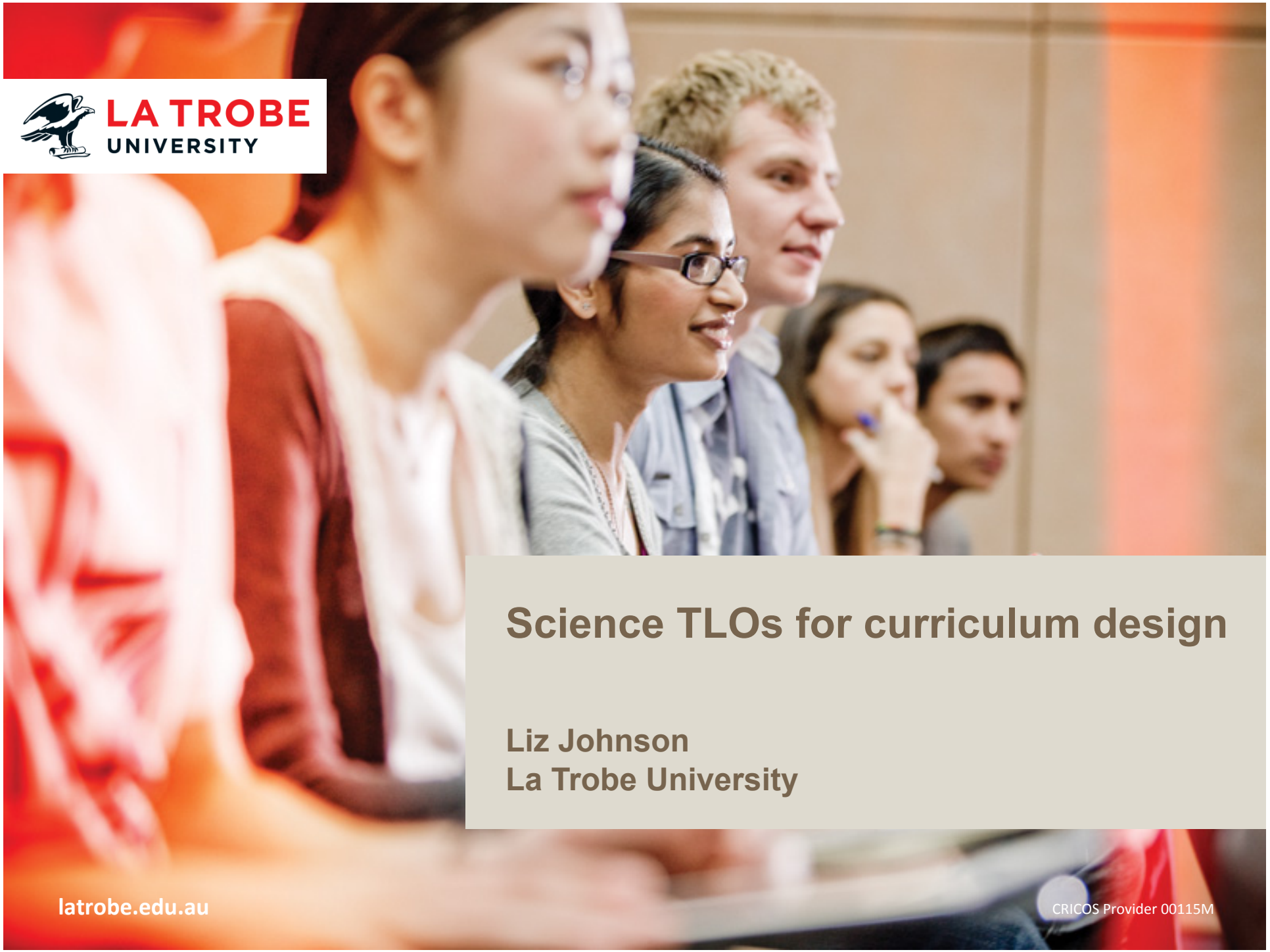


Science TLOs for curriculum design

Liz Johnson
La Trobe University

Presentation…

The shape of curriculum reform

Curriculum renewal at La Trobe University: Design for Learning

Mapping and planning a new curriculum

Translating learning outcomes into assessment

Curriculum reform: large-scale, iterative

Curriculum mapping: what **is** in the curriculum?

Content (skills and knowledge), delivery and activities, assessment

↓

Curriculum planning: what **should** be in the curriculum?

Plan using reference points…

Science TLOs → *Degree LO* → *Subject/topic/unit LO*

↓

Implementation

Translate ILOs → *teaching activities, assessment (alignment)*

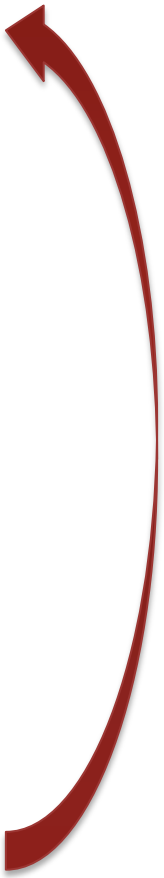
Assessment: evidence for student achievement

↓

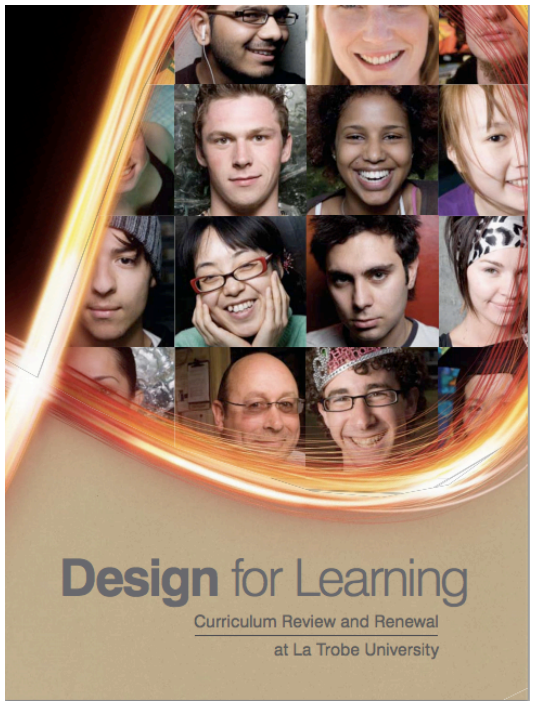
Evaluation

Outcomes: student perceptions, staff experience, sustainable?

