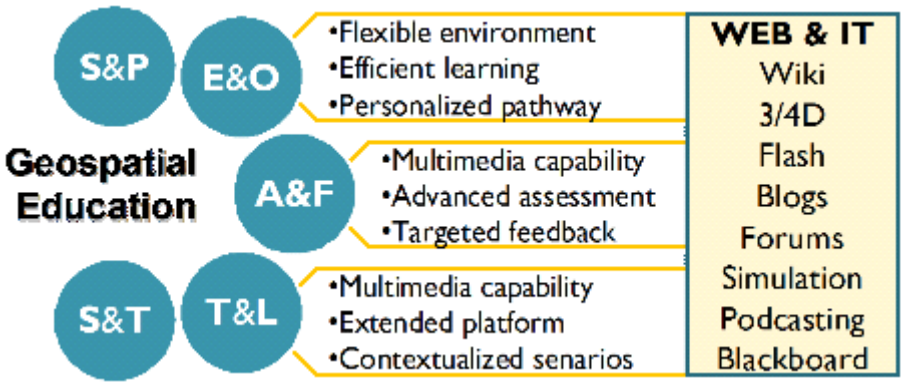
Geospatial Education - Challenges



Geospatial Education – Opportunities



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Geospatial Science and Technology

e.g. Rapid developments of GNSS

- From the first satellite launched in 1978 to today's reliable cm-level positioning world wide
- Many new GNSS systems under development
  - **e.g. European GALILEO, Chinese Compass/Beidou, Japanese QZSS and Indian systems**
- Wide applications
  - **space objects tracking, precision farming, sports, recreational and intelligent transportation**
- 260,000,000 search results in Google for GPS/GNSS

US$22 billion in 2006
US$75 billion in 2017

With such rapid developments of the GNSS technology and applications, how Geospatial Education at RMIT can meet the rapidly evolving needs of both the geospatial industry and the learner community?

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Industry Requirements

The geospatial industry needs

- to be kept abreast of the latest developments in the "enabling" geospatial technologies, including GNSS
- a platform for engaging (and interacting) with university academics for vocational and professional development, and R&I activities
- an authority and standardised knowledge base for
  - **the sustainable developments of the industry, including**
  - ***e.g.* surveyors' on-going training**

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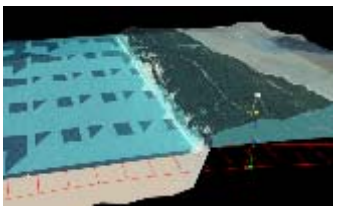
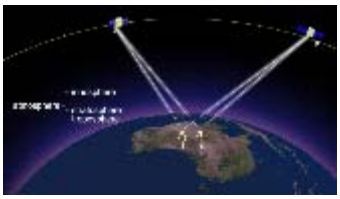
Experience and Outcome

Students' perspective

- ✓ The multi-dimensional and dynamic nature of GPS and surveying components
  - *e.g.* **rotation, various coordinate systems, datum, timeframes, map projections and satellite signal propagation**
  - **cause difficulty for students to grasp if represented two-dimensionally (e.g. on a standard whiteboard)**
- ✓ Mega online information is often
  - **less structured**
  - **repeated**
  - **"uncensored"**
  - **misleading**
- ✓ Lead to poor learning experience and outcome





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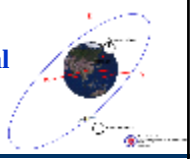
Teaching and Learning

Lecturers' perspective

- ✓ How to employ digital multimedia and WEB techniques
  - **to help students better understand multidimensional and dynamic geospatial concepts**
  - **to inform students the latest developments in GNSS technologies and applications in a timely and effective manner**
  - **to enhance our knowledge delivery to different levels/groups of students**
  - **to design, align and integrate tasks and assessment**
  - **to inform and influence students' learning attitude, process and approach**
  - **to prepare students as effective and responsible geospatial professional practitioners**
- ✓ …….



