



**INSTITUTE OF EDUCATION**

**Taught Module 2007-2008**

**Introduction To Secondary School Teaching (Physics)**

**Module Code: IE2A6**

(24 CATS points)

**MODULE GUIDE**

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# Introduction to Secondary School Teaching (Physics)

## Introduction

## Links to Other Modules

This module provides students with an introduction to theoretical aspects of the teaching of physics (within the context of science) in secondary school. It draws on the practical experience in school which is undertaken as part of the Student Associate Scheme or by the student's own arrangement.

## Aims and Objectives

The purpose of this module is to give students on undergraduate programmes in physics an academic introduction to the teaching of physics, and more generally science, at secondary school. Students will develop their understanding of the pedagogy of the subject and of the structure of physics at an elementary level.

## Learning Outcomes

By the end of this module, students should be able to:

1. Know and understand the nature of the secondary school curriculum in science (with particular reference to physics) and how it is transformed into plans for teaching.
2. Understand basic theories and recognise their application in the classroom.
3. Design learning activities to match typical learning objectives in their subject.
4. Evaluate lesson plans and delivery in terms of quality of learning.

## Teaching **WT106 (Westwood) Friday 09.00 – 11.00**

The teaching for this module will be in 7 seminars of 2 hours each. The schedule for the seminars is as follows.

### **Date**

Friday 11<sup>th</sup> January

Friday 18<sup>th</sup> January

Friday 25<sup>th</sup> January

Friday 1<sup>st</sup> February

Friday 8<sup>th</sup> February

Friday 22<sup>nd</sup> February

Friday 29<sup>th</sup> February

Nb There will be no session on 18<sup>th</sup> February (BM will be in Moscow)

## **Programme**

The course will be structured in five parts. Each part will consist of between 1 and 2 taught sessions and will focus on a single theme relating to teaching physics and science in secondary schools. The taught sessions will include workshop activities in many of which you will work together in small groups to consider issues raised. For each theme there will be one or more required readings from relevant web articles, academic texts or from research papers in education, and a short task which will contribute to the assessed portfolio.

### ***Theme 1: The National Curriculum for Science***

The study of science is compulsory in primary and secondary schools until the age of 16. The science, and within that the physics, that must be taught in schools in England and Wales is specified in the National Curriculum. In this theme you will consider the organisation and structure of the National Curriculum for Science in England and Wales, and the recent history of its development. You will also consider why science has such an important place in the school curriculum. The National Curriculum (and within it science) is also located within the context of the 'Every Child Matters Agenda' (ECM). Briefly, 'Every Child Matters: Change for Children' is a new (2004) approach to the well-being of children and young people from birth to age 19.

The Government's aim is for every child, whatever their background or their circumstances, to have the support they need to:

- Be healthy
- Stay safe
- Enjoy and achieve
- Make a positive contribution
- Achieve economic well-being

See: <http://www.everychildmatters.gov.uk/aims/>

During your work on this theme you should ask yourself questions about what science is required and for what purposes.

The National Curriculum for Science comprises a programme of study ('PoS') which is based on 4 themes or attainment targets (in the first iteration in 1998 there were 17!!). These themes broadly correspond to practical work, biology, chemistry and physics, however the official terminology is:

- Sc1 Scientific enquiry
- Sc2 Life processes and living things
- Sc3 Materials and their properties
- Sc4 Physical processes

For each of these there are a set of descriptions corresponding to 'levels' which are used to measure attainment.

In this module we will concentrate on Sc4 – Physical Processes (aka ‘Physics’) and on Sc1, since the principle behind Sc1 is that it should be taught in the context of the other 3.

*Required Readings:*

### **Introduction to science in the National Curriculum**

These two links will give you

a) an Overview:

[http://curriculum.qca.org.uk/subjects/science/keystage3/Science\\_and\\_the\\_national\\_curriculum\\_aims.aspx](http://curriculum.qca.org.uk/subjects/science/keystage3/Science_and_the_national_curriculum_aims.aspx)

b) Potted History and more detail:

<http://www.ucsm.ac.uk/icted/6/ssm/dfes-0260-20023.4CoreSubjectsInSecondarySchoolsChapter4Science.pdf>

**(suggest you read NO MORE THAN the 1<sup>st</sup> 4 pages (115-119) of this chapter to start with!)**

Then, in order to familiarise yourself with the NC for Science go to the following site, which is the ‘home page’ of the whole of the national curriculum (national curriculum online).

