Outcomes-based Learning

Developing and assessing generic outcomes

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What are learning outcomes?

- Learning outcomes define the student in terms of what they can DO at the end of period of study.

- The traditional approach defines courses in terms of what is taught.

- By sharing intended learning outcomes with students they can share the responsibility of achieving them.

Constructive alignment

- Constructive Alignment (Biggs, 1999) is the underpinning concept behind the use of learning outcomes and assessment criteria.
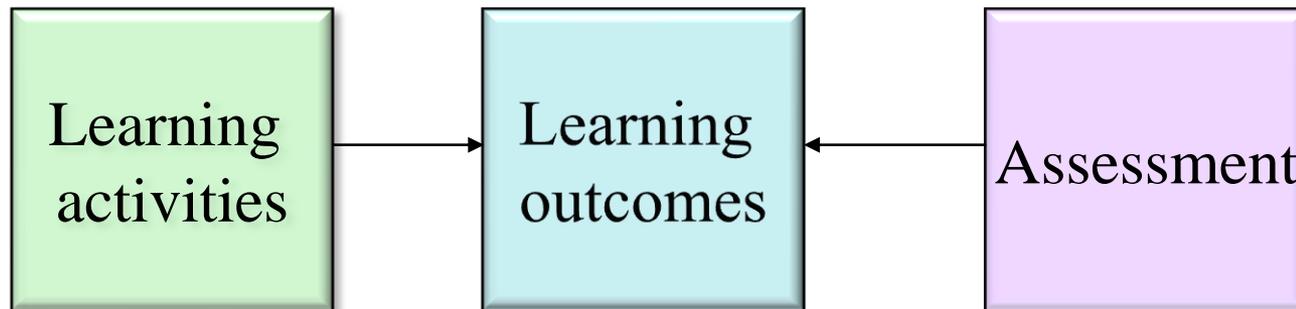
Benefits of the approach

■ Students know what is expected of them

■ Shift from inputs (teaching) to outputs (learning)

■ Programme learning outcomes define the graduate

What can learning outcomes be applied to?

- Individual teaching sessions

- Courses comprising several sessions

- Modules

- Programmes

What do learning outcomes look like?

- Should describe something a student can DO to demonstrate the outcome

- Use active verbs

  ► Describe, discuss, evaluate, plot, sketch, …

- Do not use terms that cannot be DIRECTLY assessed

  ► Understand, appreciate, know….

- Think about how you are going to assess the outcome

'At the end of this module you should be able to….'

Learning outcomes at Bachelor and Master levels

- describe and comment upon particular aspects of current research

- evaluate critically current research and advanced scholarship in the discipline

- apply the methods and techniques to review, consolidate, extend and apply their knowledge and understanding

- evaluate methodologies and develop critiques of them and, where appropriate, to propose new hypotheses.

Structure and bonding

At the and of this course you should be able to

- Understand models of atomic structure
- Understand the structure of the periodic table
- Appreciate different models of bonding in simple molecules

X

Structure and bonding

At the and of this course you should be able to

- describe the arrangement of elements within the Periodic Table
- explain the trends in properties of the elements within the PT in terms of electronic structure
- describe bonding in terms of atomic and molecular orbitals
- predict the shapes of simple molecules

School learning outcomes

- Be able to apply scientific principles and reasoning methods to critically evaluate available information and make independent judgment. **(judgment)**
- Be able to work independently, and to collaborate effectively in team work and team building. **(interpersonal skill and leadership)**
- Be able to understand and explain the scientific principles in broad areas and to use of tools of one or more science disciplines at the college level. **(knowledge)**
- Be able to communicate effectively, both orally and in writing, about science to both lay and expert audiences, utilizing appropriate information and communication technology. **(communication)**
- Be able to conduct self-evaluation, and continuously enrich themselves through life-long learning.[1] **(self reflection)**
- Be able to apply scientific principles in conjunction with quantitative reasoning methods and experimental and IT skills to analyze, execute tasks and solve problems in daily life and at work. **(execution)**
- Be able to recognize the importance of complying with the ethics of science, of being a responsible citizen, and of ensuring a sustainable environment.[1] **(ethical practice)**

