Queen Mary University of London

Beijing University of Posts and Telecommunications 中文版

- Dr Dawn Black (dawn.black@elec.qmul.ac.uk)
- Lecture at two institutions (UK and China)
  - Digital Broadcasting (PG).
  - Image and video processing (PG).
  - Real-time DSP (Master's and UG).
  - Speech and music processing (PG).
  - Introduction to electronics (UG).
- Research
  - Singing voice.
  - Real-time DSP.

Experience

- Academic
  - PhD in speech synthesis.
  - Responsible for course design and innovation.
  - Active researcher.
- Industry
  - Ministry of Defence.
  - Games console design.
  - Start-up company (audio processing).
  - Software defined radio.

Teaching Practical Skills

A case study in course design

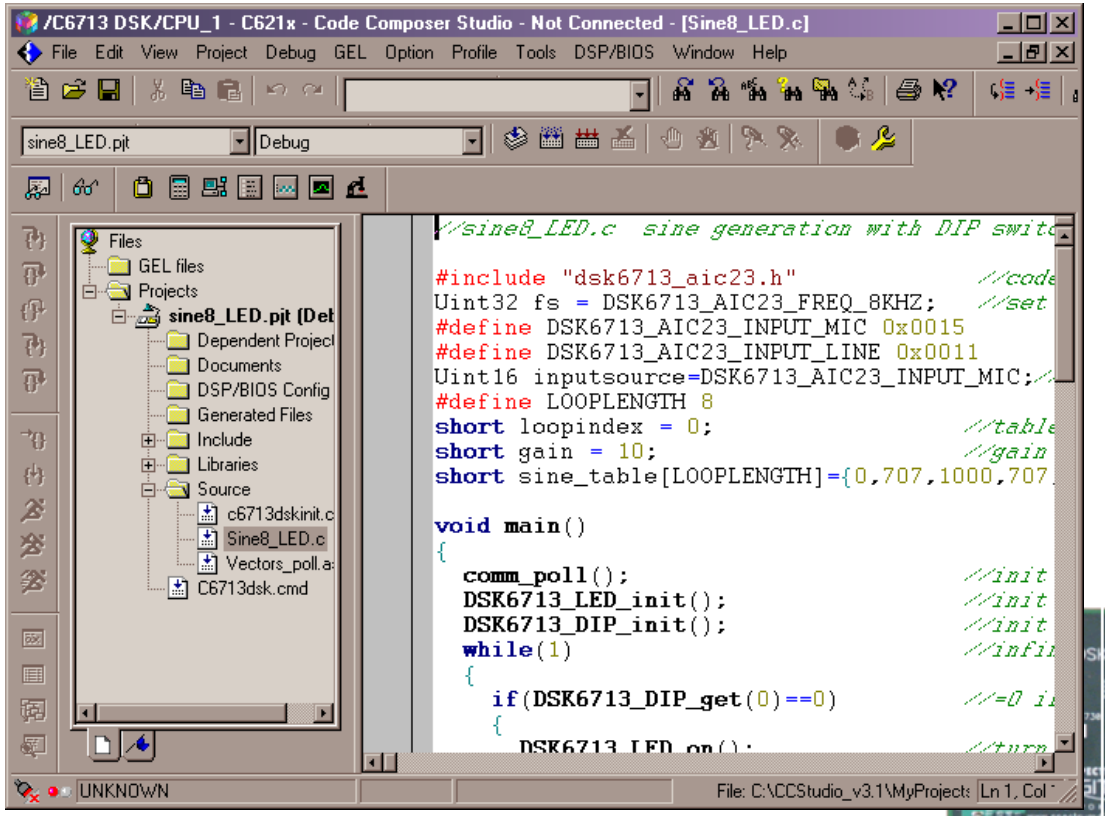
Introduction

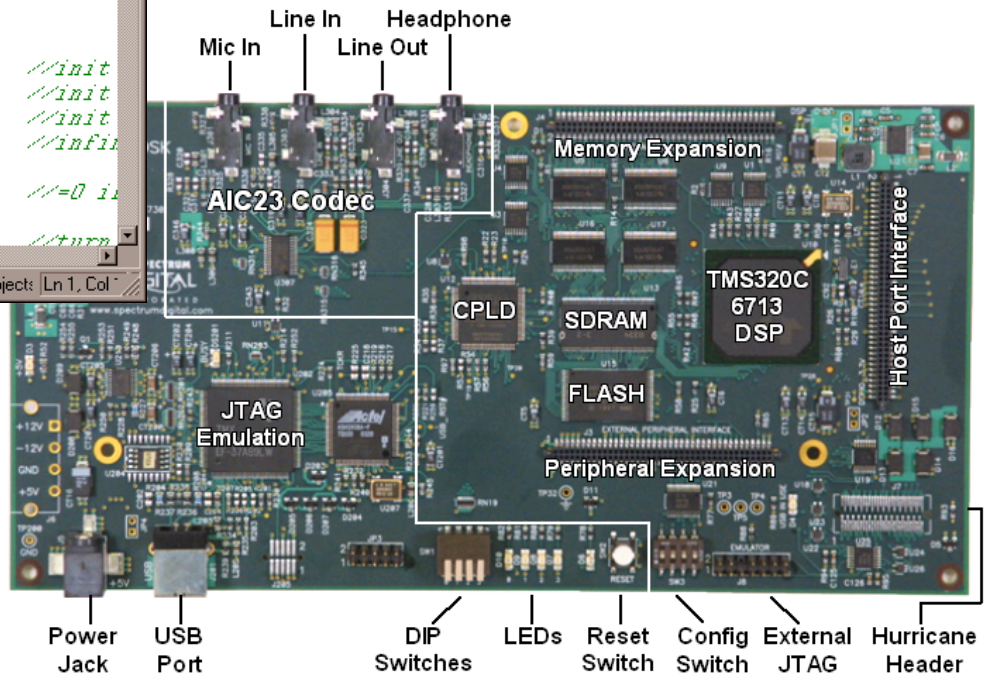
- How to prepare students for their career ahead.
  - Skill sets.
  - Course design (learning outcomes).
  - Assessment.
  - Feedback.
  - Information delivery.

Real-Time DSP

- A case study in teaching practical electronics.
  - Broad range of skills taught/required (hardware, software, professional standards, real-time considerations).
  - Attracts students with a broad range of skills.
  - Geared towards the application of knowledge rather than the acquisition of knowledge.

