This is the second main assignment given during the second term's teaching, on the GITEP (Gloucestershire Initial Teacher Education Partnership) PGCE secondary course based at the University of Gloucestershire School of Education, Cheltenham.

Active learning

This assignment **Active learning** allows you to evaluate your use of active learning techniques in your teaching of science.

Make use of Ross et al (2004) chapters 6-10, the ATLAS material (Sheffield Hallam, 1993), Driver (1994), Sutton (1992) and the KS3 strategy materials to help you consider the sequencing and overall purpose of each of the lessons.

Concentrate on the *Reformulation* phase of the lesson - the *Word-work* (Sutton,1992), you used to support, extend (or even replace) practical tasks.

The written report should be in 4 parts with appendices if appropriate:

Part 1.

A general overview of the purpose of and need for active learning tasks to facilitate understanding.

This will be your chance to survey the literature and resource material which give pupils the opportunity to make their own sense of the scientific ideas they meet at school and apply them to their everyday lives. You need to make your own understanding of the need for active learning (reformulation) clear. (500 words)

Parts 2 to 4

Using active learning in your class - a report and evaluation of your successes and failures. Support your account with actual lesson plans, subject mentor and your own lesson evaluations, **and with photocopies of children's written/drawn** (or transcripts of their verbal) responses to the lessons. You should aim to comment on several lessons (or lesson fragments), so that you can illustrate your use of Listening talking & doing, Reading and Writing to allow pupils to take *ownership* of the ideas you are presenting or exploring in your lessons. (500 words maximum each).

> **Part 2 Active listening and talking and doing** - evaluating the use of active learning techniques involving pupil talk/discussion/drama etc. in your teaching of science. Experiment with the *tell each other* technique.
> **Part 3 Active reading** - evaluating the use of active learning techniques involving DARTs in your teaching of science.

Part 4 Active writing - evaluating the use of active learning techniques involving creative writing in your teaching of science.

The majority of examples of these are likely to come from your twin placement in term two.

Appendices to contain relevant *lesson notes, photocopies of pupils' work, lesson evaluations by your class teacher, subject mentor or training manager, etc.*

Criteria for assessment

The assignment will be assessed on the standard Post Graduate criteria with emphasis on the following:

- quality and range of active learning exercises used/developed.
- understanding of reasons why the lesson is being taught, and why the specific techniques were chosen.
- examples of pupils' work, lesson plans and evaluations in appendix to which you refer in the account.
- evidence of reflective reading/listening/observation
- reference to science education books and journals, national curriculum documents, student texts/schemes, lecture notes, AV material etc. (use Harvard system)

Sutton CR	1992	Words, Science and Learning Buckingham: Open Univ. Press
Ross, K., Lakin, E. and Callaghan, P.	2000	Teaching Secondary Science London: David Fulton
Centre for Science Education, Sheffield Hallam,	1994	Active teaching and learning approaches in science,(ATLAS) London: Collins
Driver R., Squires A., Rushworth P. and Wood-Robinson V.	1994	Making Sense of Secondary Science London: Routledge

Star comments used for feedback to assessed PDP entries.

You may find these comments from previous years helpful as you are working on this assignment (these numbers, and others, will be used during marking of assignments to give you more detailed feedback - it is a technique you may like to adopt with your classes in school):

General Comments (used for all assignments)

***10** You should be using the Harvard system in full for referencing. No need for ref. numbers - Just 'Newton (1666 page 43)' in text, and the authors listed alphabetically at the end, with full publishing details.

***11** Take care with apostrophes in possessives, but note *his hers its* but *it's=it is.*

***12** Don't use pupils' original work - use photocopies and return originals.

***13** a phenomen**on**, but several phenomen**a** (from Greek) SepArate, prepAration.

***14** Make sure your appendix is paginated so items included in it are easy to refer to and find.

30's Children's ideas (These refer mainly to you first assignment in term one where you interviewed a small group of children to elicit their ideas

***30** Incorrect? Wrong? ... or are children's ideas useful, but limited? Our science ideas may be too contradictory to every-day experiences ever to be useful to many children and adults, even though we find their wider applicability essential to our scientific world-view. (see *33)

***31** Must we **over-ride or replace** children's ideas? Are they too well used in everyday life to discard (no animals allowed, there is energy in fuels)? Perhaps we need instead to make the pupils **aware** that there is conflict, and to show the limitations of both the scientific and the every-day versions?