<http://www.nc.uk.net/webdav/harmonise?Page/@id=6016>

Then click on ‘Science’ in the LH menu. From the Science ‘Welcome’ page you should follow the link to attainment targets. This will take you to:

[http://www.nc.uk.net/webdav/harmonise?Page/@id=6001&POS\[@statId\\_eq\\_main\]/@id=6323&POS\[@statId\\_eq\\_at\]/@id=6323](http://www.nc.uk.net/webdav/harmonise?Page/@id=6001&POS[@statId_eq_main]/@id=6323&POS[@statId_eq_at]/@id=6323)

Note that the subheading ‘Sc1’ in the top LH panel is illuminated.

The PoS (syllabus) is defined on the left hand side of the screen and on the right you will find the attainment level descriptions.

Now click on ‘Sc4’ - the same format as for Sc1 applies.

These two links will provide all you need to gain an overview of:

Attainment Target 1 (Sc1) – essentially a generic approach to practical science

Attainment Target 4 (Sc4) – Physical Processes (essentially ‘Physics’)

(Note that Sc2 and Sc 3 refer to ‘Biology’ and ‘Chemistry’ respectively and you should at least be aware of these).

It is suggested that you familiarise yourself with the overall structure of the NC for Science and specifically Sc4. Please don’t try to learn the detail of this! However much

of it may be familiar from your own experience of school science. We will return to look at this in more detail in Theme 4 below.

See also Theme 4 below.

**Task:**

“Science should no longer be a compulsory subject for all pupils beyond the age of 11”  
Discuss in no more than 500 words your own views about this statement.

**Theme 2: Learning**

The readings for this theme will encourage you to consider what it means to learn science at secondary school level. As you do so, you will need to reflect back on your own experiences of learning science in secondary school, as well as considering what you observe during your practical experience in school. You may find that this theme links back to your experiences in the first training session for the Student Associates Scheme.

*Required Readings:*

Alsop, Steve, 2001. ‘Learning Science’. Chap 4 (pp 35-51). In Alsop, S. and Hicks, K: *Teaching Science*. Published by Kogan Page.

Atherton, J., 2005 (online). Angles on Learning

<http://www.learningandteaching.info/learning/>

This is a comprehensive and quite discursive site and there is a lot of information here. It is primarily written for the ‘post compulsory school’ phase of education but it covers a lot of relevant material on the various theories of learning.

Start with ‘What is Learning’ for an overview and then look at the work of Piaget and then Vygotsky in ‘Constructivism’ (follow hyperlinks).

Ross, K., Lakin, L., and Callaghan, P. (2004). *Teaching Secondary Science*. David Fulton. Chapters 6-10, pp 50-78.

**Task:**

Think of a particular occasion when you were a pupil at secondary school and when you had to learn some new science. Try to remember how it felt, what happened and what you did. Write an account of this learning experience in terms of one of the learning theories that you have read about in the readings for this theme. Your account should be no more than 500 words. It is important that you focus your account on your experience of a single occasion, or even a single incident.

**Theme 3: Planning to Teach**

How do teachers teach? Very often teachers select or design learning activities to match their learning objectives for the lesson. In this theme you will consider how the learning activities are related to the learning objectives of some lessons that you have observed. A particular issue that will form a focus in this theme is how teachers plan to meet the diverse needs of individual learners in a class.

*Required Readings:*

Alsop, Steve, 2001. 'Planning for Science Teaching'. Chap 6 (pp 69 - 84). In Alsop, S. and Hicks, K: *Teaching Science*. Published by Kogan Page.

Scott Baumann, Alison; Bloomfield, Alan; Roughton, Linda, (1997). *Becoming a Secondary School Teacher*. Hodder and Stoughton. Chaps 17 and 18, pp 155 – 172.

**Task:**

Observe a small group of pupils at work in a physics lesson. If possible, have the teacher's lesson plan in front of you as you observe. Identify the learning activities in the lesson and note how the pupils initially respond to each activity as it is introduced, and later how the pupils engage with the activity: did they experience any difficulties and, if so, why? After the lesson, ask to discuss the lesson briefly with the teacher and identify the teacher's learning objectives for the lesson. Write an account of the lesson in no more than 500 words, discussing the feasibility of planning to provide for the full range of different individuals within the class.