Be able to explain science to lay audiences and arouse their interest in the beauty, logic, and precision of science.[1] **(appreciation of science)**
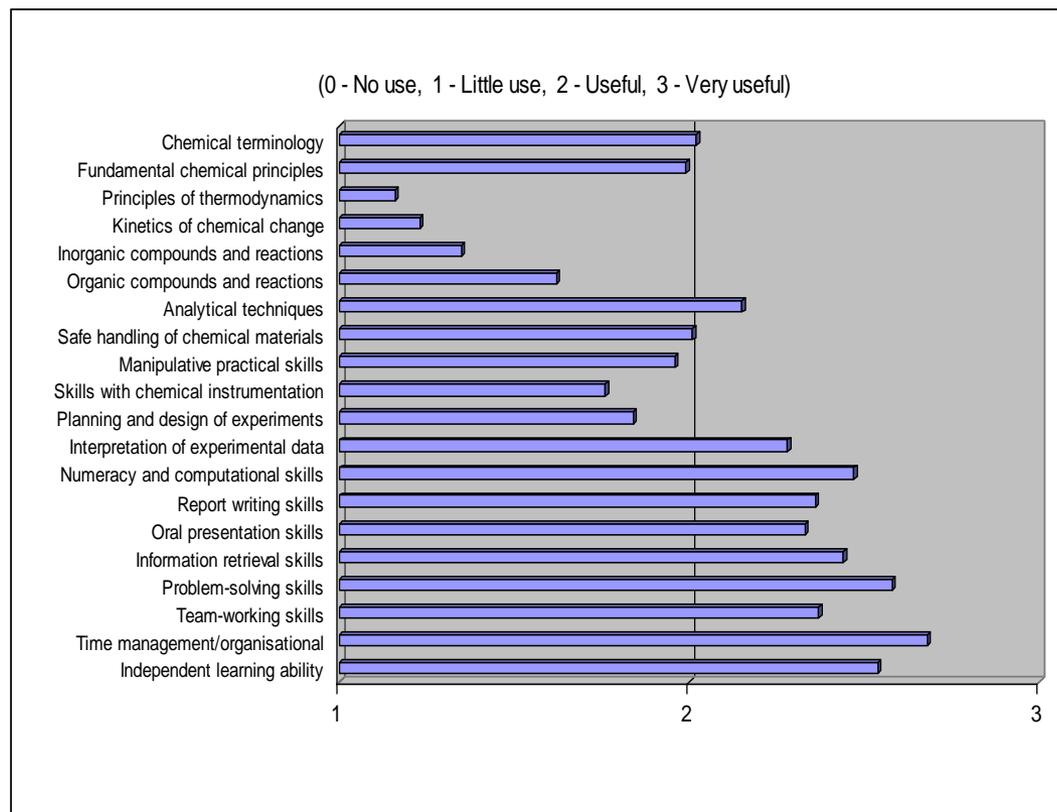