Real-Time DSP





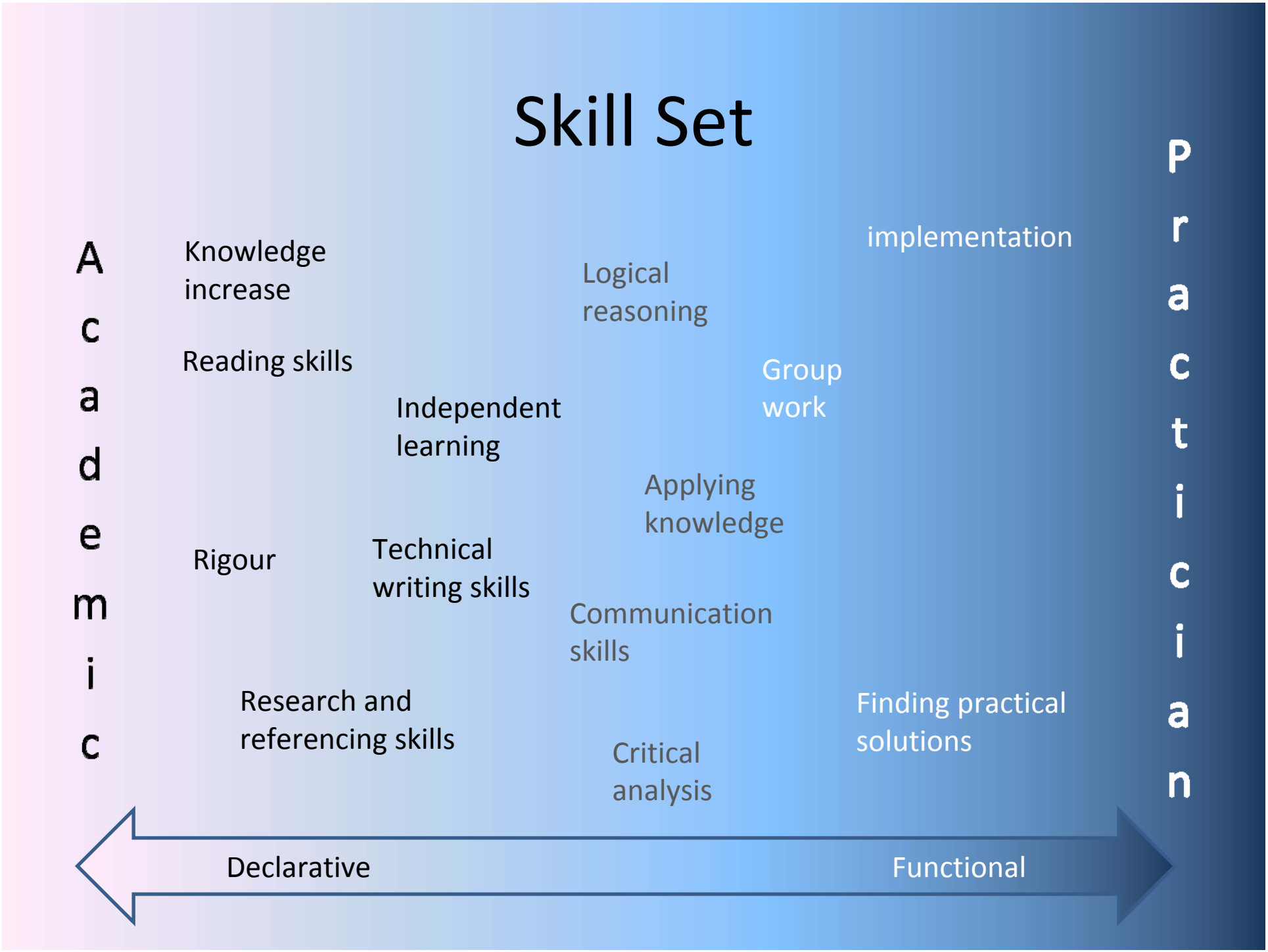
Practical Electronics

- "Knowing is not enough; we must apply. Willing is not enough; we must do"
  - Johan Wolfgang von Goethe (1749 - 1832).
- Want the student to:
  - develop both academic and practical skills.
  - to have the freedom to decide for themselves were their strengths lie without fear of failure.

Different mind sets

- Academic
  - Independent learning.
  - Knowledge.
  - Reading skills.
  - Writing technical papers.
  - Referencing and research.
  - Rigour.
  - Logical reasoning.
  - Applying knowledge.
  - Critical analysis of own work.
- Long range perspective.
- Declarative knowledge.

- Practician
  - Group work.
  - Problem solving (finding practical solutions).
  - Implementation.
  - Communication skills.
  - Testing.
  - Logical reasoning.
  - Applying knowledge.
  - Critical analysis of own work.
- Short range perspective.
- Functional knowledge.


Skill Set
Academic
practician
Knowledge increase
Reading skills
Independent learning
Rigour
Technical writing skills
Research and referencing skills
Logical reasoning
Applying knowledge
Communication skills
Critical analysis
implementation
Group work
Finding practical solutions
Declarative
Functional

Preparing students

- It is the responsibility of universities to prepare students for the career ahead of them.
  - Academia
  - Industry
- Allow students to develop the appropriate skill set.
- Allow students to discover which direction is most suited to them.

