

*This is your opportunity to let us know what you think needs to be done to make science teaching and learning more engaging for your pupils. If you wish to contribute to the debate and respond to the issues raised in the paper or to add your own issues, **please send your comments to info@ase.org.uk as soon as possible and no later than 15 March 2006 so they can be considered as part of the final report.***

**THE ASSOCIATION FOR SCIENCE EDUCATION
NATIONAL NETWORK OF SCIENCE LEARNING CENTRES**

ENGAGING TEACHERS... ENGAGING PUPILS...ENGAGING SCIENCE
Teachers' views on teaching science in ways which will get pupils
excited about the subject.

DISCUSSION PAPER

Introduction

If you were to walk into a science lesson in any school you may sense a buzz of excitement, observe pupils engaged in their work with enthusiastic, effective and engaged teachers delivering an engaging science curriculum. Alternatively you may experience the opposite - disaffected pupils, tired and dispirited teachers and an utterly tedious science curriculum – or something between these two extremes. You may well ask, "Why this disparity?" and "What can be done to ensure that all pupils (and teachers) are engaged in vibrant and engaging science lessons?"

In his Presidential Address to the ASE in January 2005, Sir Mike Tomlinson emphasised the importance of the role of teachers in developing the curriculum they teach and in making science exciting for their pupils. This idea was echoed by The Nuffield Review of 14-19 Education and Training in its second annual report when it argued that,

The curriculum should be seen as a creative act within schools, not something handed on. Hence the teacher should be a curriculum developer, not a transmitter, translating the national framework into planning in classrooms and at school. This creative aspect of teaching is undermined by the relentless pursuit of targets. (Executive Summary p2).

Despite the pressures, the majority of science teachers want to interest their students in science and there still exists the enthusiasm and determination to improve the situation. The recent revision of the KS4 programme of study and the review of KS3 curriculum in England provide opportunities for revitalising curriculum development at the level of the school and laboratory. Developments elsewhere in the UK offer similar opportunities, as do calls for more creativity in primary schools. These opportunities, however, may be lost if teachers in both primary and secondary schools are unable to take advantage of such changes due to the barriers, perceived or actual, that currently exist.

Aims

This discussion paper, which arises out of a 24 hour seminar held on 17-18 November 2005 at the National Science Learning Centre in York, aims to take the initial debate forward and provide the basis for further discussions throughout the country in order to determine the views of teachers as to how they, as teachers, can work to improve pupils' engagement with science and, crucially, what needs to be done to support them (nationally and locally) in their efforts.

Concerns and barriers

Despite the wide variety of ways of expressing the complex mix of factors that are involved in teaching science there is a fundamental commonality, regardless of phase – primary, secondary or tertiary - in the concerns expressed. In addition to the particular issues listed below it is clear that, for whatever reason, there are some very strong perceptions that are held by teachers regarding what is statutory and what is advisory. Three particular ‘myths’ are referred to frequently. The first is the belief that the QCA schemes of work at KS1, KS2 and KS3 are compulsory. The second is the misconception that many experiments are ‘banned’. The third is the ‘requirement’ for a ‘three-part lesson’.

The main concerns and barriers seem to cluster around seven issues: lack of time, narrowness of teaching repertoire, assessment regime, subject knowledge, lack of confidence and ownership, professional development and school management. Each of the items in itself can be a major inhibitor to effective teaching and the impact of each one varies from situation to situation. However, as the quotes reported below clearly illustrate, these issues are seen to be significant concerns and barriers for teachers.

a. Lack of time

“I never get time to think about my teaching.”

“Our medium term plans are so restrictive that there just isn’t time to experiment with new ideas “

b. Narrowness of teaching repertoire

“We have to follow the QCA scheme of work in my school. It is really frustrating as I don’t think it is the best thing for some of my pupils, but the timing is so rigid that I can’t change it.”

“If you look at the technician order sheets in my department you’ll find some of my colleagues are doing hardly any practicals. Surely science is essentially a practical subject.”

c. Assessment regime

“After Christmas we do 3 or 4 mock SATs papers. No one seems to have the guts to just carry on teaching good interesting science.”

“Year 10 and 11 just seem to be on a treadmill of one module exam after another. That wouldn’t have inspired me to take science (and it certainly doesn’t inspire them)”

d. Subject Knowledge

“I feel less confident in my science knowledge than with history or geography for example. My science co-ordinator does her best to help but she isn’t very confident either.”

“I’m all for science teachers teaching science (and not just their specialist area) but one or two colleagues are expected to do this when they obviously don’t have the necessary background knowledge. I feel that they are really switching some pupils off.”

e. Lack of confidence and ownership

“There is so much pressure to get results that I just daren’t take risks.”

“Everyone is so paranoid about results that they seem afraid to innovate in case things go wrong.”

f. Professional development (CPD)

“It is always the same people who seem to go out on courses- those who are “in” with senior management”

"Most of our CPD budget was used up on whole school CPD i.e. getting in visiting speakers"

g. School management

"Senior management always seem to focus on "whole school" issues. These don't always match the needs of the science department."

