

School of Civil Engineering

FACULTY OF ENGINEERING



UNIVERSITY OF LEEDS

Teaching Civil Engineering Skills

Professor Denise Bower

- Which skills do civil engineers need?
 - Industry
 - ICE
- How should these skills be taught?
 - Student
 - Space
 - Speaker

Higher Ambitions:

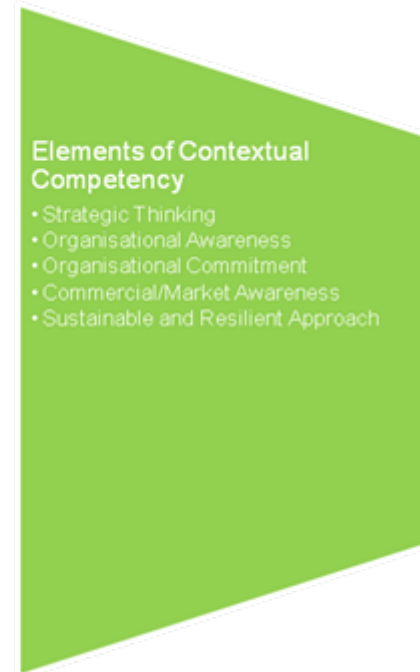
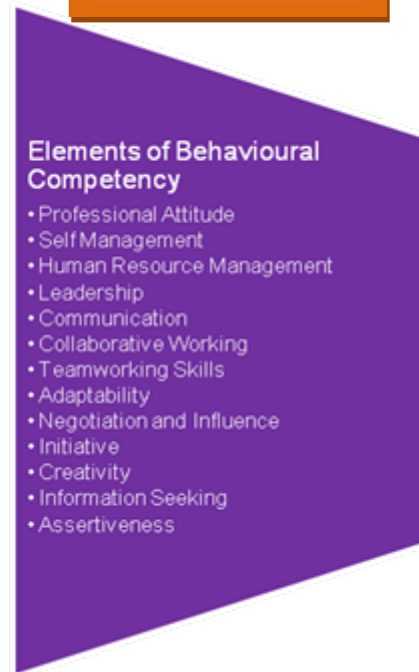
- Building relationships with industry, business, schools and students
- Developing flexible modes of delivery, learning and assessment
- Developing modules/courses/programmes with industry for industry
- Developing graduates with a commitment to work and learn
- Developing a professional approach to academia
- Developing a code of conduct for academics (cf professional engineers)

- **Engineering Graduates for Industry**
 - Self-management, team working, business and customer awareness, problem solving, communication and literacy, application of numeracy and IT, all of which are underpinned by a positive attitude.
- **Biggest gaps?**
 - Communication, EI, Planning, Running meetings, managing people, the big picture, interpersonal appreciation and understanding, developing others.



- ICE Competency Framework
 - Post professional review
 - The framework is not for the purpose of assessing fundamental knowledge or educational understanding but the manner in which they are applied
 - *Foundation Competencies* are demonstrated through awareness and critical understanding of the distinct body of knowledge and the ability to apply and challenge the methodology
 - *Foundation Competencies* are developed through formal learning, are regulated by the professional accreditation process to achieve the workplace standard and form the foundation for the development of *Professional Competencies*

- ICE Competency Framework
- *Professional Competencies* are gained through experience and interaction and are cultivated, matured and honed through continuing professional development
- Within the framework, the term competency relates to the personal attributes used in work activities which underpin competent performance.
- The *Professional Competencies* have been split into three areas and the competencies within those areas defined by a set of indicators all designed to provide an accessible form of assessment





Practice Competency

- Knowledge Application
- Problem Solving
- Decision Making
- Organisation and Planning
- Quality Management
- Technology Management
- Information and Knowledge Management
- Resource Management
- Achievement Orientation
- Health and Safety



P2 Problem Solving: The effective application of engineering knowledge to arrive at an appropriate solution(s).