Course Design

Constructive Alignment

- Prof John B. Biggs (2003)
  - "The fundamental principal of constructive alignment is that a good teaching system aligns teaching methods and assessment to the learning objectives so that all aspects of this system are in accord in supporting appropriate student learning"
- Principal used for course design that focuses on the learning outcomes.
- Teaching, learning and assessment must all be aligned to the desired outcomes of the course.
- Outcomes can be a mix of both academic and practician.

Typical Course Design

Course designer asks:

- What facts do my students need to know?

Which leads to

- Lecture writing to cover facts.
- Choice of text book(s).
- Introduce experiments to support taught theory.
- Introduce coursework to assess knowledge levels.
- Allocate grades to coursework and exam.

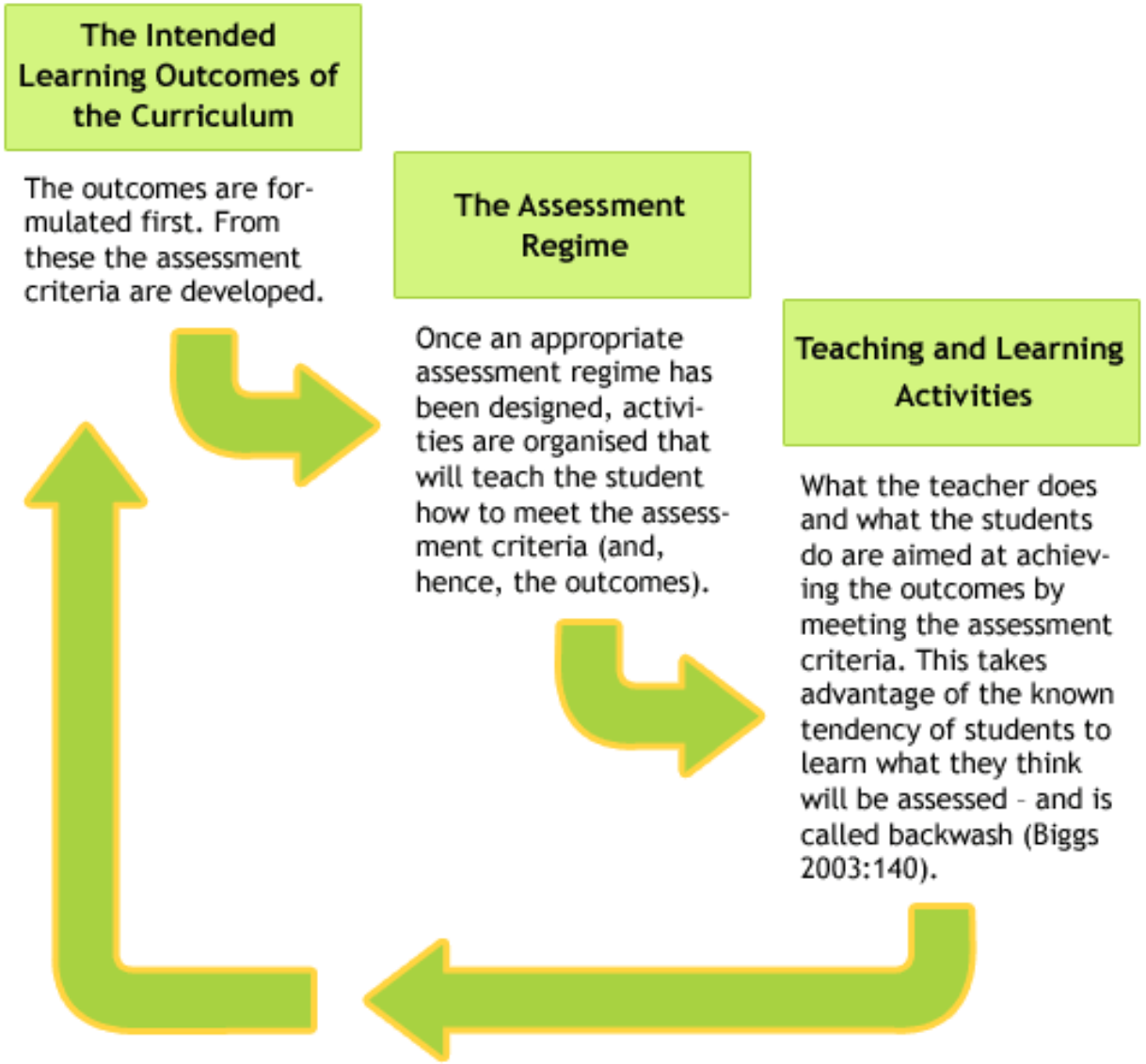
Aligned Course Design

Course designer asks:

- What skills do my students need to acquire?