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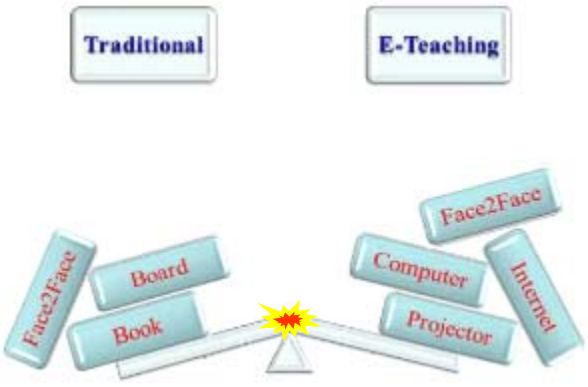
Assessment and Feedback

- How to overcome these limitations by deploying e-learning platforms that
  - are open, distributed, dynamic, interactive, and responsive
  - have flexibility (to meet varied learners' needs and interests) and scalability (i.e. the more users the better)
  - provide global, 24/7, and flexible access to contents, resources, tasks and activities
  - are not restricted by two dimensional media (i.e. paper-based)
  - engage students in active learning, higher order thinking and problem solving
  - encourage participation, interaction, sharing and collaboration
  - enable authentic and formative assessment and feedback for learning
  - allow personalized learning pathways
  - enhance learning experience and outcome

Traditional assessment and feedback in Geospatial Science are

- more content-focused than student-centred
- limited by two dimensional media (i.e. paper-based)
- less flexible (*e.g.* one-size-fit-all in terms of contents, context, scope, time and place)
- hard to identify individual's strength and weakness

Advantages of e-Learning Platforms



- **F**lexibility
- **E**fficiency
- **E**ffectiveness
- **L**earner-centred

- Enable **lifelong learning** by overcoming the barriers between our social, educational and professional lives

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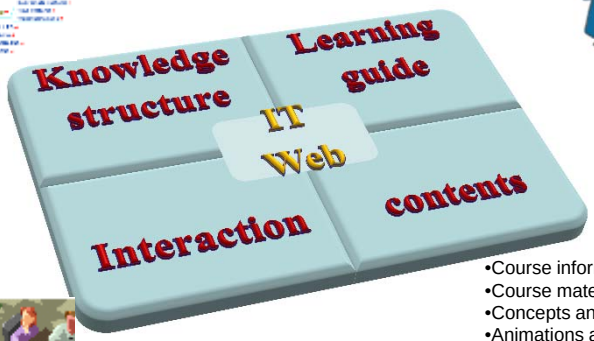
An e-Learning Platform

Mind Map



wiki online platform for

- Collaboration
- Communication

- Course information
- Course materials
- Concepts and structure
- Animations and simulations
- Selected website linkages
- References
- ……

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Main Components

- ✓ using customized **mind map**
  - **as a learning tool for structuring, categorizing and navigating a large amount of information**
  - **to guide students with various backgrounds and/or needs**
- ✓ employing a **wiki online platform** for collaborating and communicating
  - **among teachers, students and teachers/students**
  - **across HE and TAFE at RMIT**
  - **with external contributors/participants**
- ✓ using **multimedia tools** to
  - **develop and present relevant animations and simulations**
  - **support student-centered and problem-based authentic learning, assessment and feedback**

