Queens University

Wednesday 18th June

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CCEA

‘ The Physics Syllabus’

GCSE/A level Reform

- Review of GCSE/A level Qualifications in N Ireland
- Changes to GCSE/A level qualifications across E/W/NI
- Changes to Science A levels
- GCE Physics Practical Assessment Changes
  - Recent changes to the current model
  - CCEA and UK statistics
  - Future considerations for a new specification

Review of GCSE/A levels

- Strong support for GCSE and A level qualifications
- flexible delivery (linear/modular) supported
- Short/medium term review to ensure CCEA GCSE and A Levels continue to be ‘fit for purpose’
- Longer-term developments (Expert Group)

The Fundamental Review of GCSE and A Levels

Final Report: Recommendations

General findings

- Full report available with Appendices
  - www.ccea.org.uk/accreditation
- Generally happy with GCSEs and A levels.
- Want to see joined-up thinking in education.
- Need for flexibility in qualifications system.
- Portability and comparability vital.
- No support for Gove's policies for England.
- Short term and long term considerations

Recommendations - GCSE

- Need for flexibility – modularity, tiering, internal assessment where best for the subject.
- Should show progression of skills from NI Curriculum at Key Stage 3.
- Subject offer for English, Mathematics and ICT needs reviewed to ensure GCSEs on offer meet requirements.
- Should encourage connected learning and transferability of skills.

Recommendations – A level

- Need for flexibility – modularity, internal assessment where best for the subject.
- AS should be kept part of A level.
- Support development of literacy, numeracy and ICT skills.
- Incorporate skills valued by employers and HE.
- Should have the support of employers/FE and HE in their development (also GCSEs).

Short-term considerations

- Timescale – DENI consultation closes **20 December 2013**.

- Some considerations:
  - Different grading in England.
  - What will be a GCSE/A level in England?
  - How will NI ensure the rigour, currency and portability of qualifications offered/taken here only?
  - Are the needs of NI candidates different from those of England and Wales?

Recommendations – longer-term

- Development of 14-19 strategy.
- Longer-term vision developed over 3 years with a view to trialling/implementation over 10-15 years.
- Considerations:
  - experiences, qualifications and systems from UK, Ireland and internationally;
  - academic research into best practice and qualifications reform;
  - alignment with international best practice;
  - need for high-stakes assessment at 16; and
  - the rigour, portability and currency of qualifications post-16 must be ensured.

GCE Physics

PRACTICAL ASSESSMENT CHANGES

Gavin Gray Education Manager (Physics, SAS and ELQ Science)

Issues Arisen from accredited model

- Malpractice

  This was not found to be significant in Physics.

  Issues with dates for alternative dates for practicals:

  Survey of centres carried out in April 2014

  Out of 18 centres, 5 centres expressed concerns that they could not be sufficiently accommodated with only one date for the practical exam.

CCEA Statistics

Rewarding Learning

Table 1: 2011 – 2013 AS Physics Results

	A	B	C	D	E	U	Total
2013	31.4	52.8	70.6	83.7	92.5	100.0	**2200**
2012	33.0	56.8	74.4	86.2	92.8	100.0	**2184**
2011	35.6	59.0	74.8	86.1	93.2	100.0	**1912**

Table 2: 2011 – 2013 A2 Physics Results

	*	A	B	C	D	E	U	Total	% Not progressing from AS
2013	5.7	34.7	64.8	83.1	92.1	97.4	100.0	**1294**	**54.1**
2012	8.5	35.8	65.3	82.8	92.8	97.4	100.0	**1276**	**51.0**
2011	9.9	39.3	64.7	83.6	93.4	97.8	100.0	**1143**	**50.2**

% not progressing is calculated by matching A2 candidature to previous year's AS candidature at cashin level. Repeat candidates have not been excluded.

Corresponding statistics for % not progressing from AS to A2 GCE Physics are similar to Chemistry with Biology slightly lower.