Identify next target…



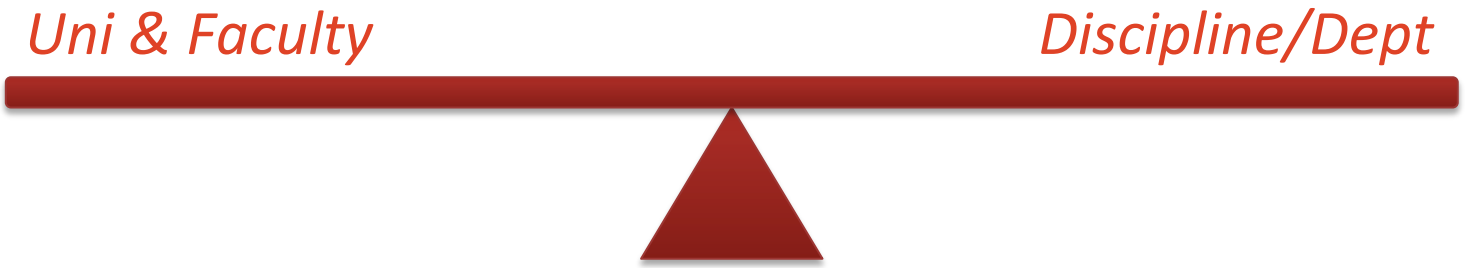
Curriculum Renewal at La Trobe: Design for Learning 2010



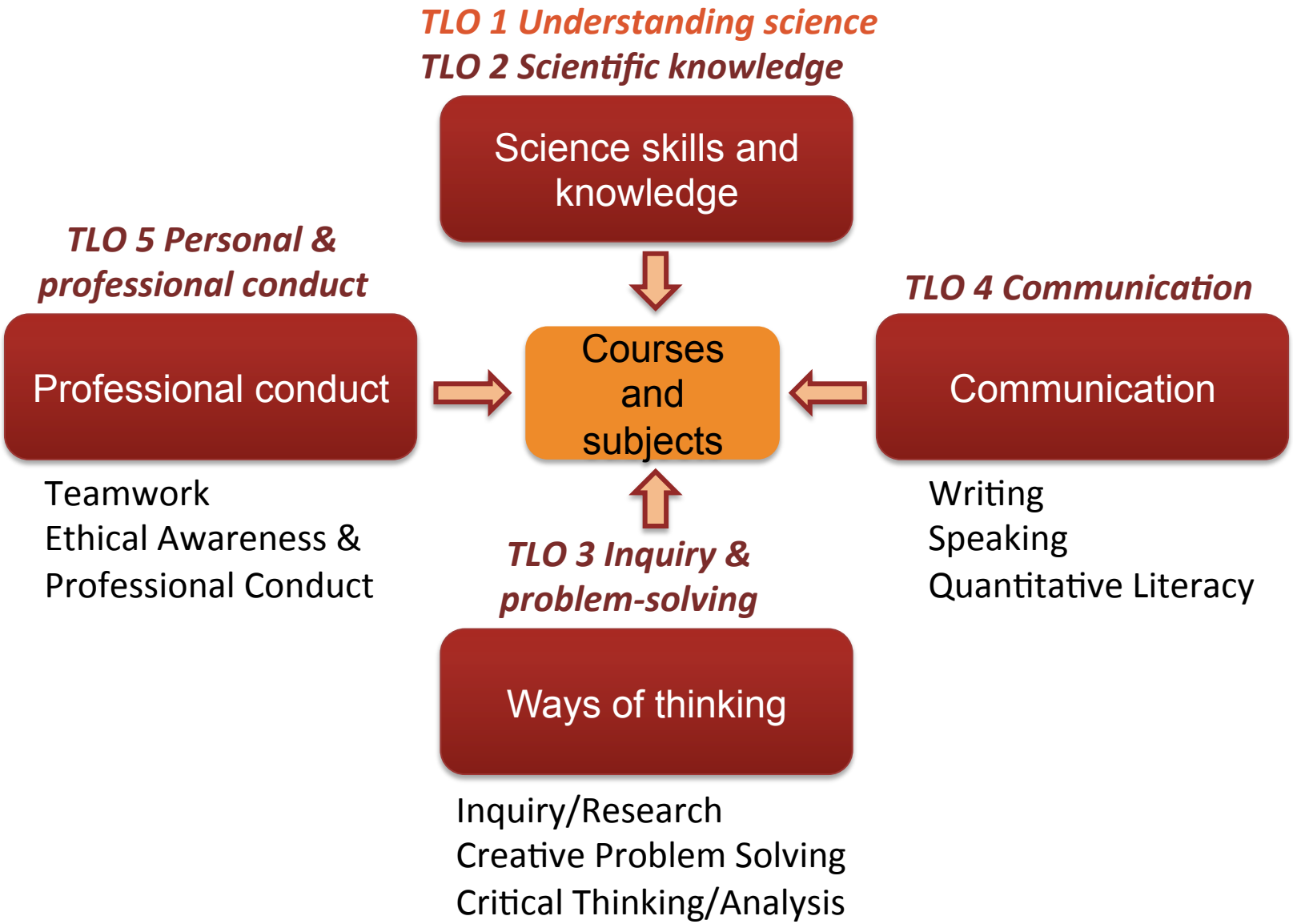
Redesign all undergraduate courses to:

- Improve learning outcomes
- Improve the student experience
- Construct aligned courses of study
- Embed agreed University graduate capabilities
- Collect evidence of achievement of graduate learning outcomes

See http://www.latrobe.edu.au/ctlc/dfl/



Mapping TLOs to Uni graduate capabilities



LTU interpretation of learning outcomes

TLO 4: Communication

4. Be effective communicators of science by:

4.1 communicating scientific results, information, or arguments, to a range of audiences, for a range of purposes, and using a variety of modes.