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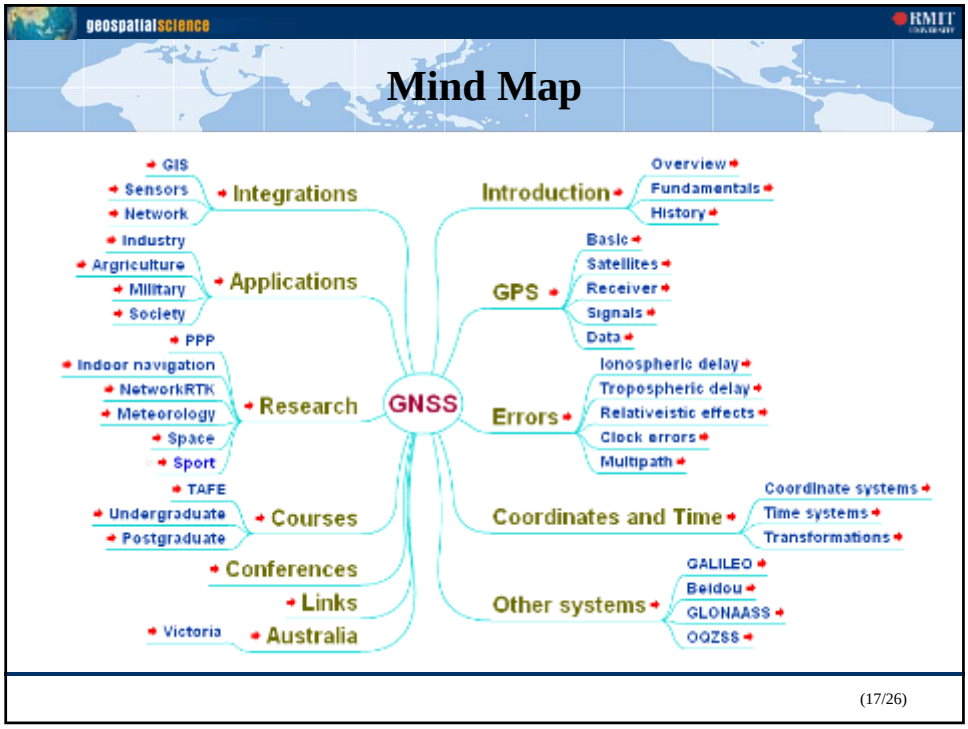
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RMIT
Mind Map
GNSS
Integrations
GIS
Sensors
Network
Applications
Industry
Argriculture
Military
Society
Research
PPP
Indoor navigation
NetworkRTK
Meteorology
Space
Sport
Courses
TAFE
Undergraduate
Postgraduate
Conferences
Links
Australia
Victoria
Introduction
Overview
Fundamentals
History
GPS
Basic
Satellites
Receiver
Signals
Data
Errors
Ionospheric delay
Tropospheric delay
Relativeistic effects
Clock errors
Multipath
Coordinates and Time
Coordinate systems
Time systems
Transformations
Other systems
GALILEO
Beidou
GLONAASS
QQZSS
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RMIT
Wiki Online Platform
Measurement Science
Main Page
Web-based teaching and learning system for Global Navigation Satellite System (GNSS)
Background of the project
Enter the GNSS mind map navigation page. GO

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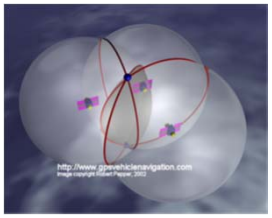
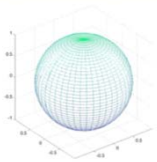
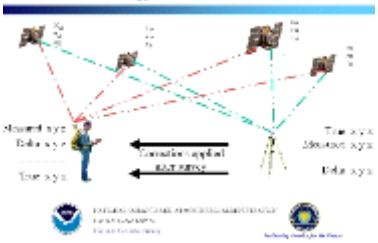
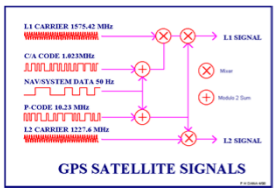
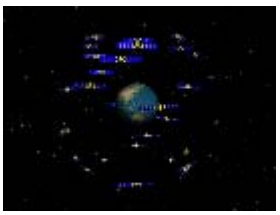
Multimedia Tools

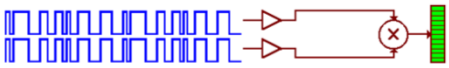












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Problem-based Assessment and Feedback