**Theme 4: Physical Science**

During this theme you will consider briefly how physics ideas are developed in learners from primary school, through secondary school, and into higher education and into the workplace. This will involve tracking topics through the science National Curriculum, and through GCSE and A level syllabuses for physics (and/or Sc4 within 'science' syllabi). You will consider where your topics are used and applied in workplace contexts, and where they are developed in undergraduate physics. It is likely that you will need to read more widely than the required readings as you think about the task for this theme.

*Required Readings:*

DfEE/QCA, 2000, *Science: the National Curriculum for England*, HMSO.

([www.nc.uk.net](http://www.nc.uk.net))

*Note that this will be an opportunity to develop greater depth than the introduction in Theme 1 above.*

GCSE and A-level syllabuses for science (and separate subject physics) - available from the exam board websites: [www.aqa.org.uk](http://www.aqa.org.uk), [www.edexcel.org.uk](http://www.edexcel.org.uk), [www.ocr.org.uk](http://www.ocr.org.uk)

Selected school physics textbooks.

The handbook for your undergraduate degree.

**Task:**

Consider a topic that you have observed being taught within secondary school. You will identify some of the physical precursors to the ideas that you saw being taught in the lesson that you observed and track these ideas through the higher levels of secondary school and, if possible, into undergraduate study of physics. Write a brief account in no more than 500 words of the progression of your topic from primary school, through secondary school and beyond.

**Theme 5: Assessment**

Teachers make judgements about pupils, what they know and understand about science in many different ways. In this theme, you will consider some of the strategies, both

formal and informal, that teachers use to monitor and assess pupils' understanding, and how the information generated can contribute to the teacher's future planning.

*Required Readings:*

Ross, K., Lakin, L., and Callaghan, P. (2004). *Teaching Secondary Science*. David Fulton. Chapters 17-19, pp 127-142.

Black, P. and Harrison C., 2006, *Science Inside the Black Box*. London: Kings College

**Task:**

Observe a physics lesson, noting all the ways in which the teacher was monitoring and assessing the pupils. Discuss with your mentor how the science department involves pupils in their assessment, if at all. Look at a sample of marked work, whether in exercise books or on worksheets or on paper. Discuss with your mentor how they seek to make their marking effective. Write a brief account of no more than 500 words of what you learn about how physics (science) is assessed and monitored in your school, relating it to the ideas and terminology used in the reading above.

**Module Assessment**

Your written tasks should be submitted for assessment in two parts.

The first part will be a portfolio of the five 500-word pieces of writing responding to each of the five themes discussed in the module. This portfolio should be submitted to the physics general office by 12 noon on **Friday 25<sup>th</sup> April 2008**.

**NB:** If you wish me to comment on any of your short 500 word pieces before you submit them, you will need to get them to me by **Friday 21<sup>st</sup> March 2008**. Any drafts received after that date will not be read until they are submitted for assessment. Note that I do not have a base on campus but can be contacted by phone or email as detailed on the front cover.

The second part will be an essay of 1500 words drawing and reflecting upon your experiences in a secondary school teaching science over a two week period. For most of you this experience will be observing experienced teachers or working alongside experienced teachers. This will give you plenty of opportunity to observe how teachers plan for their teaching, the varieties of teaching approaches they use, and how they assess pupils' learning and evaluate their own teaching. You will also have opportunities to work with groups of pupils and to observe pupils learning. In your final essay you should write a reflective account of some of your experiences, and seek to relate these to at least two of the Themes addressed in the module. You may wish to include examples of lesson plans, lesson observations, or other material from your school placement in appendices at the end of your essay. If you do so, these will not count towards the word limit, but you should expect that your essay may be read without reference to any appendices. This essay must be submitted to the physics general office by **12 noon on Thursday 15<sup>th</sup> May 2008**.

## Reading and Referencing

All of your essays should include academic references to relevant literature relating to physics and education in general, and more specifically to science education. You will receive a general handout offering guidance about how to reference using the Harvard System.

**You are expected to read all of the required readings, and to refer to them as appropriate, but your reading for this module should go beyond the required readings, and this should be reflected in your assignments.**

## Bibliography

Alsop, S. and Hicks, K., 2001 Teaching Science – a handbook for primary and secondary teachers. Kogan Page.

Black, P. and William, D., 1998, Inside the Black Box: Raising Achievement through Classroom Assessment. London: Kings College

Davies, S., 2006, The Essential Guide to Teaching. (Chap 13 for Assessment for Learning). Pearson Education.