LTU Writing descriptor:

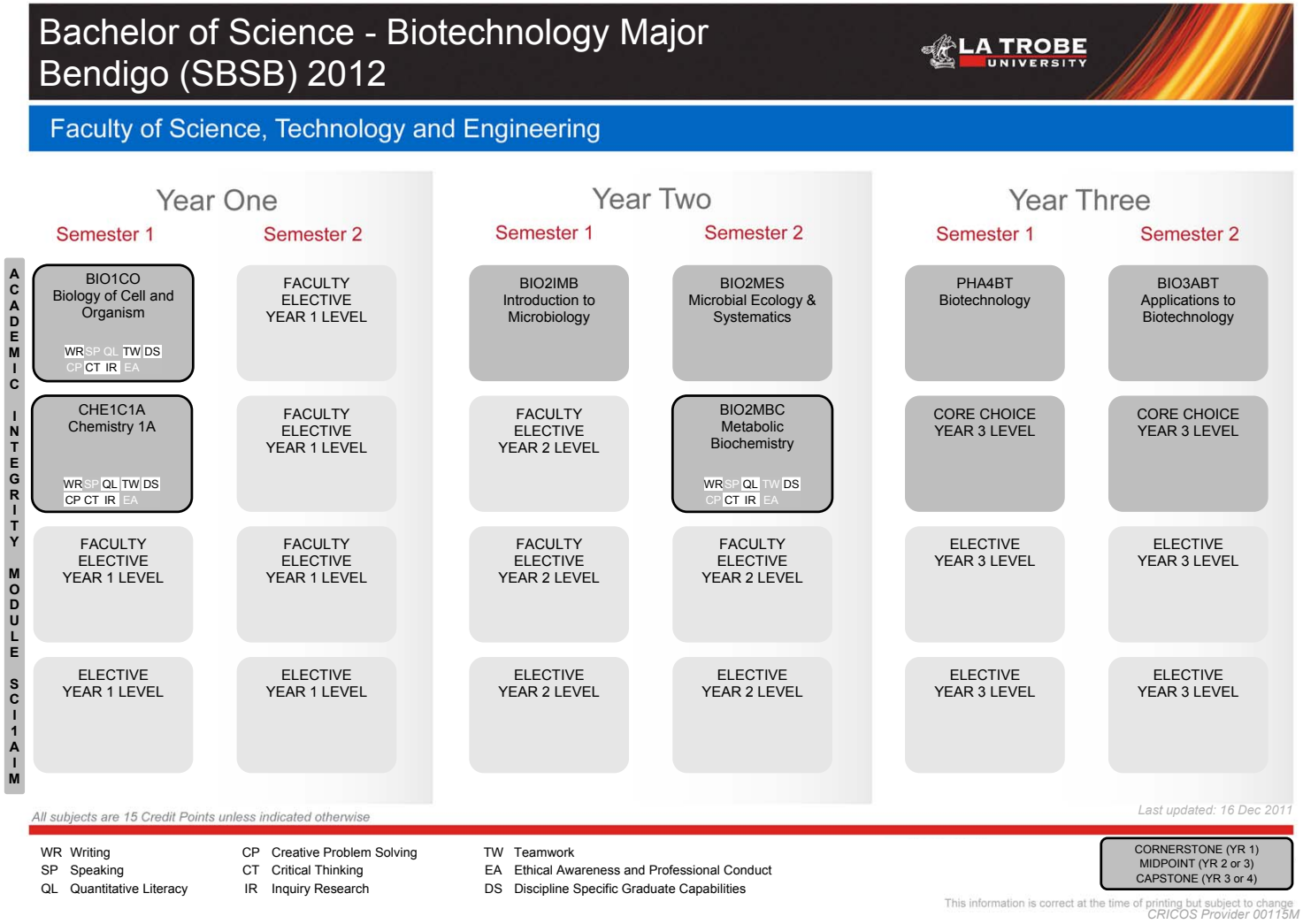
Present coherent explanations, supported by evidence and correctly referenced

Course intended learning outcome: B Computer Sci

Create technical reports to communicate to peers, company stakeholders…consistent with professional standards