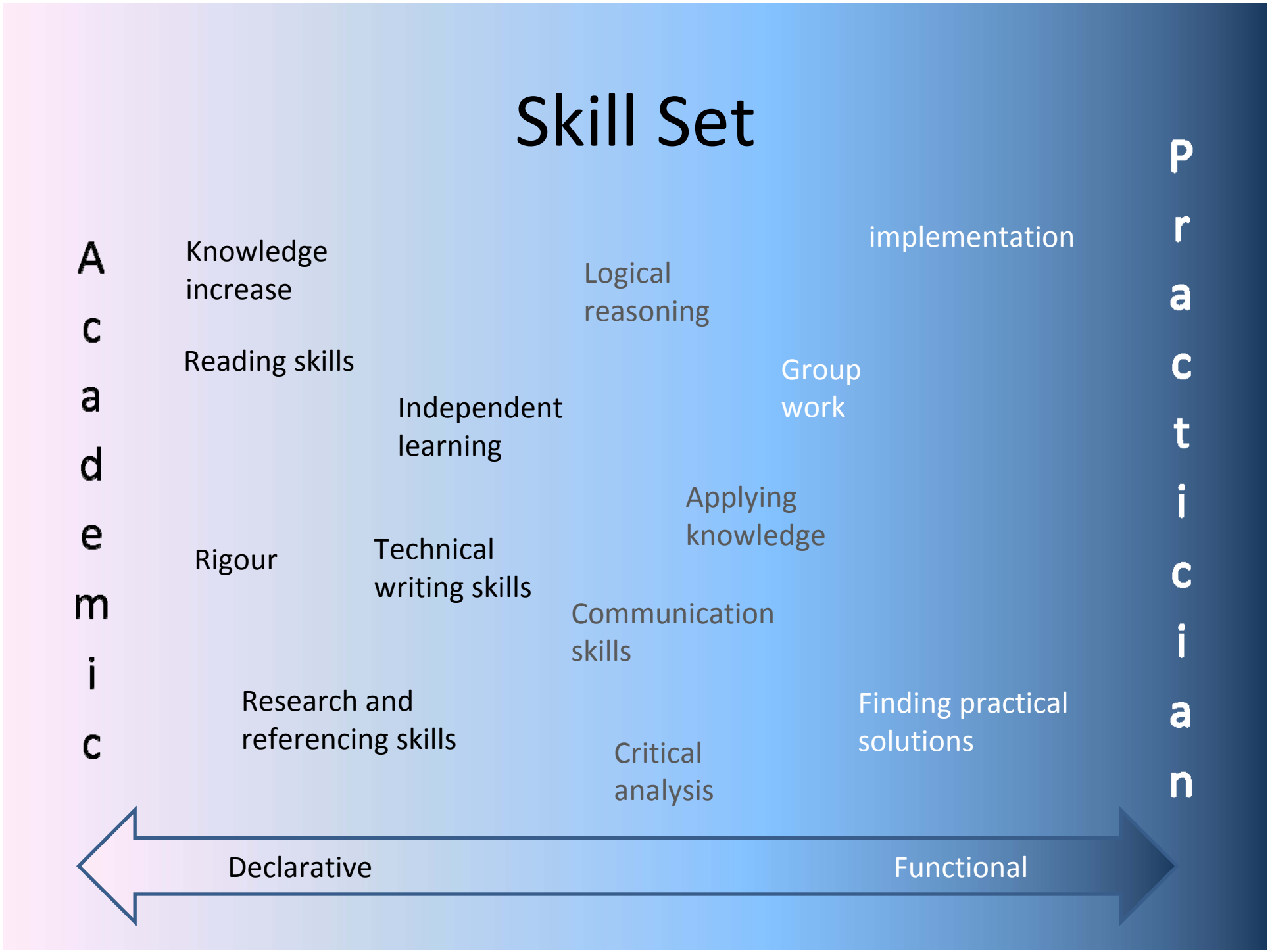
Which leads to

- Intended learning outcomes.
- Design assessments that allow students to demonstrate learning outcomes.
- Write lectures to support assessments.
- Choose supporting text books.


The Intended Learning Outcomes of the Curriculum
The outcomes are formulated first. From these the assessment criteria are developed.
The Assessment Regime
Once an appropriate assessment regime has been designed, activities are organised that will teach the student how to meet the assessment criteria (and, hence, the outcomes).
Teaching and Learning Activities
What the teacher does and what the students do are aimed at achieving the outcomes by meeting the assessment criteria. This takes advantage of the known tendency of students to learn what they think will be assessed – and is called backwash (Biggs 2003:140).