Indicators: Personal Attributes – Behaviours, skills, knowledge and attitudes	Score (1-10)
Contributes to the identification of problems and the production of practical solutions through the use of analytical thinking.	6
Demonstrates the appropriate amount of attention to detail.	5
Logically assess situations for their constraints, patterns, interrelationships, implications and potential benefits.	7
Demonstrates lateral thinking. Encourages inclusive and cross-discipline brainstorming.	4
Capable of complex analysis and critical thinking.	7
Identifies and evaluates alternative solutions through application of engineering knowledge.	8
Able to identify root causes and related issues.	7
Reflects – evaluates solution after it has been implemented.	4
Total	48
Competency Score (Total ÷ 8)	6

I do this most of the time

I feel confident and capable of this

I am aware I should, but often do not

Demonstrates **Good** problem solving. Can effectively apply knowledge to arrive at a solution but needs to be more than just aware of other sources and reflect on choices made.

Range	Description
0-1	None Competency not demonstrated, or only basic awareness. Needs supervision/assistance.
2-4	Low Low but progressing awareness and demonstration. Would benefit from mentorship or greater experience.
5-7	Good Good awareness and demonstration of competency. Regularly demonstrates many of the indicators, may need to focus on specific attributes.
8-9	Informed Sound awareness, understanding and demonstration of competency.
10	Model Exemplary demonstration of competency.

Behavioural Competency

- Professional Attitude
- Self Management
- Human Resource Management
- Leadership
- Communication
- Collaborative Working
- Teamworking Skills
- Adaptability
- Negotiation and Influence
- Initiative
- Creativity
- Information Seeking
- Assertiveness



B4 Leadership: The ability to create and convey vision and strategic direction through empowerment, inspiration and example.

Indicators: Personal Attributes – Behaviours, skills, knowledge and attitudes	Score (1-10)
Motivates and facilitates others through the provision of visible strategic direction.	4
Proactively takes the lead through the recognition and application of the appropriate leadership styles.	6
Able to establish buy-in and gain the trust and confidence of others.	5
Acts as an effective change agent to make strategy and vision reality.	4
Creates and maintains energy and momentum for the achievement of goals and objectives.	5
Empowers others with advice and support. Lobbies on the behalf of others.	7
Encourages high performance and others to be successful.	7
Total	38
Competency Score (Total + 7)	5

I am somewhat aware of this in my daily life but need to be more tapped into the business side

I am aware of what style to use and naturally take control of situations in a manner which my colleagues appreciate.

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Good level of leadership but needs to apply this in an organisational context.