Development through the curriculum

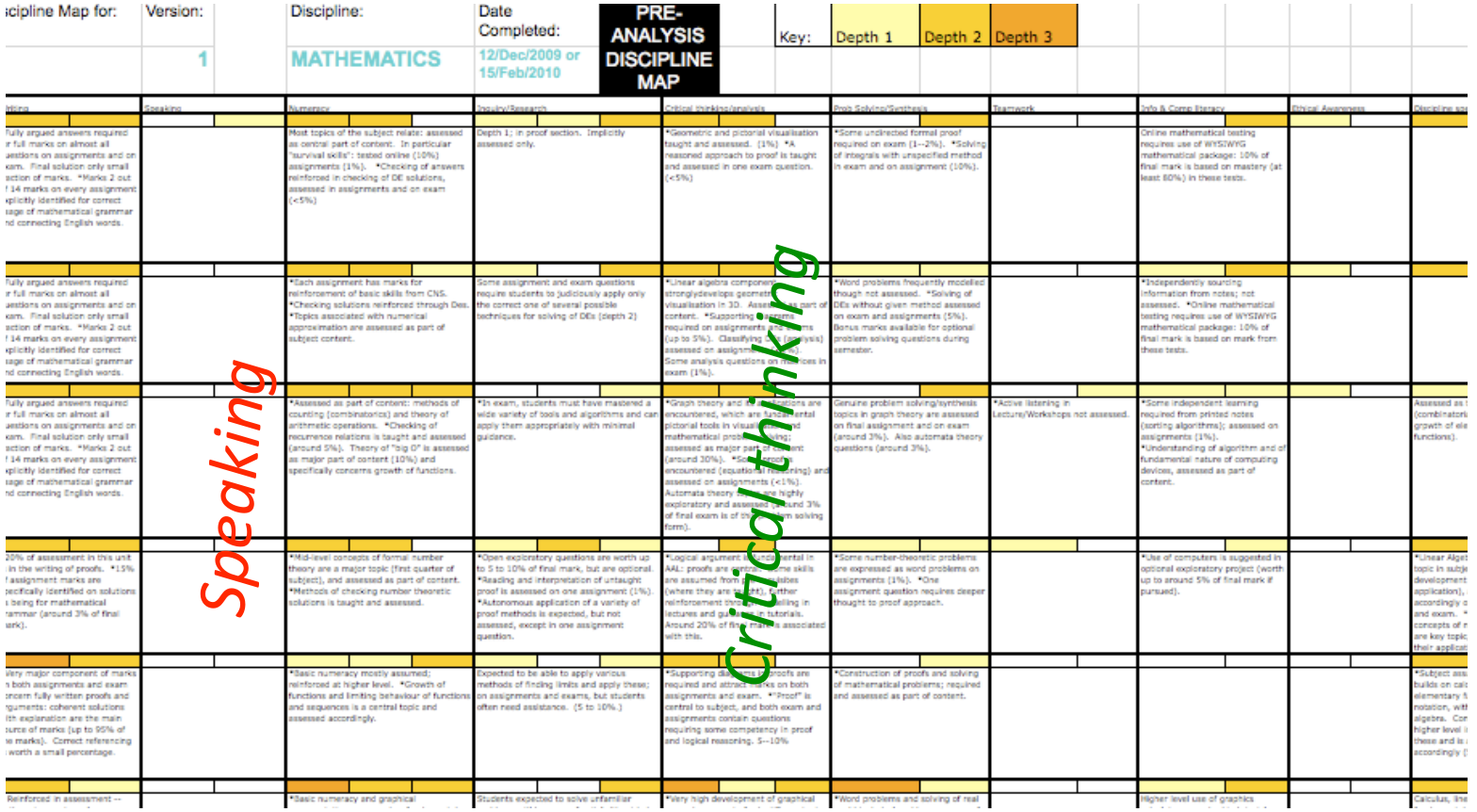
Cornerstone → *Midpoint* → *Capstone*



Discipline maps for planning

TLOs/ Graduate capabilities

Subject/Yr level



TLO 4
Communication

TLO 3
Inquiry & problem solving

TLO 5
Personal & professional responsibility

Constructive Alignment in subjects

Subject descriptions → peer review, refinement, approval

FGCs /TLOs

Course Learning Outcomes

Subject Learning Outcomes ILOs

Teaching and Learning Activities

Assessment

Are Faculty Graduate Capabilities applicable to this subject?		☒ Yes ☐ No	
	Faculty Graduate Capability	Assessed in this subject?	Level of instruction Please mark only ONE box if the FGC is assessed in this subject
1	Writing	☒ Yes ☐ No	☐ Introduction ☒ Reinforcement ☐ Extension/Expansion
2	Speaking		
3	Inquiry/researc		
4	Critical thinkin		
5	Creative probl		
6	Team work		
7	Quatitative liter		
8	Ethical Awarer conduct		

31. Intended Learning Outcomes and Teaching and Learning Activities for this Subject

What learning outcomes would students expect from this subject? Please list and provide examples of Teaching and Learning activities that might develop and measure these outcomes. The learning outcomes must address any Graduate Capabilities identified above as being assessed in this subject.

	Subject Intended Learning Outcomes (ILOs)	Example of Teaching and Learning Activities for this ILO	Aligned to which FGC(s)?
1	After successful completion of the subject, students will be able to: demonstrate their knowle understanding of the stru functions of biological macromolecules by writte descriptions and answeri choice questions.	Lectures and practical classes. In lectures students will be instructed in molecular interactions, information transfer and the synthesis and	1, 9
2	Explain how the metaboli are regulated to achieve by written descriptions an multiple choice questions		

	Assessment element	Percentage	Included in these Instance(s) (enter #(s))	Central exam required?	Subject ILO(s) to be assessed in this element
1	Practical class assignments	5%	1	☐ Yes ☒ No	1, 2, 4, 6
2	Two practical reports equivalent to 1000-words each	25%	1	☐ Yes ☒ No	1, 2, 3, 4, 5, 6
3	Four 10-minute tests	15%	1	☐ Yes ☒ No	1, 2
4	One 3-hour end-of-semester examination	55%	1	☒ Yes ☐ No	1, 2, 3, 4, 6
5	Enter text	Enter %	Enter number	☐ Yes ☐ No	Enter number
6	Enter text	Enter %	Enter number	☐ Yes ☐ No	Enter number
7	Enter text	Enter %	Enter number	☐ Yes ☐ No	Enter number
8	Enter text	Enter %	Enter number	☐ Yes ☐ No	Enter number

Please use the section below if more explanation of assessment tasks is required

Evidence for graduate outcomes

Progress towards graduate capabilities reported through subjects.

Allocate snapshot measurement of capability to an assessment task

writing

Inquiry/research

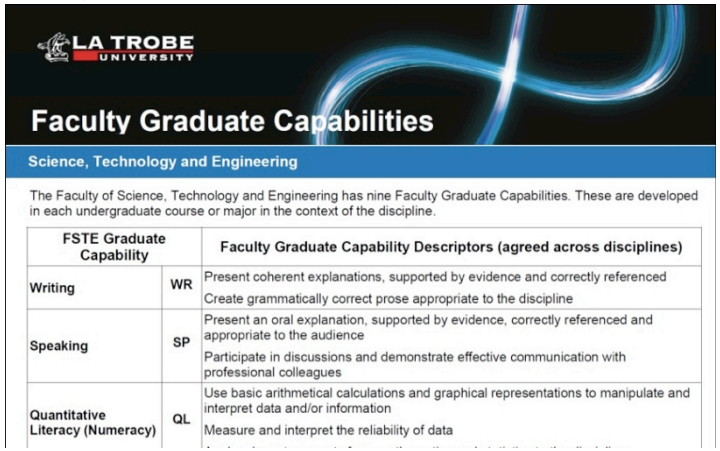
Report to student to give feedback on progress

Report to Uni to monitor comparable student achievement

Demonstrate learning outcomes externally

Developing standards to assess outcomes

Agreed Description



LA TROBE UNIVERSITY

Faculty Graduate Capabilities

Science, Technology and Engineering

The Faculty of Science, Technology and Engineering has nine Faculty Graduate Capabilities. These are developed in each undergraduate course or major in the context of the discipline.