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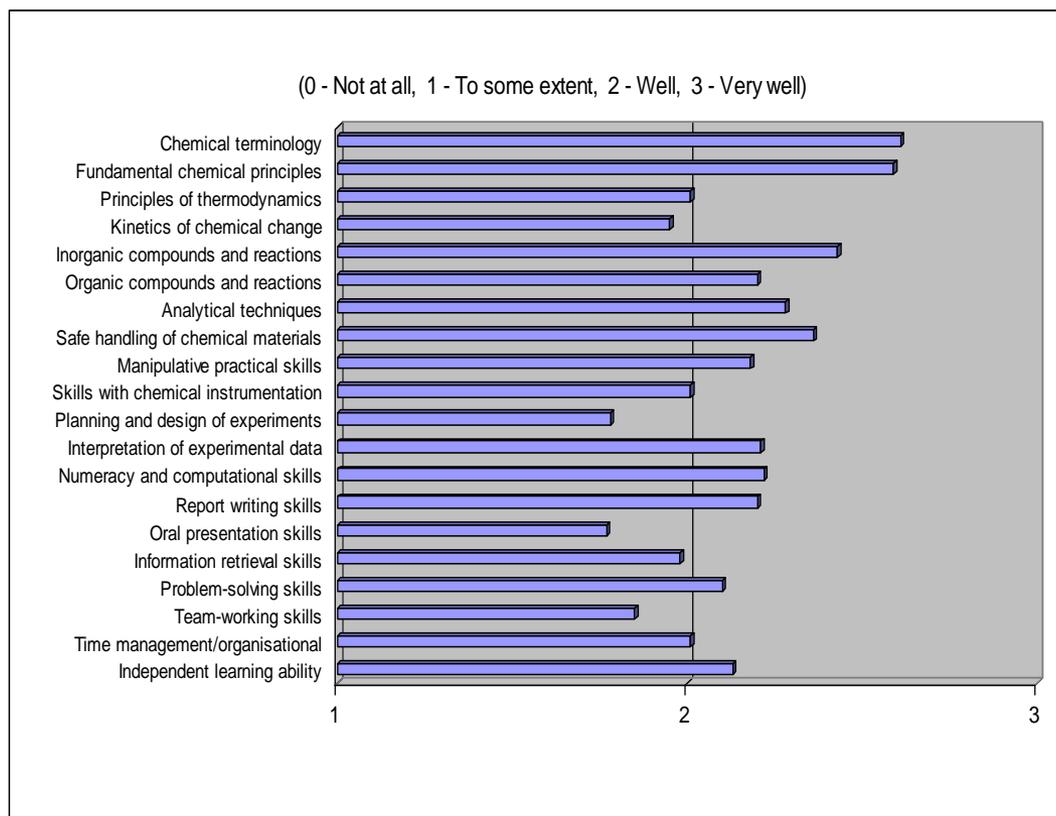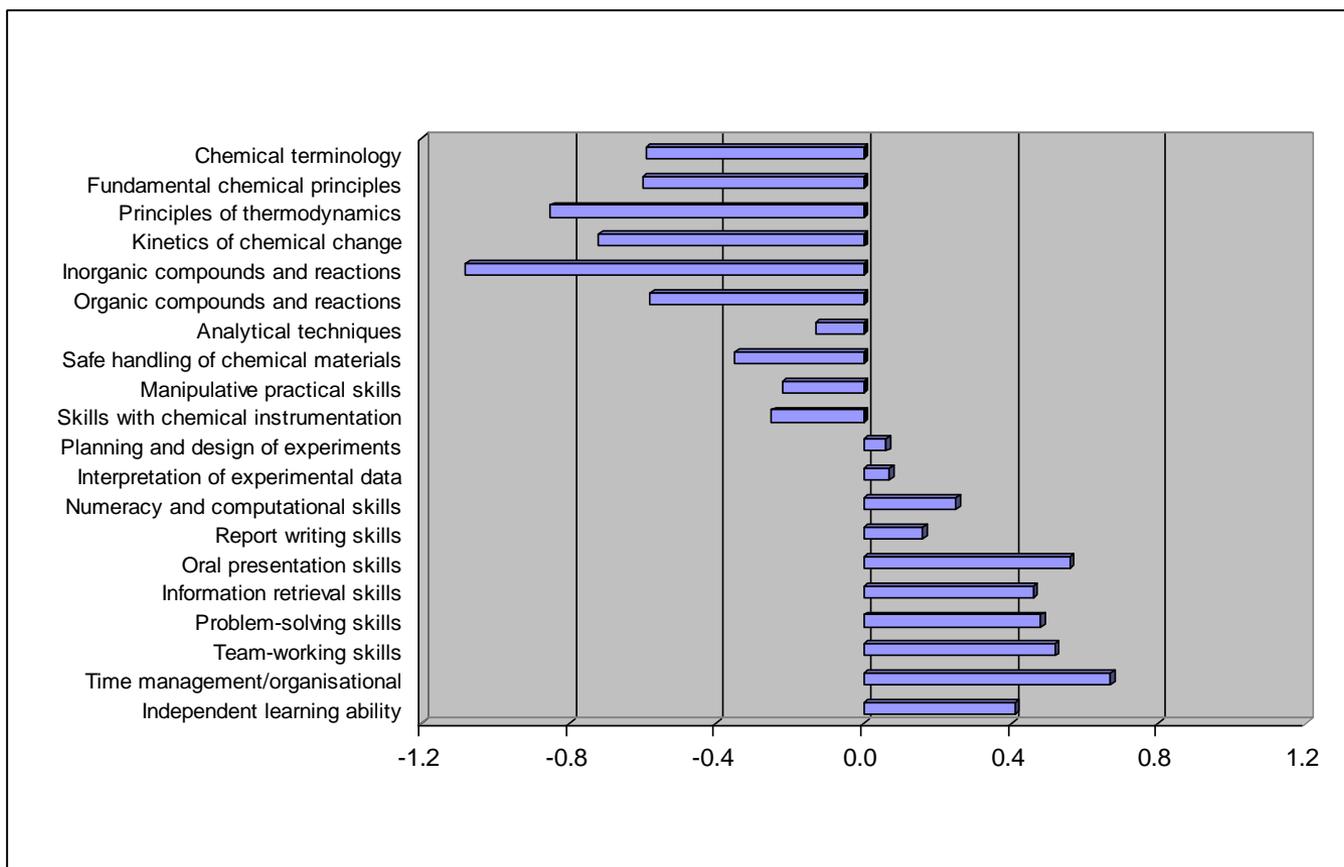
Why have generic outcomes?