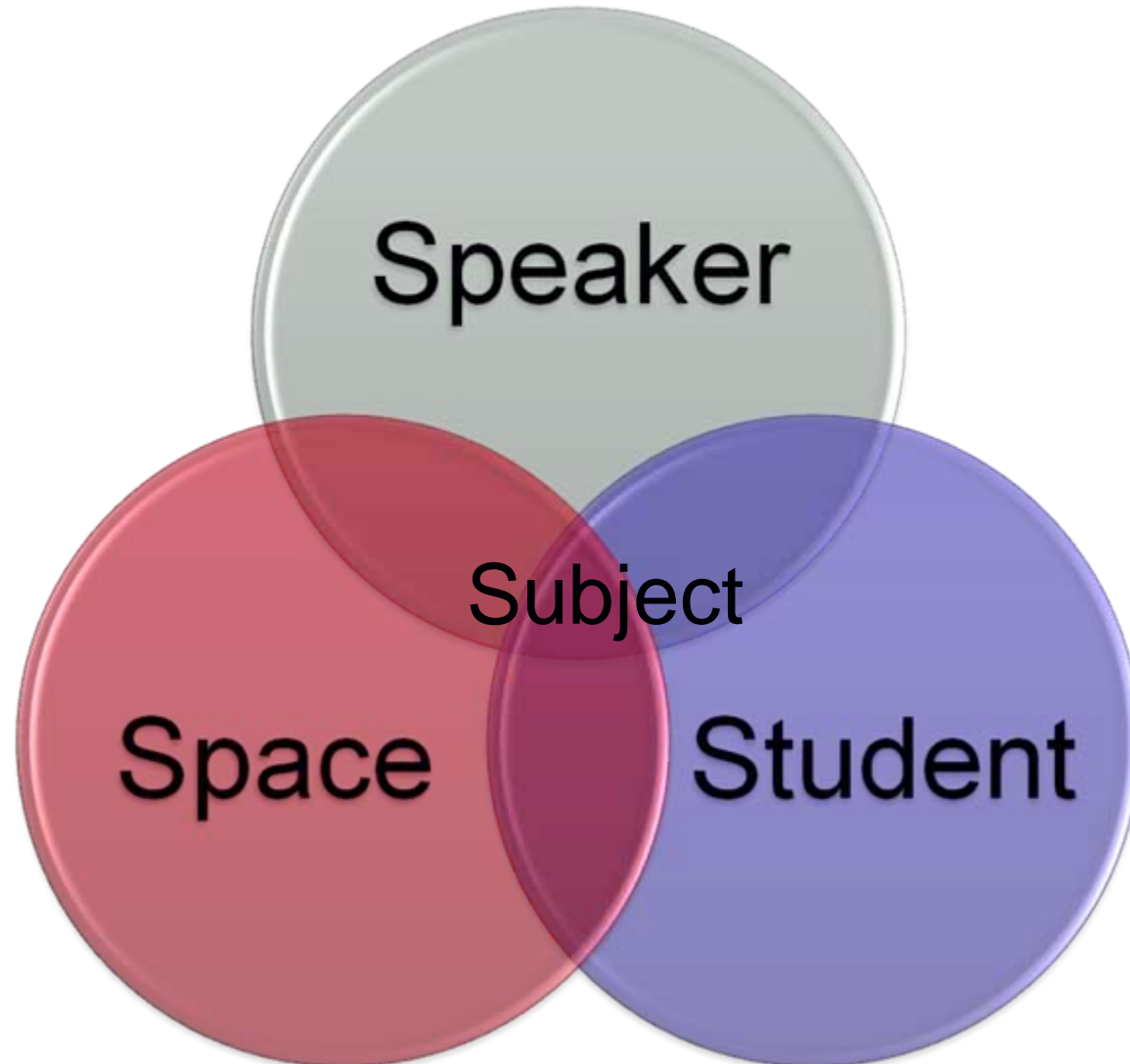


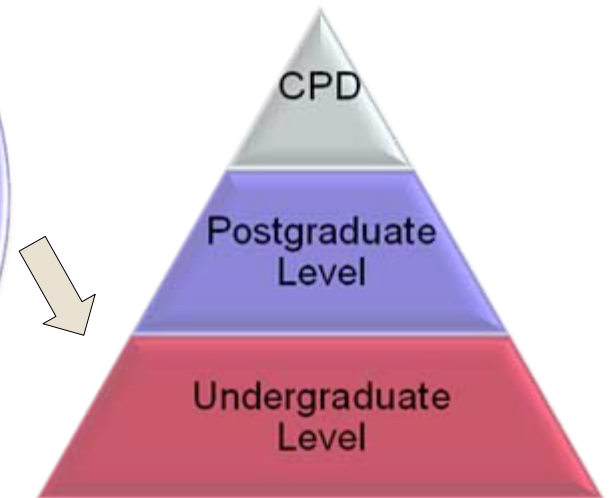