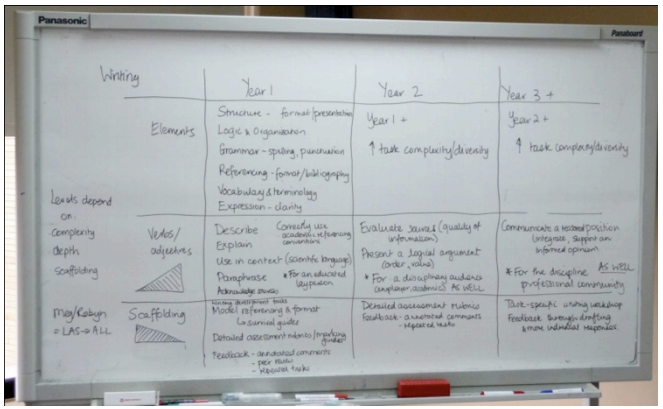
FSTE Graduate Capability		Faculty Graduate Capability Descriptors (agreed across disciplines)
Writing	WR	Present coherent explanations, supported by evidence and correctly referenced Create grammatically correct prose appropriate to the discipline
Speaking	SP	Present an oral explanation, supported by evidence, correctly referenced and appropriate to the audience Participate in discussions and demonstrate effective communication with professional colleagues
Quantitative Literacy (Numeracy)	QL	Use basic arithmetical calculations and graphical representations to manipulate and interpret data and/or information Measure and interpret the reliability of data