2 years post-graduation
What skills have you used most?

Developed within degree

(0 - Not at all, 1 - To some extent, 2 - Well, 3 - Very well)

Chemical terminology
Fundamental chemical principles
Principles of thermodynamics
Kinetics of chemical change
Inorganic compounds and reactions
Organic compounds and reactions
Analytical techniques
Safe handling of chemical materials
Manipulative practical skills
Skills with chemical instrumentation
Planning and design of experiments
Interpretation of experimental data
Numeracy and computational skills
Report writing skills
Oral presentation skills
Information retrieval skills
Problem-solving skills
Team-working skills
Time management/organisational
Independent learning ability

1   2   3

'Development deficit'

Do you currently explicitly teach and assess these skills?

- How?   Where?

- Teaching and assessing generic skills takes time.

- Make space for it in the curriculum.

- At the expense of 'content'?

- Generic outcomes unlikely to be achievable through traditional teaching methods

- Use assessment tasks to drive skills development

Be able to work independently, and to collaborate effectively in team work and team building.

- ■ Teaching
  - ► Group dynamics, expectations, negotiate ground rules
  - ► Group tasks, problems, projects, problem-based learning
- ■ Tasks must complex enough to demand team work, collaboration, distribution of tasks, cooperative learning
- ■ Assessment
  - ► Observation, reflective log, peer assessment, meeting notes, online discussion boards

Be able to communicate effectively, both orally and in writing, about science to both lay and expert audiences, utilizing appropriate information and communication technology.

■ Teaching

  ► conventions of science writing, using sources, referencing, plagiarism

  ► lay audience, style, purpose, vocabulary,

■ Assessment

  ► Oral presentations

  ► Written reports, literature reviews, essays, project reports

  ► Newspaper articles, wiki or blog entry, short story, video, oral presentation, external visit, hosting visitors, peer mentoring

Be able to conduct self-evaluation, and continuously enrich themselves through life-long learning.[1] (self reflection)

■ Teaching

► Evaluate own performance

► Personal development planning

► CV/resume production

■ Assessment

► Reflective log book

► learning plan

► self assessment

► blog

Be able to recognize the importance of complying with the ethics of science, of being a responsible citizen, and of ensuring a sustainable environment.[1] (ethical practice)

■ LOs

► Apply ethical principles to the practice of science

► Demonstrate a professional attitude

► Discuss the importance of sustainability in the context of chemical processes

■ Teaching

► Problem-based learning, case studies, projects, practical activities

■ Assessment

► Essays, presentations, reports, blogs, practical reports, reflective log, video, oral presentations

Be able to explain science to lay audiences and arouse their interest in the beauty, logic, and precision of science. (appreciation of science)

■ Teaching

▶ Purpose, aims, outcomes, vocabulary, media, etc.

■ Assessment

▶ Essays, newspaper reports, video, wiki/blog, short story, oral presentations, schools visits, etc.

Communicate with a lay audience

- Write an article for the local newspaper based on a recent article from ….

- Produce a short video suitable for viewing by schoolchildren that explains how you think science will change the world in the next ten years.

- Prepare an oral presentation based on your final year project that will be presented to students in the School of Humanities and Social Science

Work effectively as part of a team, solve novel problems, identify learning needs, oral and written communication, awareness of sustainability

- You are team of scientists and managers at the Hong Kong Titan Company which produces titanium dioxide pigment by the sulfate process. Your Director has asked you to investigate the issues involved in moving production to the chloride process.

- Evaluate both processes, consider economic, environmental issues related to both.

- Produce an executive summary of your finding and prepare a presentation to the board of the company.

Issues

- Must all learning outcomes be assessed?

- Must all learning outcomes be achieved?

- Do they define typical, minimum or maximum achievement?

- Lack of alignments between teaching, assessment and learning outcomes

For each of the generic skills below devise a teaching and assessment activity. You may cover more than one skill at a time:

► Communication

► Teamwork

► Ethical/sustainability awareness

► Problem solving

► IT