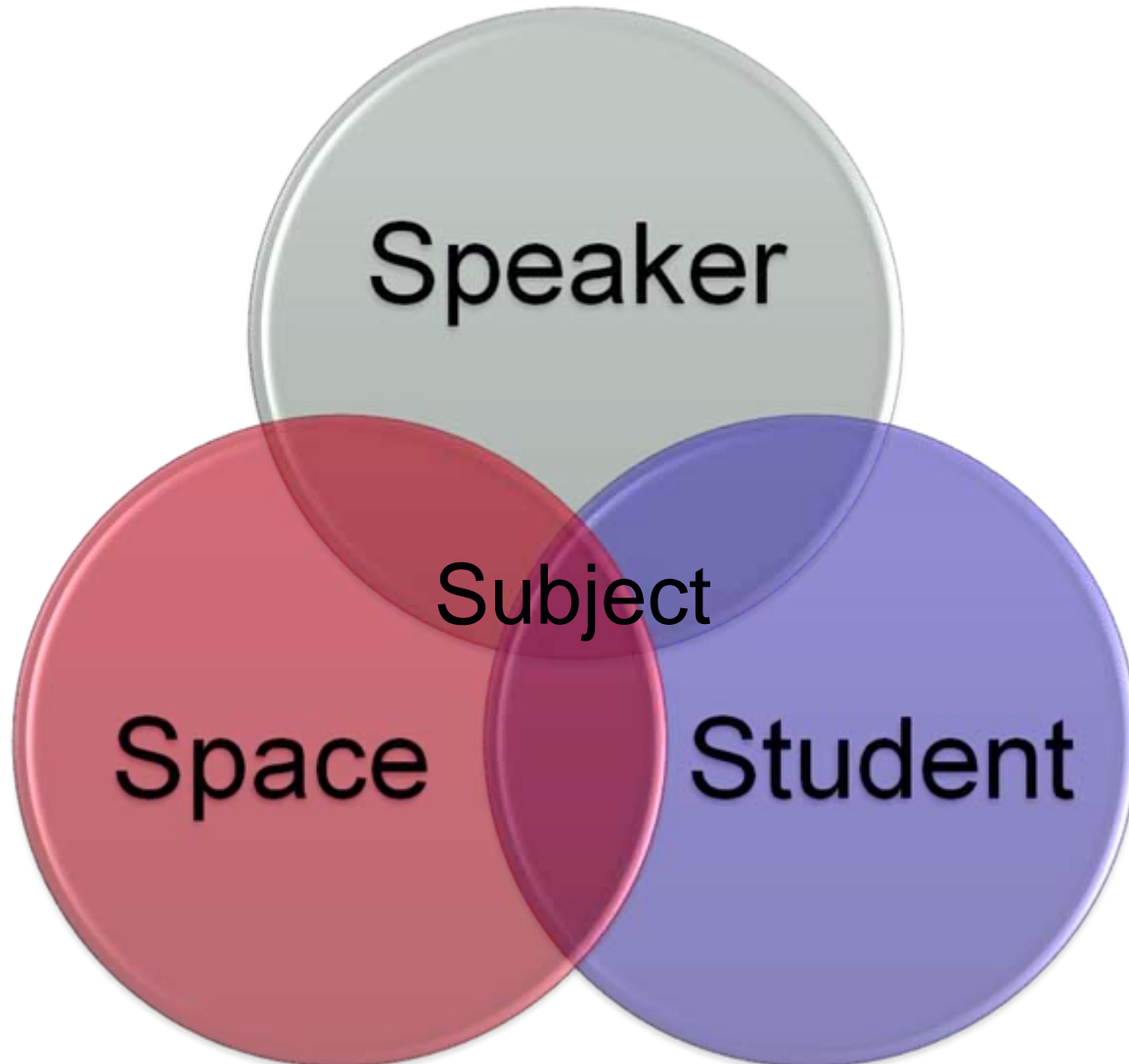
Contextual Competency