DfEE/QCA, 2000, Science: the National Curriculum for England, HMSO

Farmery, C., 2005, Getting the Buggers into Science. Continuum.

Ross, K., Lakin, L., and Callaghan, P. (2004). Teaching Secondary Science. David Fulton.

McGregor, D., Developing Thinking, Developing Learning. McGraw Hill

Sang, D., 2006, Teaching Secondary Physics. ASE / John Murray

Wood-Robinson, V., 2006, ASE Guide to Secondary Science. Association for Science Education, Hatfield.

## Useful web references

### The Key Stage 3 Strategy for Science

<http://www.standards.dfes.gov.uk/secondary/keystage3/subjects/science/>

This section contains a guide to the Key Stage 3 Strategy for science, case studies and a calendar of key activities for science departments.

Publications and resources are available to order or download.

The complete text of the *Framework for teaching science in Years 7, 8 and 9* is also available to read or download.

### The National Curriculum in Action

<http://www.ncaction.org.uk/subjects/science/>

This website uses pupils' work and case study materials to show what the National Curriculum in science looks like in practice.

The examples given show:

- the standard of pupils' work at different ages and key stages
- how the programmes of study translate into real activities
- effective use of ICT across the curriculum

These examples come from different pupils, contexts and schools.

### **The Qualifications and Curriculum Authority (QCA)**

<http://www.qca.org.uk/>

'QCA is a non-departmental public body, sponsored by the Department for Education and Skills (DfES). It is governed by a board, whose members are appointed by the Secretary of State for Education and Skills, and managed on a day-to-day basis by an executive team.

QCA maintains and develops the national curriculum and associated assessments, tests and examinations; and accredits and monitors qualifications in colleges and at work.

### **Examination system**

QCA regulates the public examination system, so that it is responsive to the needs of learners and society and is responsible for the development, delivery and administration of high-quality national tests.

We develop the national curriculum, which defines the knowledge, understanding and skills to which children and young people are entitled. We keep it under review, to evaluate its appropriateness and relevance to the changing needs of learners and society.

### **National qualifications framework**

Our national qualifications framework enables us to accredit qualifications at appropriate levels to meet the needs of employers and learners. We fund occupational standards, support learning at work and regularly review the suitability and availability of qualifications, to ensure that the needs of learners, employers and the economy are met.'

### **The Department for Children, Families and Schools (formerly The Department for Education and Skills (DfES))**

<http://www.dfes.gov.uk/> (yes it still uses the DfES URL!)

Has various science links however...

**The Race to the Top (A review of Government's Science and Innovation Policies** is best accessed at:

[http://www.hm-treasury.gov.uk/media/%/E/sainsbury\\_review051007.pdf](http://www.hm-treasury.gov.uk/media/%/E/sainsbury_review051007.pdf)

This is a review by Lord Sainsbury (The Sainsbury Review) and should be of general interest. It's worth reading the introduction and Chapter 7 'Educating a new generation of young scientists and engineers' pp 95-116.

### **Every Child Matters**

<http://www.everychildmatters.gov.uk/>

This is the over-arching social agenda which links all agencies and organisations responsible for children. For the time being the hyperlink to 'education, training and employment' is the most relevant and sets the context for schools and education providers.

### **The Teacher Training Agency**

<http://www.tta.gov.uk/>

The purpose of the Teacher Training Agency (TTA) is to raise standards by attracting able and committed people to teaching and by improving the quality of training for teachers and the wider school workforce.

<http://www.tta.gov.uk/upload/resources/pdf/t/teaching-physics.pdf> which refers directly to teaching physics is essential reading.

### **Association for Science Education.**

An international organization which specifically focuses on all aspects of science teaching. Books, policy and practice advice, resources, meetings and conferences.

<http://www.ase.org.uk>

### **Astro Projects**

An astronomy resource aimed at high ability students, but with something for everyone interested in astronomy.

<http://www.astroprojects.net/>

### **The Institute of Physics**

An excellent starting point for a range of educational resources.

<http://www.iop.org/activity/education/index.html>

### **Science Enhancement Programme (SEP).**

A site and programme funded by Gatsby. Some excellent resources – including super magnets, radiation and communication, energy storage. Log on and sign in to become an associate for free.

<http://www.sep.org.uk/>

### **The Science Learning Centres**

A network of one national and 8 regional centres providing support, training and resources for teachers.

<http://www.sciencelearningcentres.org.uk/>