Our approaches

- ✓ To **work with** colleagues, students, industry and government agencies
- ✓ To **identify** a range of geospatial industry-focused situations and contexts for the applications
- ✓ To **design** a bank of simulations and **cases** (*i.e.* problem-based learning questions / tasks / activities) based on industry and professional practitioners' inputs
- ✓ To **develop** and **implement** these cases by using web and multimedia technologies
- ✓ To **incorporate** these cases into formative and authentic assessment processes

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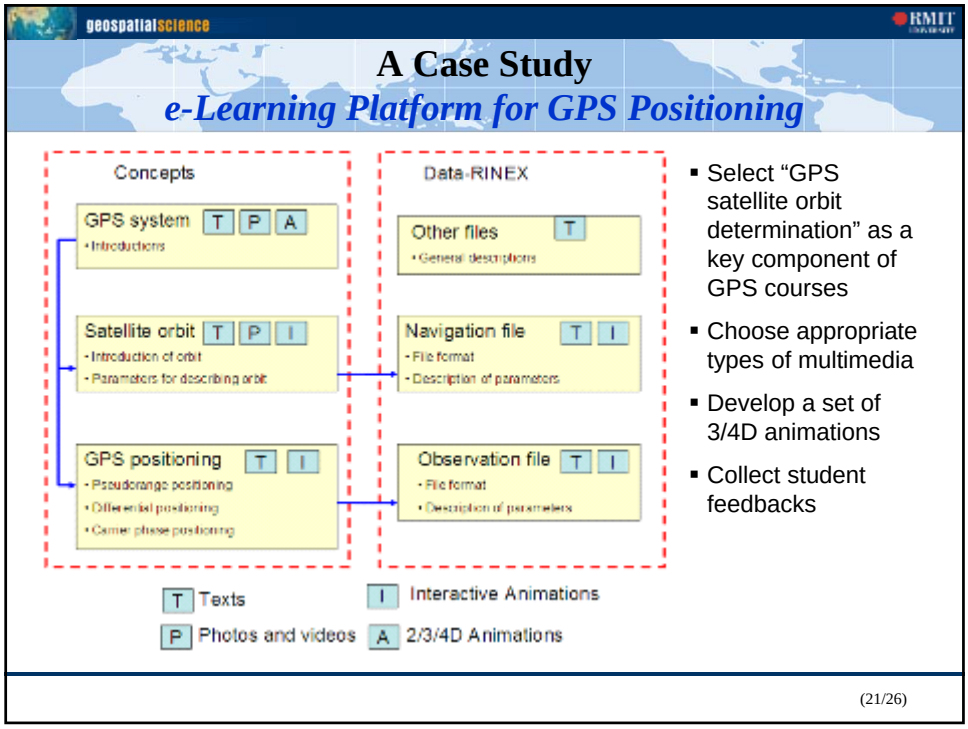
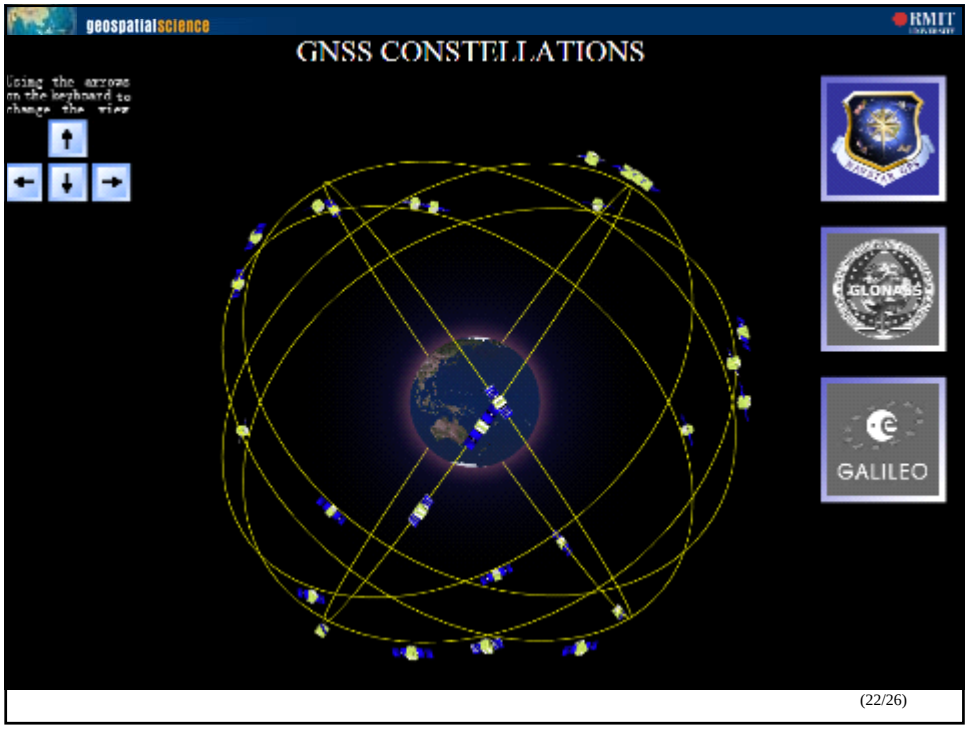
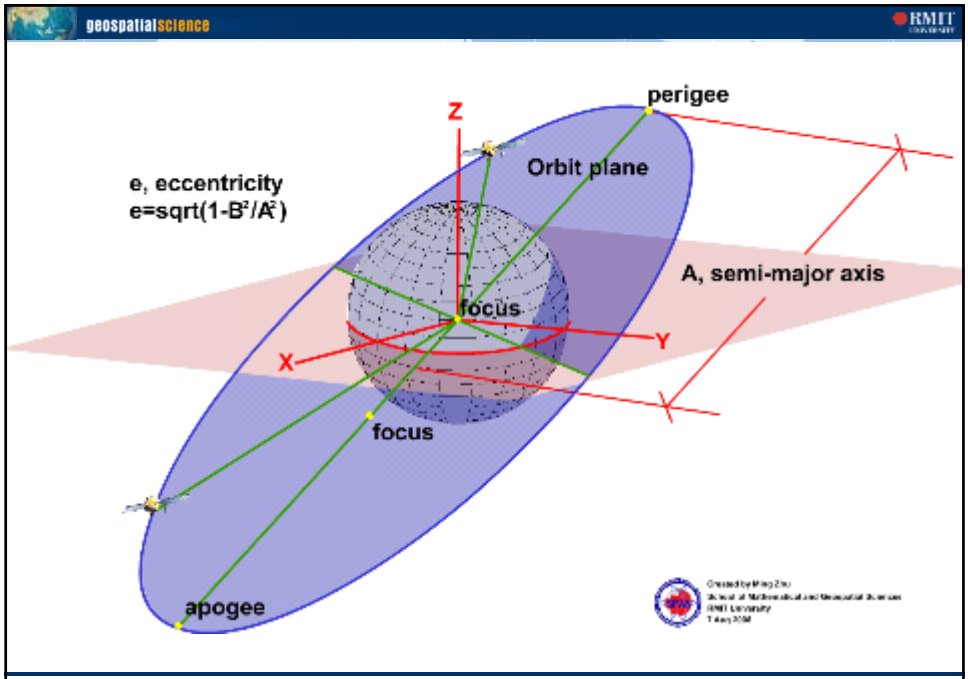