***32** Those who question the "Taken-for-granted" make the biggest strides forward in our understanding of the world. See "Grains of truth" for some comments we tend to take for granted

***33** Scientific ideas, models, metaphors are useful but not absolutely true - so it is helpful to show, not only where they help our understanding of a phenomenon, but also when they break down, and become inappropriate. (see *30)

***34** It may not be necessary to make children's ideas explicit on every occasion - if teachers are aware of the range of ideas children might have, they can provide appropriate learning materials - see *31

***35** Paradigm shifts are not instantaneous - several refutations are needed coupled with a dissatisfaction with the existing paradigm. Several of you mentioned how tenacious children's existing ideas appear to be - but see *31

***36** I'm not very happy about the word 'fact', since it implies something absolute 'out there'. We all see things differently, and observation is always a combination of our preconceptions and the incoming sense data. Why not talk of *experiences* that have to be explained, rather than facts? ... see *33

***37** ... in the same way 'definitions' have no real meaning until you make links with other concepts - learning a definition tells you very little. By saying "**The** definition..." implies that there is one right one - who decides? I like Sutton's (1992) burr model of a concept, with its core of definition (the seed), and its links (burrs) to other concepts to develop its meaning, where it can link or hook onto other ideas.

***38** The **constructivist** approach must not be confused with **discovery** learning - evidence shows that pupils discover little by doing experiments, unless they have a clear idea of why the experiment has been set up, and what sort of outcomes are possible - in this way experiments are used to test out ideas. If pupils only hold their naïve ideas, then the experiences will only serve to confirm their beliefs. New ideas usually need to be suggested by the teacher, and these can then be tested against the old, possible in the laboratory, but certainly by a consideration of 'real-life' experiences.

***39** As a research exercise the elicitation stops here, but as a teacher you need to respond to what you heard/read, just as you would in a lesson. The advantage of dividing the elicitation from the teaching, is that you might persuade pupils that you **really** are interested in **their** ideas, and that they might actually tell you - whereas in a lesson they are more likely to tell you what they think you want to hear.

40 Active learning General

Be careful not to equate active learning with pupil centred learning (see *38)

***40** Active learning doesn't **have** to give autonomy over organisation of the learning - many active learning tasks are very directional. The main point is that they are impossible to do unless the children **think**.

***41** Constructivist ideas need to be mentioned - pupils come with existing ideas (assignment 1) and need actively to re-construct meaning (this assignment) in order to see the conflict between existing and scientific ideas. Make elicitation brief but significant, and use the lesson time for intervention and reformulation activities - see *38 & *43.

***42** Asking the pupils to question what is **taken for granted** is one of the most challenging activities, and leads very often to some very constructive learning (see *32)

***43 Reformulation** Be careful not to equate active learning with pupil centred learning - we cannot expect pupils to re-invent the whole of science, so their task is more to take over some of the stories/ideas that scientists have used to explain the world. This may involve pupils having to modify their own ideas (*41), or thinking about things they have just never bothered to question (*42), or it may be ideas about phenomena they have never experienced before. In all cases they need **time to reformulate and thus take ownership of ideas** (see *44)

***44 Teacher must teach** The teacher must provide alternative ideas for the pupil to latch onto before any restructuring can occur, unless they have already been suggested by a child - even then they need to be clearly presented. One of the mis-interpretations of the idea of 'constructivist' learning is that people think that children will be able to construct meaning by themselves. Sutton (1992 and later) talks of 'stories' of how scientists believe things are which children hear. Children then construct these stories into their mental map.

***45** The last, but perhaps most important of all of the principles of Bruner's learning strategy is that ideas must be **used**. It is all very well visiting topics only once in a four year GCSE course, but unless the ideas are constantly in use - what is their value? Most of the conceptual work done in school should be concerned with refinement - a to-ing and fro-ing between the big ideas, and the everyday details. Perhaps we can deliver the curriculum but ideas need to be (re-)constructed.

***46** "The **'eureka'** feeling when understanding suddenly bursts through the mental fog and a difficult concept is mastered." Gestalt psychologists call this a **gestalt**. Sutton (1992) calls it the **"Aha!" effect**. Perhaps it is similar to Kuhn's scientific **revolutions** of thought. But it is the hallmark of someone who is actively taking over meaning. It is the excitement of learning, and the reward.

***47** It is only when you have to teach that you really realise if you understand or not - making pupils teach each other (or them self) is at the heart of active learning.

***49** Another good sign of active learning is argument and discussion by pupils - trying to make sense of ideas.

***48** Correct or useful? Are children's ideas completely wrong, or scientists' completely right? See comments about children's ideas (*30 – 39 above).