Intended Learning Outcomes

- The skills and knowledge which it is intended that students should be able to demonstrate by the end of the course.
- Types:
  - Knowledge-based (knowledge and understanding).
  - Application based (practical skills).
  - Skills based (intellectual and transferable skills).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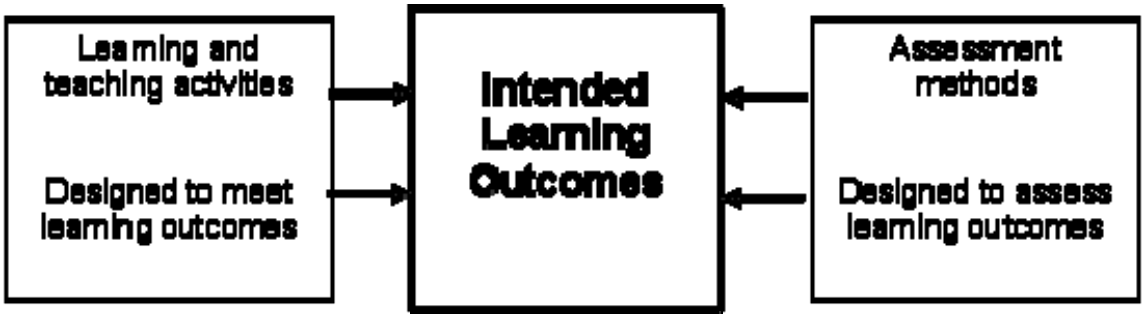
Teaching conflicting skills

- Teach the skills central to both mind sets.
- Give the students the opportunity, support and space to develop the other skills independently.
- “Aim to provide an environment for learning rather than teach.”