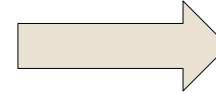
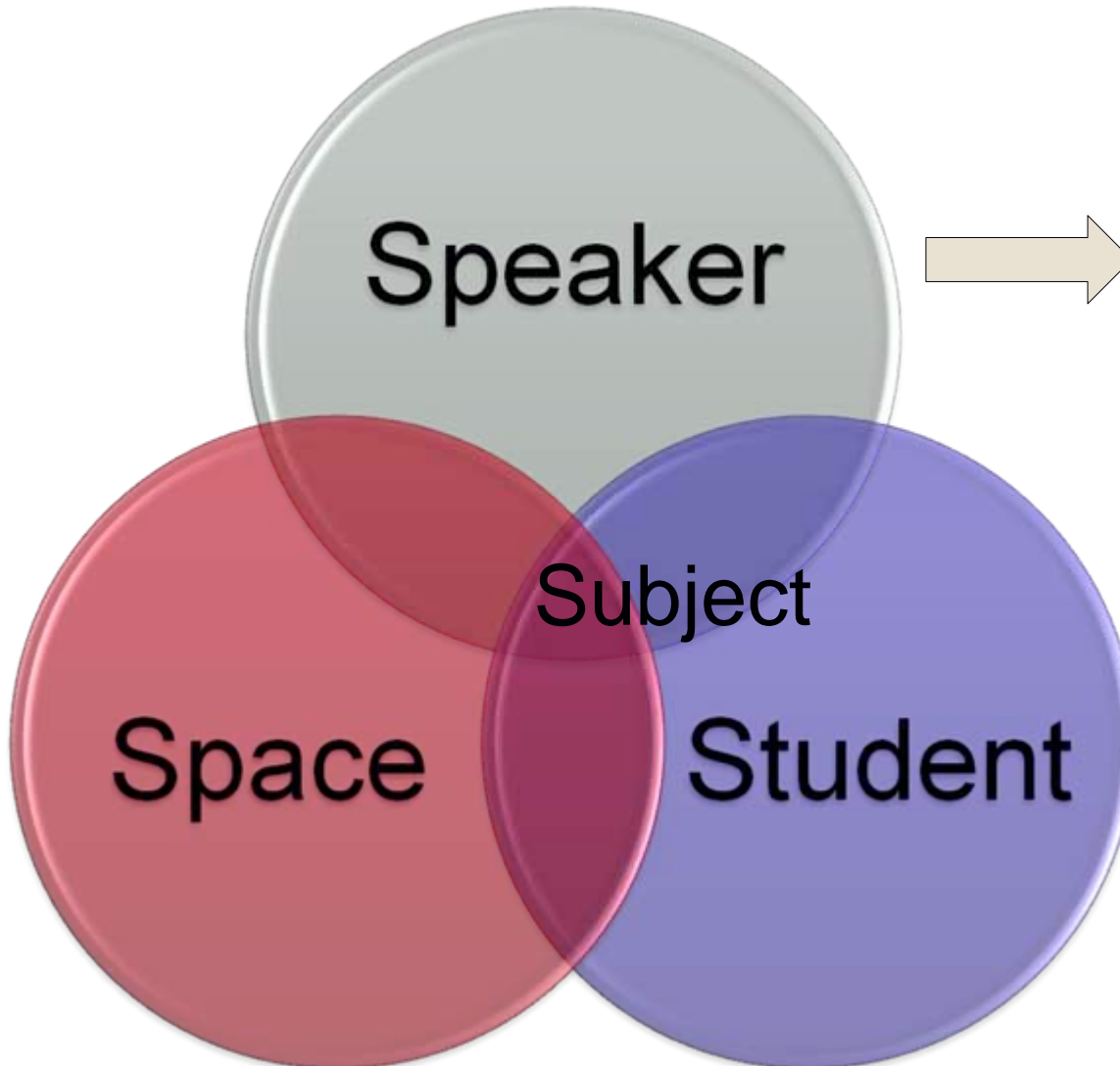
- Strategic Thinking
- Organisational Awareness
- Organisational Commitment
- Commercial/Market Awareness
- Sustainable and Resilient Approach

- Challenge – which of these skills can we / should we teach undergraduates, how should they be taught?
- Currently a number of initiatives at a variety of universities eg. Liverpool, Coventry, Constructionarium
- Focus on “Active” learning – but are the required skills being developed??