"I don't think my head understands the needs of science at all, especially the practical nature of the subject."

Aspirations

Teachers have aspirations in relation to their teaching and what they feel they need in order to improve their own teaching, support their colleagues and enhance the learning of their students. Aspirations broadly fall into four areas – pedagogy and resources, assessment, leadership, continuing professional development (CPD) – all of which need to be addressed if progress is to be made in removing the barriers and allaying concerns. Again the quotes illustrate the issues clearly.

1. Pedagogy and resources

I would like...

my job to be creative and have time to try out new ideas.

to be involved in developing teaching strategies.

to reflect on my teaching so that I can make improvements myself.

time to get used to new initiatives and to get them working in my classroom (before being presented with the next).

the resources I need to make my lessons exciting (i.e. a working fume cupboard, enough beakers etc...).

our medium term planning to be more flexible so that I had space to experiment with new ideas.

2. Assessment

I would like...

assessment to motivate my pupils and reward their success.

assessment to encourage learning (and not be a full stop at the end of learning).

to be able to continue teaching engaging science in year 6, rather than feel pressured to do endless SATs preparation.

3. Leadership

I would like...

to be empowered to do a good job.

senior management to support my own professional development as well as the school's.

4. CPD

I would like...

to have the right to a certain amount of CPD, without needing to ask for it all the time.

CPD to support innovation and not just to encourage the following of a recommended method.

science specific CPD.

Table 1, attached as an appendix, indicates some of the ways in which, based on the discussions at the York seminar, the concerns and barriers impact on the four areas outlined above.

Furthermore it is widely accepted that the quality of teaching and learning is at the heart of any improvement that might be achieved by a school and this in turn is dependent on what constitutes teachers' professional knowledge. This, however, is not always reflected in the way in which priorities are addressed in schools and nationally. One of the difficulties is the lack of a 'common language' for discussing the issues and results in unnecessary tension and conflict which results from misunderstandings rather than fundamental differences in opinion.

Key questions to be addressed

This paper has attempted to provide an overview of the concerns, barriers and aspirations of teachers who are striving to present science to their students in a way which is engaging and meaningful. Three key questions arise, to which responses are invited.

1. Does the overview presented in this paper reflect the current situation?

- a. Are there any major concerns or barriers that have been omitted?
- b. Are the aspirations widely shared and are there others?

2. What needs to be done in order to meet the aspirations for engaging students of all ages more effectively?

This question should be considered at three levels:

- a. What can / could be done by individual teachers (even if nothing else changed)?
- b. What could be done in schools?
- c. What needs to be done nationally by, for example, DfES, other government departments, QCA, Ofsted, Specialist Schools and Academies Trust, Science professional bodies and learned societies (including Royal Society, Institute of Physics, Royal Society of Chemistry, Institute of Biology,) Science Council?
- d. In addition, what should ASE and the Network of Science Learning Centres be doing?

3. What are the key messages that need to be understood in order to initiate action?

This is also a multi-level question which might be characterised by asking what needs to be said to:

- a. individual colleagues
- b. the subject leader in a school
- c. the senior management team
- d. the Secretary of State for Education.

APPENDIX: Table 1: IMPACT OF CONCERNS/BARRIERS ON ASPIRATIONS: the notes in the boxes aim to indicate ways in which the aspirations are NOT being met. (The contents of this table are based on the discussions which took place during the 24-hour seminar held at the National Science Learning Centre, University of York on 17-18 November 2005.)

Concern / Barrier	Aspirations			
	Pedagogy and resources: wish to be more creative	Assessment: should support learning better	Leadership: needs to empower more	CPD: appropriate to include subject focussed
Lack of time	Too much to do in the time available	Takes time away from teaching	Focus on results increase pressure to teach to the test	Not enough time for reflection or subject focussed work
Narrowness of teaching repertoire	Pressures to use specific schemes of work	Focus on tests	As above	Little opportunity to find out about and try new ideas
Assessment regime	Results driven pressures restricts activities	Emphasis on summative diminishes impact of formative	Demands of league tables and targets increase central control.	Geared to examination requirements
Subject knowledge	Lack of confidence in subject knowledge restricts range of activities.	Need to get 'right' terms – factual recall rather than understanding	Not always aware of needs at subject level.	Need for sustained study.
Lack of confidence / ownership	Risk averse – play safe in approach and activities	Focus on tests not subject understanding and enjoyment	Sense of needing permission to try something different	Feeling time cannot be taken to leave students (or they might miss something)
Lack of Professional development	Continue with standard activities. Few new ideas.	Re-enforces test focus	Different priorities linked to school targets	Lack of reflection and development
School management	Lack of encouragement to try different things	Demands for further increases in grades and test scores	Pressures on SMT get pushed onto others	Tension between different priorities and availability of staff