Assessment

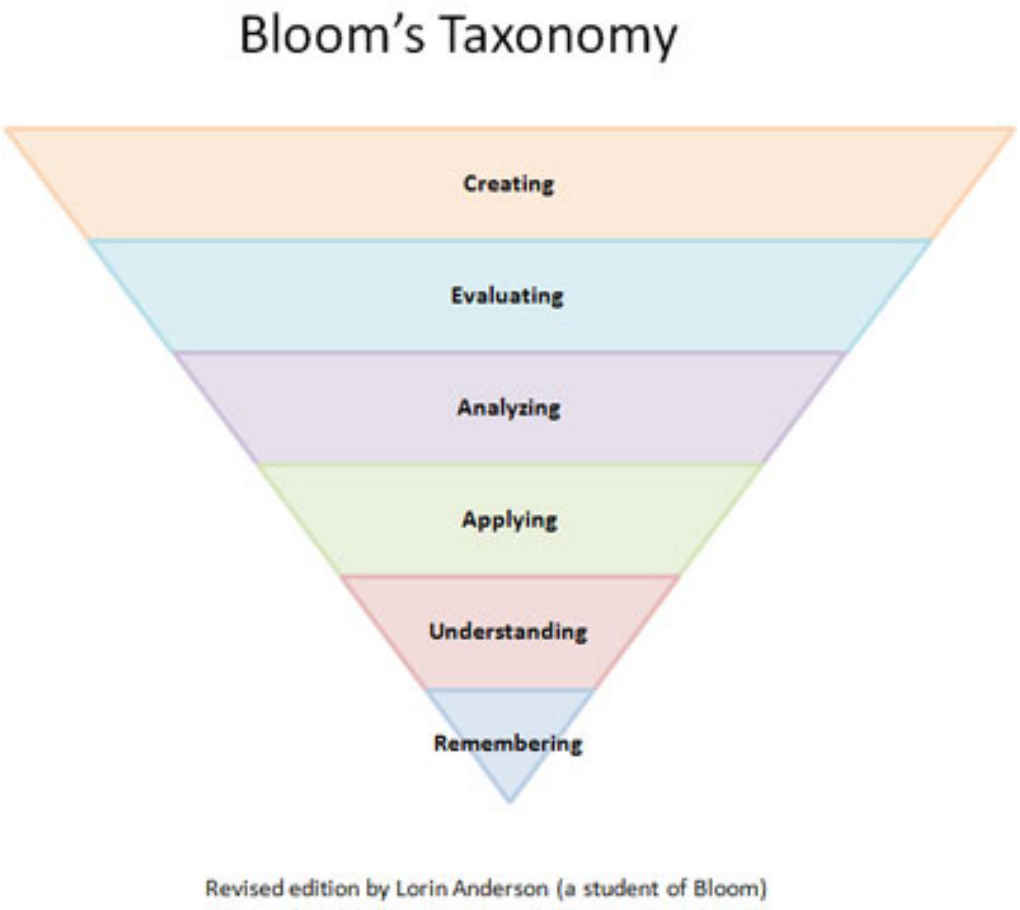
- Constructive alignment.



- Bloom's taxonomy -three domains of teaching and learning:
  - Cognitive (knowledge and comprehension)
  - Affective (emotional reaction)
  - Psychomotor (physical manipulation)
- Educators should try to focus on all three domains to provide effective learning.

Bloom and Assessment

- Levels of learning
  - **Lowest level:**
  - Surface learning
  - Remembering
  - **Highest level**:
  - Deep learning
  - Creating



Assessment

Assessment Criteria

- “Assessment systems dominate what students are oriented towards in their learning. Even when lecturers say that they want students to be creative and thoughtful, students often recognise that what is really necessary, or a least what is sufficient, is to memorise (Gibbs, 1992)”

Practical Assessment

1. Encourage deep learning.
2. Choose methods that teach key skills.
3. Enable students to progress in the direction they are most suited to.

- To teach practical skills – examine practically!
  - Assessment 100% by project work.
  - No written exam.

Project Ownership

All students complete the same task.

- Easy to mark.
- Low supervision load.
- Plagiarism.
- Students work together.
- Students constantly ask for help.
- Surface learning (will only do what is necessary to get the minimum functionality).
- Conclusions = ‘it works!’

All students complete a project of their own choosing.