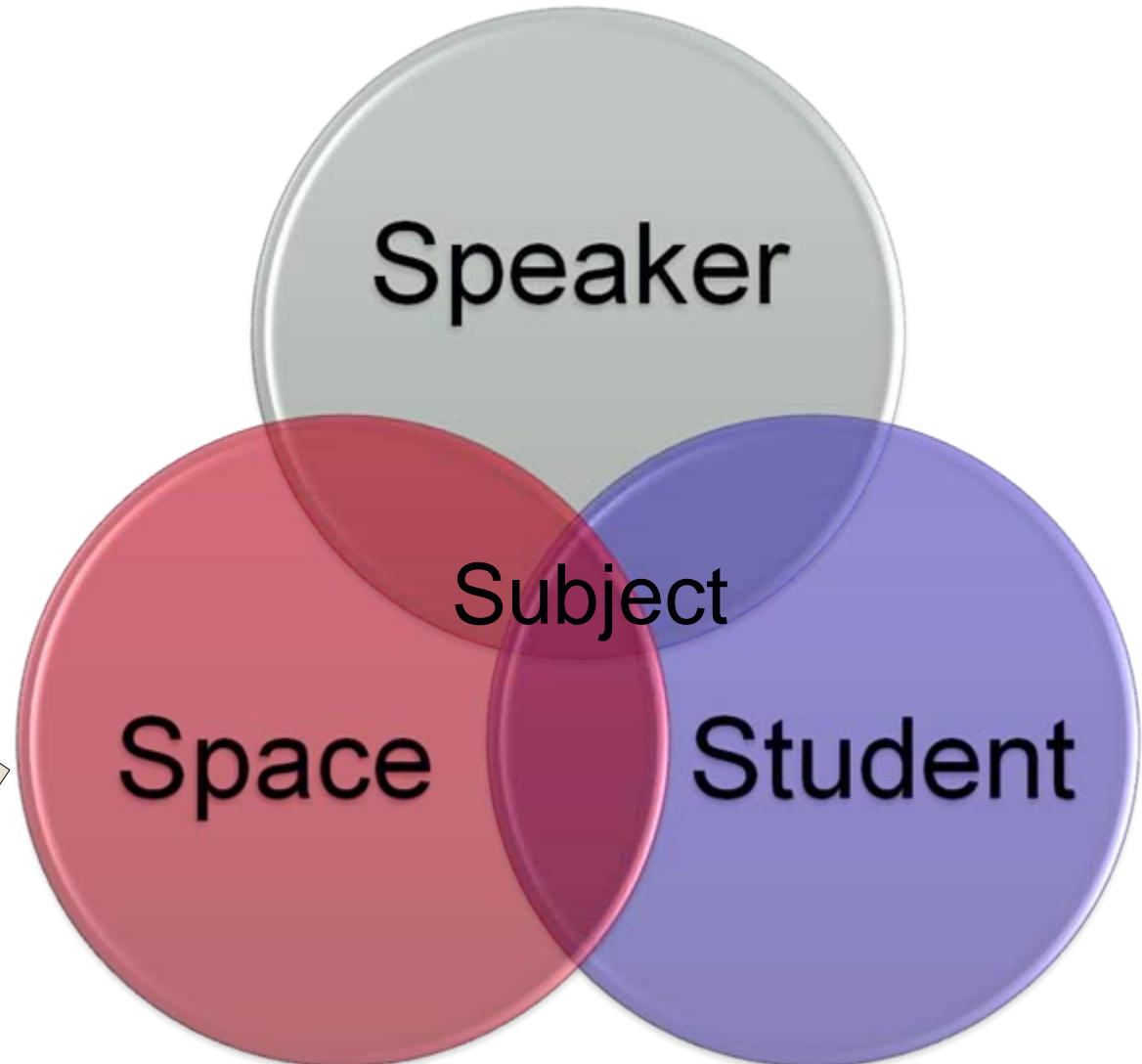
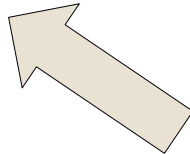




industrial experience, a knowledge of the full range of learning modes available, professional qualifications (engineering and teaching), the ability to flex across discipline boundaries, good knowledge of the external context, the ability to be part of a team, facilitation skills, mentoring skills, a good knowledge of learning technologies, excellent communication skills, enthusiasm, a collaborative attitude (with other staff, students and industry), a broad and cross disciplinary view

Need:

- Investigation
 - See Learning Landscapes, EDUCAUSE, SCALE-UP and Next Generation Learning Spaces
- Evidence
- Guidance



Competency

Mode

Space

Communication

Chalk and talk

- Lecture theatre

Problem solving

Role playing

- e-learning

Planning

Group work

- Innovation lab

Strategic thinking

Self-directed

- Media theatre

Teamwork

Facilitated

- Computer cluster

Leadership

Simulation

- Break-out & social space

Real world

Final Thoughts:

- Need to understand which professional competencies should and can be developed at each level in conjunction with foundation competencies.
- Must appreciate relationship between skill, speaker, space and student.
- Academic staff must have the right competencies.
- Investigation, evidence and guidance is needed if space is to be used efficiently and effectively.