Moderation with student work

Faculty standards statement

Assessment rubrics

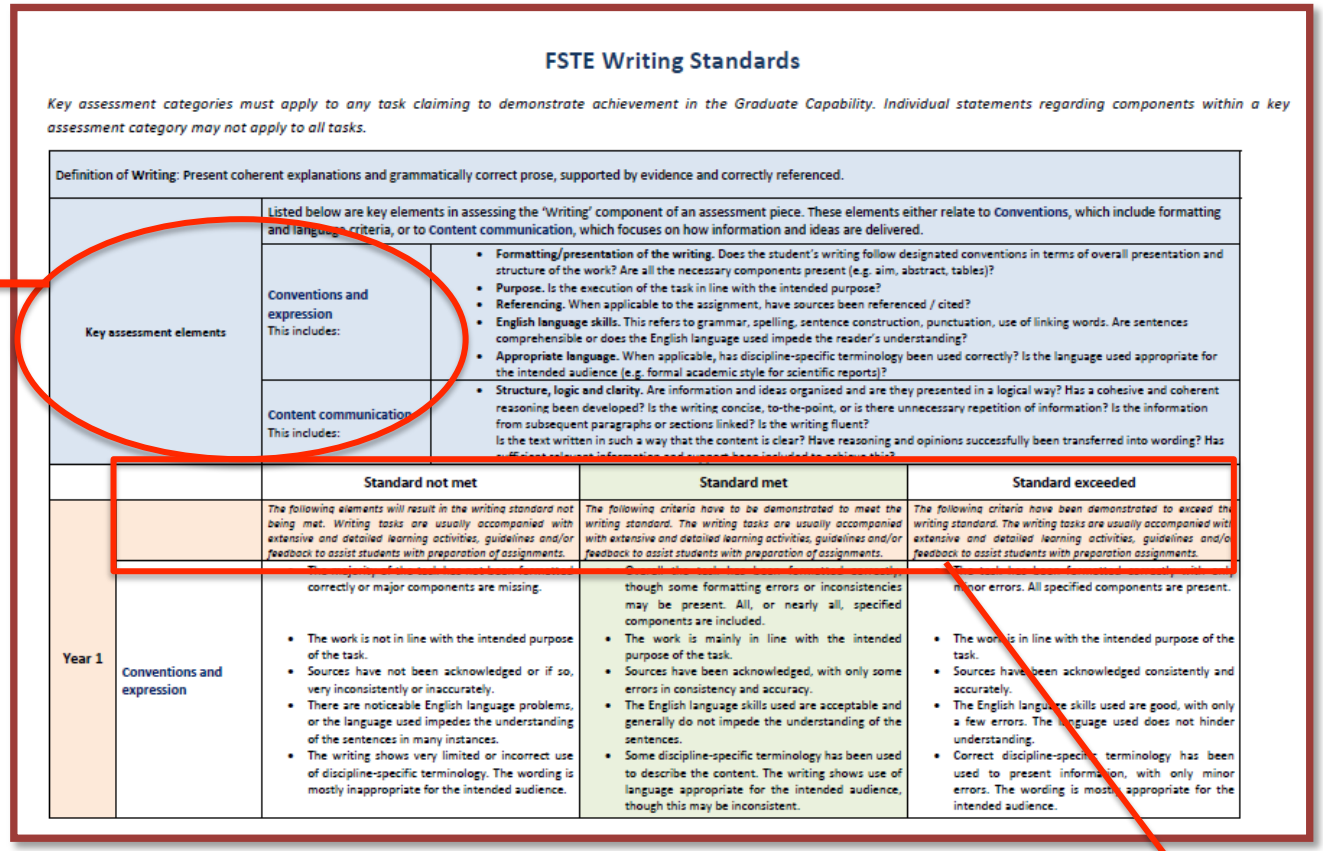
Identify elements



Published rubrics

Faculty standard statement

Key assessment elements



FSTE Writing Standards

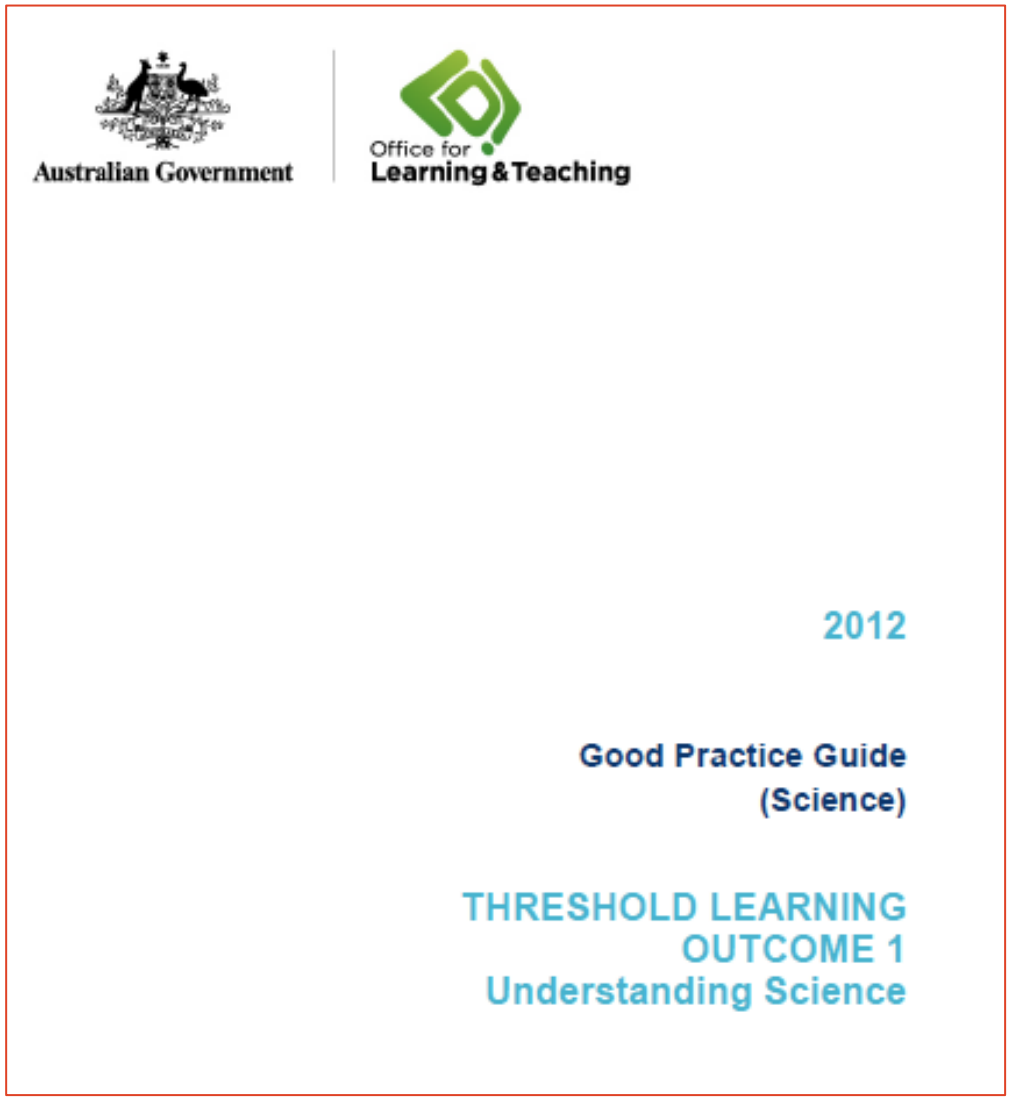
Key assessment categories must apply to any task claiming to demonstrate achievement in the Graduate Capability. Individual statements regarding components within a key assessment category may not apply to all tasks.

Definition of **Writing**: Present coherent explanations and grammatically correct prose, supported by evidence and correctly referenced.				
Key assessment elements	Listed below are key elements in assessing the 'Writing' component of an assessment piece. These elements either relate to **Conventions**, which include formatting and language criteria, or to **Content communication**, which focuses on how information and ideas are delivered.			
	Conventions and expression This includes:	• **Formatting/presentation of the writing.** Does the student's writing follow designated conventions in terms of overall presentation and structure of the work? Are all the necessary components present (e.g. aim, abstract, tables)? • **Purpose.** Is the execution of the task in line with the intended purpose? • **Referencing.** When applicable to the assignment, have sources been referenced / cited? • **English language skills.** This refers to grammar, spelling, sentence construction, punctuation, use of linking words. Are sentences comprehensible or does the English language used impede the reader's understanding? • **Appropriate language.** When applicable, has discipline-specific terminology been used correctly? Is the language used appropriate for the intended audience (e.g. formal academic style for scientific reports)?		
	Content communication This includes:	• **Structure, logic and clarity.** Are information and ideas organised and are they presented in a logical way? Has a cohesive and coherent reasoning been developed? Is the writing concise, to-the-point, or is there unnecessary repetition of information? Is the information from subsequent paragraphs or sections linked? Is the writing fluent? Is the text written in such a way that the content is clear? Have reasoning and opinions successfully been transferred into wording? Has sufficient relevant information and support been included to achieve this?		
		Standard not met	**Standard met**	**Standard exceeded**
		The following elements will result in the writing standard not being met. Writing tasks are usually accompanied with extensive and detailed learning activities, guidelines and/or feedback to assist students with preparation of assignments.	*The following criteria have to be demonstrated to meet the writing standard. The writing tasks are usually accompanied with extensive and detailed learning activities, guidelines and/or feedback to assist students with preparation of assignments.*	*The following criteria have been demonstrated to exceed the writing standard. The writing tasks are usually accompanied with extensive and detailed learning activities, guidelines and/or feedback to assist students with preparation assignments.*
Year 1	**Conventions and expression**	correctly or major components are missing. • The work is not in line with the intended purpose of the task. • Sources have not been acknowledged or if so, very inconsistently or inaccurately. • There are noticeable English language problems, or the language used impedes the understanding of the sentences in many instances. • The writing shows very limited or incorrect use of discipline-specific terminology. The wording is mostly inappropriate for the intended audience.	though some formatting errors or inconsistencies may be present. All, or nearly all, specified components are included. • The work is mainly in line with the intended purpose of the task. • Sources have been acknowledged, with only some errors in consistency and accuracy. • The English language skills used are acceptable and generally do not impede the understanding of the sentences. • Some discipline-specific terminology has been used to describe the content. The writing shows use of language appropriate for the intended audience, though this may be inconsistent.	nor errors. All specified components are present. • The work is in line with the intended purpose of the task. • Sources have been acknowledged consistently and accurately. • The English language skills used are good, with only a few errors. The language used does not hinder understanding. • Correct discipline-specific terminology has been used to present information, with only minor errors. The wording is mostly appropriate for the intended audience.