Future Considerations…

- Decoupling practical and theory assessment:
  - Return to coursework model – wide open to malpractice
  - Pass/Fail – no discrimination
  - Physics is high stakes – job opportunities
  - Teaching to the test – no emphasis on practical skills
  - Poor preparation for Higher Education

New specification – opportunity for a broader range of practical skills to be assessed and include additional practical assessments

Score Response to Regulators

Rewarding Learning

Score Response to Consultations

(ASE, IOP, RSC, SOB)

Purposes of practical work

- Reinforcing the empirical link
- Experiencing phenomena
- Thinking and explaining phenomena
- Techniques
  - Using a microscope, a burette, a voltmeter etc
- Manipulation
  - Dexterity, care, fault finding
- Making independent decisions
  - Taking responsibility and knowing that it is not a menu activity
- Procedural knowledge

Purposes of assessment

- Ensure practical work happens
- In an integrated way
- Developing the attitudes and skills on previous slide
- Ensure that students achieve learning related outcomes

Principles of assessment

- SCORE document on the principles for the development of effective assessment schemes for practical work in the sciences (published Feb 2014)
- SCORE believes that effective practical work comprises:
  - Technical and manipulative skills
  - Extended investigation
  - Development of conceptual understanding

Assessment tools

SCORE recommends that:

- Practical work should be an integral part of the A levels in the sciences, their assessment and grades awarded.
  - Including direct assessment
  - Not a separate 'pass' or 'fail', it should form part of the overall grade

Assessment tools

SCORE recommends that:

- Further research should be conducted to establish appropriate methods of assessing practical work effectively[1]. It is important that any changes are piloted before introduction, however direct assessment of practical work could include the following elements:
  - a laboratory notebook, in which students record their activities (taken from a framework of skills and activities that should be covered)
  - an extended investigation
  - a test of students' technical and manipulative skills

[1]For an in-depth discussion of the portfolio model see Black, P., Harrison, C., Hodgen, J., Marshall, B. and Serret, N.; *Can teachers' summative assessments produce dependable results and also enhance classroom learning?*; Assessment in Education: Principles, Policy & Practice, Volume 18, Issue 4, 2011, http://www.tandfonline.com/doi/abs/10.1080/0969594X.2011.557020#tabModule

Ofqual

- Good
  - Fixed practical types
    - Not enough set pracs
    - Dominated by old fashioned view of practical work
  - Written assessment
  - Log book?
- Less good
  - Driven by assessment concerns
    - Malpractice, bunching/lack of discrimination
  - Wilfully ignored evidence
    - Assessments that work - investigations
    - Response to splitting grade

Ofqual

- Separating the grade
  - Philosophical objection
  - Validity objections (A*/fail)
  - Practical objection – the logic does not work

  A. If HEIs ask for pass=> more compromising for teachers

  B. If not => schools will concentrate less on PW
- Worst case is schools reduce funding
- They are experimenting with a large, hard-to-predict system. They have no idea - and not much confidence, that this will work

Thematic ideas in physics- IOP

- **Reductionism.** *Physics describes natural phenomena in terms of a small number of laws*
- **Universality**. *The laws of physics are universal - they work everywhere.*
- **Unification.** *There is a drive to reduce the number of laws to as small a number as possible.*
- **Synoptic nature.** *Physics is an interlinked totality of ideas that must be consistent with each other.*
- **Cause and effect**. *Understanding in terms of causes and effects: what makes things happen the way they do.*
- **Mathematical techniques**. *Physical laws can be expressed in a mathematical form.*
- **Conservation.** *Some quantities are conserved. These laws put powerful restrictions on behaviour.*
- **Equilibrium**. *Equilibrium occurs when two or more external influences are in balance*
- **Differences cause change**. *E.g. temperature difference, pressure difference, potential difference,*
- **Inertia**. *Things will tend to stay as they are unless something causes them to change.*
- **Dissipation.** *Many processes have an element that is resistive and dissipative.*
- **Irreversibility.** *Dissipative processes are irreversible.*
- **Fields.** *Action at a distance can be understood in terms of fields.*
- **Energy.** *There is a useful accounting tool - energy - that, allows us to do calculations*

Thinking like a physicist (in the lab)

- **isolating:** isolating physical phenomena to test ideas experimentally;
- **using experiments to test ideas:** refining models through iterative sequence experiment -> model -> prediction -> test;
- **seeking consistency:** testing answers are consistent with experience & physics
- **quantitative understanding:** realising the need for quantitative analysis
- **models:** developing models of systems to make predictions of their behaviour;
- **critical thinking and scepticism:**
- **deep understanding:**
- **reason and logic:**
- **simplification:**
- **approximation and other techniques:**
- **excising prejudice:**

Some example techniques in the physics lab

- Select & set up basic apparatus with and without instructions
- Use specialist equipment
- Make a series of similar observations over time
- Manipulate apparatus to make a series of observations
- Select instrument with appropriate range
- Quote the uncertainty in a reading

Any Ideas or Feedback?

Thoughts and ideas for experiments and practical skills to be assessed?

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