- Heavy supervision load (?)
- Your project, your problem.
- Deep learning from genuine interest.
- Overcome the ‘good enough’ work ethic.
- Students can experiment.
- Students can choose a research or implementation project.
- Students can choose a project that makes the most of their strengths.

Project Examples

Research

Industry

Imitating the sound of a violincello by a violin

Speaker gender detection

Audio mixer

Emotion recognition

Spectral delay

Bass drum generator

Granular synthesis engine

Pitch shifting

MIDI-Driven Subtractive synthesizer

Harmonizer

Increasing Ownership

- Need to encourage deep learning.
- Typically students are expected to perform lab work in a lab environment.
  - Limits the time students can spend working.
  - Limits how creative they can be.
  - Limits their freedom to work ‘at their best’.
- The kit is very portable so students are issued their own set at the start of term (for a deposit).

Grading Individual Projects

- Quality.
  - Peer pressure!
  - Every student must present to the class.
  - Students become well aware of the top-class projects and the poor projects and many adjust accordingly.
- Clear marking criteria.
  - Marks must be awarded equally for both research and implementation projects.
  - Students need to know what they are being graded for.

Feedback

Feedback

- Most common complaint from students is the lack of feedback.
- Feedback must be:
  - Explicit and transparent to the students.
  - Prompt.
  - Suggest ways to improve that are both specific and general.
  - Relate specifically to the learning outcomes.

Aligned Feedback

- Learning outcomes are generally quite broad.
  - Using judgement.
  - Analyse data.
  - Form and test a hypothesis.
- Marking criteria are often much more specific.
  - Structured report writing.
  - Clear diagrams.
  - Presentation of data.
- Need to try to close the gap.

Aligned Feedback

- **Aim:** To positively encourage independent learning and synthesis of ideas through project work.
  - Students must demonstrate the ability to critically appraise their own work.
  - Students are expected to present results in an unambiguous fashion and to appreciate why this is particularly difficult in the fields of both real-time applications and of audio or video applications.
- **Feedback:**
  - Has the student demonstrated independent learning?
  - Has the student demonstrated critical analysis skills?
  - Has the student rigorously tested their work and determined appropriate methods for real-time data?

Aligned Feedback

- Individual feedback is time consuming.
  - Small classes.
- Use a mark sheet that clearly defines marking criteria with the learning outcomes.
- Include space for individual comments as well.

Has the student demonstrated independent learning?

Level	**Mark**	
Much use has been made of additional literature from varied sources (books, academic papers, internet, user manuals).	5/5	
A little use has been made of additional literature (internet only).	3/5	
Minimal use has been made of additional literature	1/5	

Delivery of Material

The Traditional Lecture

- “I teach, you listen”
- Can lead to an expectation of a passive learning experience.
- Can prevent student from engaging fully with the material.
- Encourages surface learning.
- Practical courses tend to be taught in weekly lectures followed up by lab sessions.

Mixed-mode study

- A practical course should be taught in a practical environment.
- Used to have two hours lecture a week followed up by two hours lab session.
- Now have four hours a week of ‘in-lab teaching’.
- Much more flexible lecture structure.
- Can immediately follow up lecture material with problems.
- Students are happier to engage in discussion.

The Lab Setup

- Each student has a ‘station’ equipped with two monitors.
  - One is linked to a PC running the hardware and software.
  - One is linked to my laptop so they can see the lecture notes.
- Allows seamless progression from lecture to lab session.
- Allows me to highlight necessary material or problems to students during the exercises.

Supporting Material

Independent Learning

- Need to supply key material without overloading the student.
- One book is generally sufficient (lots of code or examples they can use as building blocks for their projects).
- Help them to navigate the user manuals through lab work.
- Recorded lectures.
- Lecture slides (partial).

Review

- Learning outcomes
  - What skills we want the students to acquire.
  - The different skills required by industry and academia.
- Course design
  - Constructive alignment
- The impact of assessment
- Feedback
- Delivery

Questions

Thank you for listening