Topic: Forces and Linear Motion

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Issues tackled:

1. **Key ideas, use of language and terminology - Understanding key terms and force diagrams.**
2. **Misconceptions- Misunderstandings about the effects of forces on motion.**
3. **ICT - Measuring speed using ICT.**

Issue 1: Key ideas, use of language and terminology - Understanding key terms and force diagrams

Trainees have already covered on their PGCE course:

Tasks for trainees:

Preparation for tutorial:

1. Select 10 key words from the KS3 Forces scheme of work. Produce a glossary for your own understanding and one to use with a class (they may not be the same).
2. Design or find a starter/plenary activity to introduce/reinforce a key word that you will be introducing next week. This needs to be a challenging idea to either the trainee or the pupils e.g. gravity.

Possible activities during tutorial:

1. Present the glossaries and discuss which words are likely to lead to confusion.
2. Discuss the starter/plenary activity that you have prepared and consider how it will fit into a lesson.

Mentor Input:

- Check and develop the trainee's own understanding of forces.
- Show how to put arrows on force diagrams – look at SATs questions, use of white board/OHP and colour, PowerPoint. (Key idea is that force arrows can show magnitude and direction.)

Reading:

Subject knowledge and understanding

Read textbooks in school, both Key Stages 3 and 4, look for section on Forces and linear motion.

Subject pedagogy

Useful websites and applications

This web page gives step by step instructions for drawing force diagrams. http://physics.wku.edu/phys201/, follow links to 'problem-solving'; 'force diagrams'.

This is a general web site about how stuff works http://science.howstuffworks.com

This web site has interesting articles and activities which may be relevant, http://www.scienceyear.com Planet science.

Resources:

Task 1
QCA Scheme of work.
www.standards.dfee.gov.uk/schemes3 and select Science Key Stage 3, then unit 7K Forces and their effects.
School scheme of work.

Issue 2: Misconceptions - Misunderstandings about the effects of forces on motion

Trainees have already covered on their PGCE course:

Tasks for trainees:

Preparation for tutorial:

1. Design/find/adapt an activity to discover pupil misconceptions about forces.
2. Plan a lesson to address a particular misconception eg. to 'keep an object moving a force must be kept on it'.
3. Analyse a sample of SATs responses to identify misconceptions on one or two forces questions.

Possible activities during tutorial:

1. Present activity to discover pupil misconceptions about forces.
2. Discuss prepared lesson plan.
3. Provide analysis of SATs questions.

Mentor Input:

- Illustrate examples of the 'full' range of misconceptions that pupils have about forces. See 'Useful websites. Useful websites and applications' below.
- Misconceptions are very hard to change! Suggest strategies to counter the common misconceptions. Include practical ideas, ICT simulations, analogies etc..
- Introduce checking progress activities – have you succeeded in countering the misconception? See ideas in readings 'Subject pedagogy' below.

Reading:

Subject knowledge and understanding

Traditional textbooks often cover this topic very thoroughly, e.g.
Abbott, A. F. (1977) **Ordinary Level Physics**, Heinemann, London.
Nelkon, M. (1975), **C.S.E. Physics**, Hart-Davis, St Albans.
Millar, R. (1989) **Understanding Physics,** Collins Education, London.
Avison, J. (1984) **The World of Physics,** Nelson Thornes, Cheltenham.

Subject pedagogy

Driver, R. et al. (1994**) Making Sense of Secondary Science**, Routledge, London.

Kibble, B. (2000) Forces in Sang, D. (Ed) **Teaching Secondary Physics**, John Murray, London.

Useful websites and applications

This web site covers lots of misconceptions about forces and provides ideas for tackling them with pupils.
http://www.physics.montana.edu/physed/misconceptions - click on forces.

Resources:

Task 1
See 'Useful websites and applications' above or DfES. (2002) Misconceptions in Key Stage 3 science; Resource pack for tutors. LEA consultants have this pack which contains a video on Drawing out pupils' thinking and misconceptions in science.

Task 2
QCA Scheme of work
www.standards.dfee.gov.uk/schemes3 and select Science Key Stage 3, then unit 7K Forces and their effects.

Task 3
Past SAT questions and their mark schemes.
QCA SATs reports 1999-2003 (includes misconceptions) at
www.qca.org.uk/ages3-14/tests_tasks/2670_6048.html

Issue 3: ICT – Measuring speed using ICT

Trainees have already covered on their PGCE course:

Tasks for trainees:

Preparation for tutorial:

1. Find out about the use of light gates to measure velocity.
    a. What hardware and software is available in the department?
    b. What resources to support the uses of light gates are available?
    c. How are the light gates used to teach about speed?
2. Plan a starter using ICT for one of the lessons in the current forces scheme of work.

Possible activities during tutorial:

1. Show the light gates in operation and demonstrate how they are used to measure speed.
2. Present the starter activity prepared.

Mentor Input:

- Demonstrate how to use datalogging equipment to measure speed – include setting up, communication with technician, health and safety, learning objectives and how the demo meets them, presentational ideas, what to do if it goes wrong.
- Discuss the merits/problems of using ICT to teach forces and when it is appropriate to use it.

Reading:

Subject knowledge and understanding

Subject pedagogy

QCA Scheme of work
www.standards.dfee.gov.uk/schemes3 and select Science Key Stage 3, then unit 9K, Speeding up.

Useful websites and applications

The IOP have produced a useful website at www.practicalphysics.org Follow the links to forces and motion, then look in the sections on speed and acceleration for ideas about using a motion sensor or light gates.

Resources:

Task 1 and **Mentor Input**
Light gates or motion sensor and data logging equipment, computer and software, simple trolley or similar for measuring speed.
Booklets and worksheets provided with the light gates and or datalogging equipment may give suggestions for setting up and activities or see the 'Useful websites and applications' section above.