Three levels of achievement: standard exceeded, standard met and standard not met.

Ideas from others…good practice guides

- Key ideas
- Examples
- Resources



So… TLOs and curriculum reform?

Map
track TLOs in
current practice

Design
reference point
Science TLOS
Discipline networks

Evaluate
TLOs shared
nationally

Assessment
Rubrics
Examples

Who does all the work?

LA TROBE UNIVERSITY

Curriculum Fellows

Mel Murphy
Pam Hurst
Sylvia Grommen
Robert Ross
Martin Fussell
Chris Kettle
Sabine Wilkens

School Directors Teaching and Learning

Art Stukas
Fiona Bird
Peter Cartwright
Katherine Seaton
Andrew Skabar

FSTE teaching staff

Subject & Course co-ordinators
Discipline leaders
Cornerstone co-ordinators

FSTE Teaching and Learning Team

Andy Frampton
Kevin White
Pauline Wardley
Emma Yench
Paul Goldacre
Tania Blanksby
Robyn Yucel
Meg Rosse
Reem Al-Mahmoud
Judy Lyons
Jeanette Fyffe

Australian Government

Office for Learning & Teaching

Australian Council of Deans of Science

Progress so far…

Embedding graduate capabilities (TLOs)	• Mapped across all undergraduate courses and majors • Constructive alignment of all undergraduate subjects	✓ ✓
Assessment: shared standards	• Shared criteria for assessment • Applying the standards/ • marking rubrics	✓ Just started
A course-wide view	• Horizontal integration across Year 1 • Vertical integration within disciplines (Yr1 ➔ Yr2 ➔ Yr2) • Capstone design and trial	✓ Partly Just started

Evidence beyond grades

Evidence for improvements in learning outcomes because:

- Success of reform
- QA for the future development
- Evidence for external regulators: TEQSA, professional accreditation

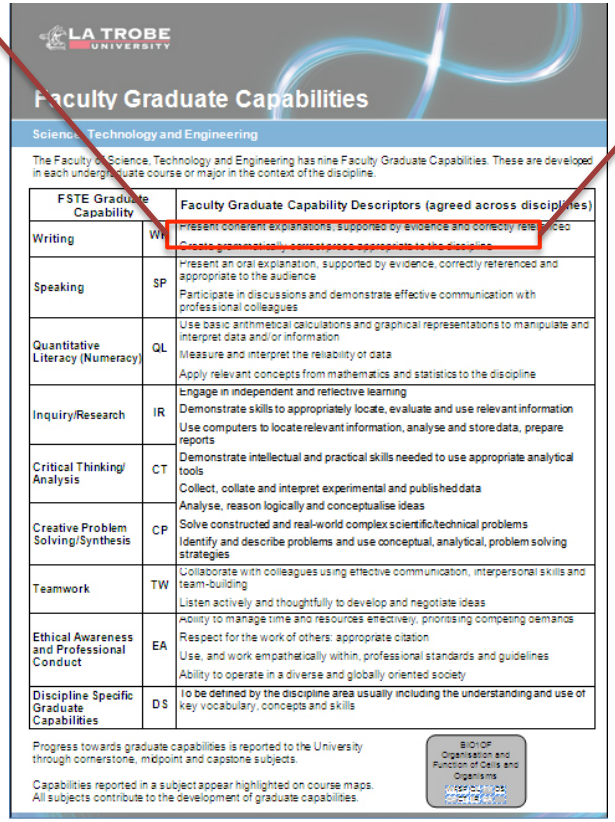
Measuring learning outcomes in a standards world

ACDS Teaching and Learning Centre

Shared understanding of learning outcomes
Faculty ➔ Discipline

Present coherent explanations, supported by evidence and correctly referenced

Create technical reports to communicate to peers, company stakeholders…consistent with professional standards