- Select "GPS satellite orbit determination" as a key component of GPS courses
- Choose appropriate types of multimedia
- Develop a set of 3/4D animations
- Collect student feedbacks

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perigee
Z
Orbit plane
e, eccentricity
e=sqrt(1-B²/A²)
A, semi-major axis
focus
Y
X
focus
apogee

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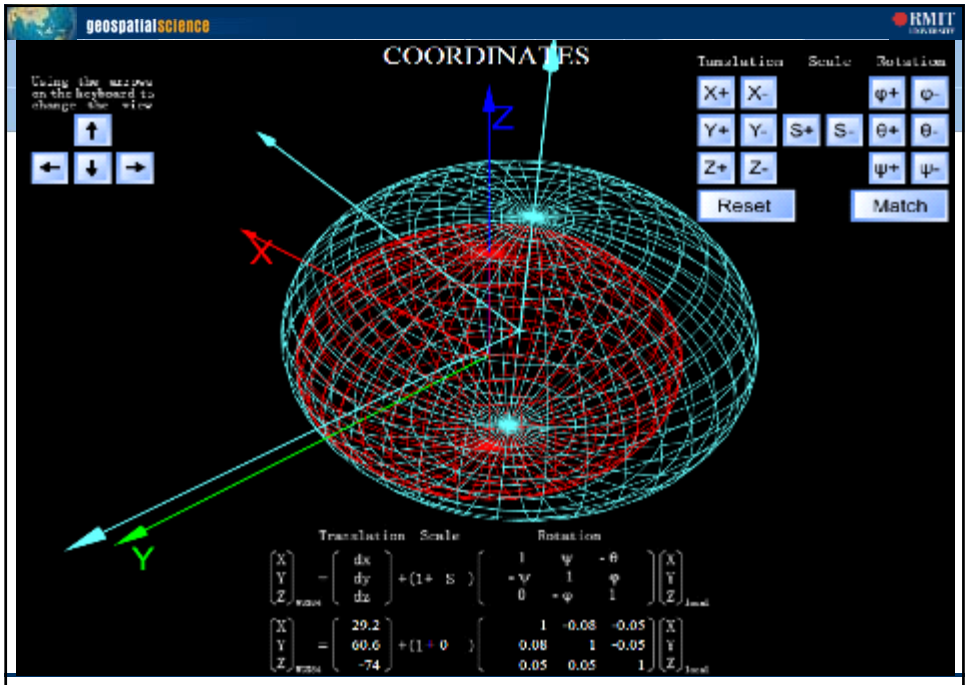
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COORDINATES
Translation
Scale
Rotation
X+
X-
Y+
Y-
S+
S-
Z+
Z-
φ+
φ-
θ+
θ-
ψ+
ψ-
Reset
Match
Z
X
Y
Translation
Scale
Rotation

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Conclusions

- ✓ The advantages of e-learning platforms have been recognized widely and more and more such platforms are playing critical roles in higher / professional education, e.g.
  - To improve the representation of multidimensional, dynamic, and complex scientific concepts and real world cases for learning and assessment
  - To overcome the limitations in using static 2D media for more effective and efficient representation of dynamic 3D geospatial concepts, processes, and real world situations / scenarios
- ✓ Inputs from geospatial industries and students need to be considered and integrated into the learning, assessment and feedback processes

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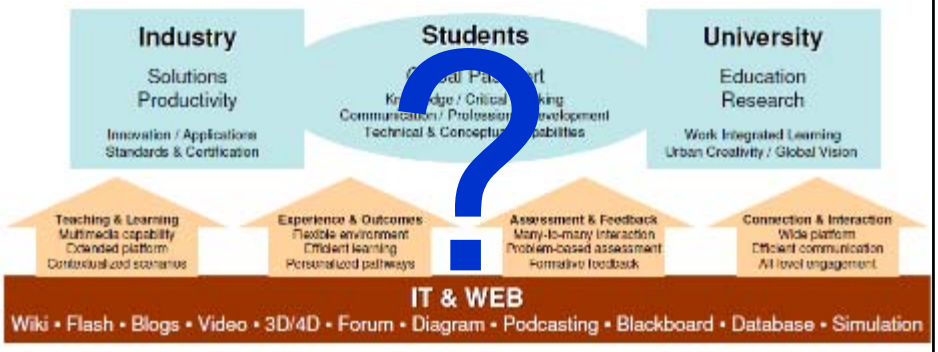
An e-Learning Platform for GPS Positioning



http://emedia.rmit.edu.au/satellite/