50 Active learning Do/role play

***50** Practical work does not necessarily result in active learning. If the experiment is to be more than recipe following, pupils must know what to look out for, be involved in the planning, have a sense of purpose..... The active learning comes before and after the doing, because the actual mechanics of carrying out the practical absorb most of the pupil's attention. See 40, 41 & 43.

***51** Getting pupils to **predict** the outcome of a recipe practical (especially when there is disagreement between pupils) helps to make the practical work meaningful.

***52** Getting groups of pupils to report verbally back to the rest of the class from a range of (practical) activities - 'teaching' their experiment or findings to the rest (see *46) - is an excellent idea.

***53** Techniques that make practical work active may appear to take more time - but if pupils know why they are doing something they are likely to be more enthusiastic and carry it out more efficiently - but note * 66

***54** Only a few of you mentioned the use of ICT to promote active learning

***55** Only one of you, I think, mentioned the use of trips out to promote active learning

***56** A number of you used simulation games

60 Active learning Listen Talk [see also * 52]

***60** The value of the **'tell each other'** technique is that it allows (nearly all) pupils to rehearse their ideas **verbally** before answering in front of the whole class (or writing it in their books) - it really only works if you restrict the time to **10 seconds**. If you give more time it is better to call it group discussion, and they will be given a more structured task. (See *66)

***61** This is a good use of **group brain storming** to collect the ideas of the class - but shy pupils may not contribute, and only 1/4 of class will contribute - why not use the first 10 seconds allowing them to tell-each-other (*60)?

***62** **Listening** can be active learning - children in rapt attention, making sense of what you say. However they still need time later to reorganise and store the ideas.

***63** I would put **talking** as the **first** activity - only after you have talked things through are you ready to begin to draft your written response - see*60.

***64** **Showing a video:** stop the video at intervals - ask the pupils to answer questions (either on the work-sheet you have given out, or from your oral reading of the questions on the sheet) using the "tell each other" technique, enables pupils (a) to sort out their ideas in an easier language mode first, and (b) takes less time so when the video re-starts (promptly) they are all able to listen and watch. You can then get them to pick up their pens and complete the worksheet in silence at the end of the video.

***65** This form of story telling converts an informative text into a narrative, making it very easy to follow

***66** The key to successful discussion (or any activity) is the **tight control of time** - set a series of short do-able tasks.

70 Active learning read

***70** DARTs, especially the sorting/cut-and-paste activities do provide a wonderful opportunity for pupils, who find reading hard and writing harder, to make a clean written record of their work, but a record that they have internalised. The essence is that writing is minimised, so those of you who ask the pupils to copy the completed text into their books are losing out on this advantage - could the copying time be used more profitably?

***71** CLOZE passages (*72) are one example of DARTs.

***72** Leaving the **working** words *(into, have, make, for)* out of a Cloze text can be very effective - it tests children's understanding of how the concepts are linked, rather than the meaning of words

***73** Scrambled text - is it best to use lines ... or sentences ??

***74** What about a classroom library which keener pupils or early finishers can refer to, perhaps with specific questions for research?

80 Active learning Write

***80** How essential is it that everything they do gets written down? Discuss.

***81** Creative writing is very helpful at eliciting pupils' misconceptions, but you have to make time for marking - so don't use it too often! Word processing allows drafts to be worked on.

***82** A few of you mentioned the use of WP to make reports (see *54)

***83** Word burrs show there is a connection between two words, but does not explain the relationship - concept mapping is needed for that. The real power of concept mapping is to label the linking lines (directional arrows) with verbs. It really makes you think about how the two ideas are connected.

***84** Death by 1000 work-sheets. Don't over-use them!

***85** Writing poems is tough - why not allow a range of media: story of the film, cartoon strip, scientific report?

***86** If you have to contain the class by rather mundane 'work' in lessons, use homework for creative writing which requires time for the pupil to work alone.

***87** Meta-cognition (becoming aware of your own learning) is almost an integral part of a constructivist approach to learning.

90 Conceptual issues (these two are worth sharing before you do your asasignment - more will follow)

***90** It is the big idea not the details that need to be emphasised **-** e.g.: The purpose of **digestion** is to get **food into the blood** so it can be used (a) as a fuel, by combining with oxygen in respiration and (b) as a raw material for growth. Most books and videos concentrate on the food canal and don't stress that the only function of digestion is to get food into the body (i.e. blood). Faeces are purely a side issue, and need to be downgraded in importance.

***91** Imaginative writing or role-play "being a particle in a melting solid or heated liquid" often produces the confusion between bulk descriptions (we are melting, we are getting hotter) and particle descriptions (we break free from one another, we vibrate faster) - the distinction must be made much clearer.

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