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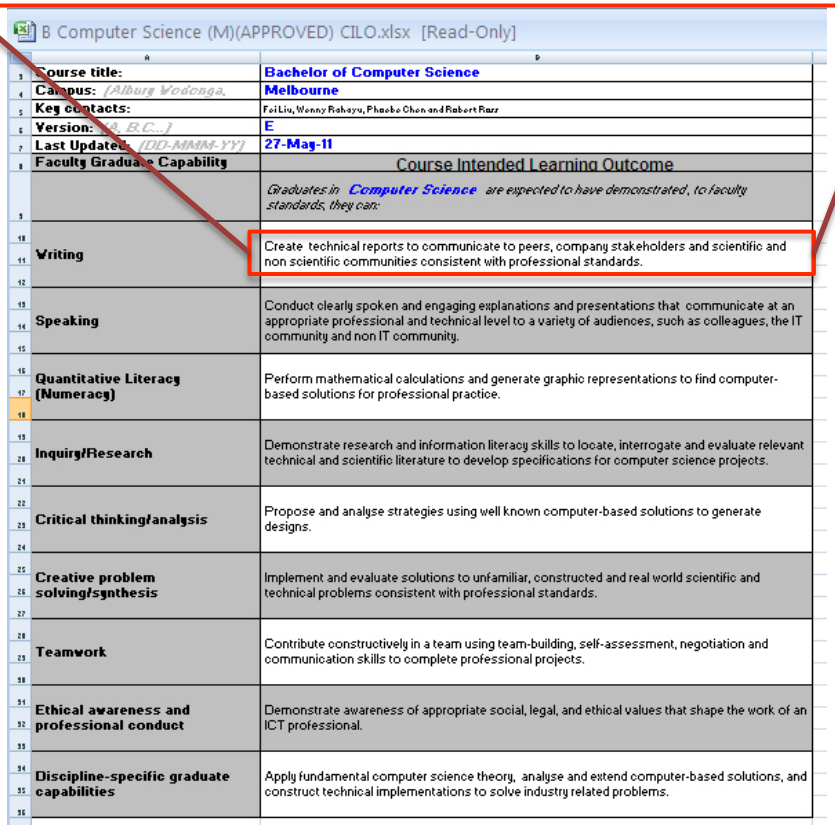
Speaking	SP	Present an oral explanation, supported by evidence, correctly referenced and appropriate to the audience Participate in discussions and demonstrate effective communication with professional colleagues
Quantitative Literacy (Numeracy)	QL	Use basic arithmetical calculations and graphical representations to manipulate and interpret data and/or information Measure and interpret the reliability of data Apply relevant concepts from mathematics and statistics to the discipline
Inquiry/Research	IR	Engage in independent and reflective learning Demonstrate skills to appropriately locate, evaluate and use relevant information Use computers to locate relevant information, analyse and store data, prepare reports
Critical Thinking/ Analysis	CT	Demonstrate intellectual and practical skills needed to use appropriate analytical tools Collect, collate and interpret experimental and published data Analyse, reason logically and conceptualise ideas
Creative Problem Solving/Synthesis	CP	Solve constructed and real-world complex scientific/technical problems Identify and describe problems and use conceptual, analytical, problem solving strategies
Teamwork	TW	Collaborate with colleagues using effective communication, interpersonal skills and team-building Listen actively and thoughtfully to develop and negotiate ideas
Ethical Awareness and Professional Conduct	EA	Ability to manage time and resources effectively, prioritising competing demands Respect for the work of others: appropriate citation Use, and work empathetically within, professional standards and guidelines Ability to operate in a diverse and globally oriented society
Discipline Specific Graduate Capabilities	DS	To be defined by the discipline area usually including the understanding and use of key vocabulary, concepts and skills

Progress towards graduate capabilities is reported to the University through cornerstone, midpoint and capstone subjects.

Capabilities reported in a subject appear highlighted on course maps. All subjects contribute to the development of graduate capabilities.

BIOH3DF Organisation and Function of Cells and Organisms



B Computer Science (M)(APPROVED) CILO.xlsx [Read-Only]

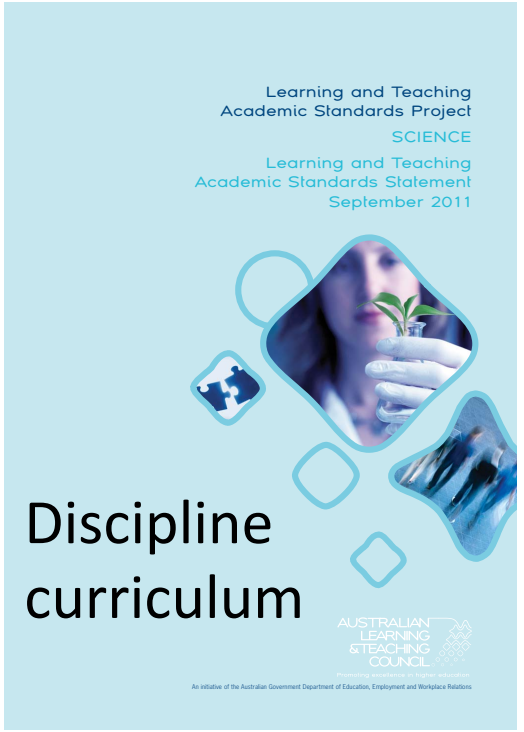
Course title:	**Bachelor of Computer Science**
Campus: *(Albury Wodonga,*	**Melbourne**
Key contacts:	Fei Liu, Wenny Rahayu, Phoebe Chen and Robert Ruzz
Version: *(A, B,C...)*	**E**
Last Updated: *(DD-MMM-YY)*	**27-May-11**
Faculty Graduate Capability	Course Intended Learning Outcome
	Graduates in ***Computer Science*** *are expected to have demonstrated, to faculty standards; they can:*
Writing	Create technical reports to communicate to peers, company stakeholders and scientific and non scientific communities consistent with professional standards.
Speaking	Conduct clearly spoken and engaging explanations and presentations that communicate at an appropriate professional and technical level to a variety of audiences, such as colleagues, the IT community and non IT community.
Quantitative Literacy (Numeracy)	Perform mathematical calculations and generate graphic representations to find computer-based solutions for professional practice.
Inquiry/Research	Demonstrate research and information literacy skills to locate, interrogate and evaluate relevant technical and scientific literature to develop specifications for computer science projects.
Critical thinking/analysis	Propose and analyse strategies using well known computer-based solutions to generate designs.
Creative problem solving/synthesis	Implement and evaluate solutions to unfamiliar, constructed and real world scientific and technical problems consistent with professional standards.
Teamwork	Contribute constructively in a team using team-building, self-assessment, negotiation and communication skills to complete professional projects.
Ethical awareness and professional conduct	Demonstrate awareness of appropriate social, legal, and ethical values that shape the work of an ICT professional.
Discipline-specific graduate capabilities	Apply fundamental computer science theory, analyse and extend computer-based solutions, and construct technical implementations to solve industry related problems.

External reference points

Professional accreditation

National standards AQF

Discipline curriculum



Careers that need to understand science
Know science
Regulators
Science-related business
Policy development
Teaching

Careers that use science
Use science
Health
Engineering
Info Tech
Environmental Mgt

Scientists
Create science
Pure research
Applied research

The shape of curriculum reform

Scale

Single activity
eg a new prac

Whole course
revision

Whole of institution
project
eg introduce enquiry-based learning

Objectives

- improve student learning outcomes
- Improve retention and progression
- structural reform
- rationalize resources