FROM TECHNOLOGY TO PROFESSIONAL DEVELOPMENT

HOW CAN THE USE OF AN INTERACTIVE WHITEBOARD IN INITIAL TEACHER EDUCATION CHANGE THE NATURE OF TEACHING AND LEARNING IN SECONDARY MATHEMATICS AND MODERN LANGUAGES?

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Key findings and recommendations

Context
At the start of the research period interactive whiteboards (IAWs) were more likely to be available in mathematics than in modern languages, though availability did not necessarily mean in a subject-based teaching room. Many institutions also reported the acquisition of a first IAW during the period of the research.

In the survey it was rare for any institution to offer more than 5 hours explicit training in how to use an IAW in the subject, but of those with IAWs all spent some time offering such training. There was a variety of practice ranging from highly IAW literate tutors using an IAW all the time providing IAW specific tuition, to tutors who sought the help of others to provide some limited input.

It is significant that a minority of trainees with limited institution experience of IAW use compensated for this by securing additional training whilst on school placement, or used their previous ICT experience to advantage.

Background
This investigation is related in particular to the following TTA priority areas:

- pedagogy relevant to training teachers
- the effective use of ICT in teaching and learning in mathematics and modern languages

Research evidence suggests that IAWs can have positive effects on teaching and learning (Becta, 2003). However, teachers take time to learn to use the IAW effectively (Miller et al., 2004) so we have assumed that the same will also be true of trainers and trainees.

Difficulties encountered by teachers who are new to the technology usually include lack of competence in basic skills, the sourcing and selection of appropriate materials and a failure to appreciate the full potential of the IAW as a force for change in approaches to teaching and learning. In addition, without appropriate training, support and advice IAWs can be used in a way that replicates the use of more traditional presentational media (whiteboard, OHP, computer with data projector) thereby failing to exploit the power of interactivity. As a result many trainers are also likely to need support and advice in order that they might also learn how to become effective IAW users and trainers. It should not be assumed that an effective teacher trainer/educator will immediately become an effective IAW trainer/educator.

Our evidence is that IAWs are being used increasingly in schools and that soon the same will apply in initial teacher training. However, whether IAWs are in use in school or on PGCE courses there is no guarantee that teachers and mentors or tutors using them are any more advanced in their understanding of the potential of the IAW than their trainees.

Our investigation of all PGCE trainees on one course well supplied with IAWs suggests that 27% had no access either to subject-based training or IAW use in schools. Just over 30% of 124 mathematics trainees on six PGCE courses in England and 58% of 47 modern languages trainees on four PGCE courses had no experience of IAW use. While only a small sample we do not believe that national figures would be any better.

The broad aim of this research was to help address this situation by studying how experienced practitioners use IAWs themselves and train their trainees how to use them in the classroom in order that we might inform the wider ITT community. The focus of the research was mathematics and modern languages but we believe that the findings are likely to have wider significance.

This work has also been informed by a Nuffield Foundation research project entitled “Enhancing mathematics teaching through new technology: the use of the IAW” (April 2002-04) and a BECTA funded bursary (September 2003-March 2004) entitled From technology to professional development: how can the use of an IAW enhance the nature of teaching and learning in secondary mathematics and modern languages? This work had also resulted in an extensive literature review, to be published in 2005, and a typology that posited three stages of development for teachers using IAW technology (Miller et al., 2004):

- **supported didactic**: the teacher makes some use of the IAW but only as a visual support to the lesson and not as an integral tool to conceptual development; there is little interactivity, pupil involvement or discussion

- **interactive**: the teacher makes some use of the potential of the IAW to stimulate pupils’ responses from time to time in the lesson and to demonstrate some concepts; elements of lessons challenge pupils to think by using a variety of verbal, visual and aesthetic stimuli
**enhanced interactive**: this approach is a progression from the previous stage marked by a change of thinking on the part of the teacher who seeks to use the technology as an integral part of most teaching in most lessons and who looks to integrate concept and cognitive development in a way that exploits the interactive capacity of the technology; teachers are aware of the techniques that are available, are fluent in their use and structure the lesson so that there is considerable opportunity for pupils to respond to IAW stimuli either as individuals, pairs or groups, with enhanced active learning; the IAW is used as a means of prompting discussion, explaining processes, developing hypotheses or structures and then testing these by varied application; a wide variety of material is used - 'home-grown', Internet, IAW specific and commercial software.

**Research methodology**
It was our intention to look for commonalities in approaches that appeared to be effective in offering trainees training and experience in IAW use within mathematics and modern language teaching. We set out to identify common and subject specific elements and their relationship to the cognitive demands in these subjects.

To do this we approached PGCE courses. However many courses at the start of our work had little structured work involving the IAW. We did find five mathematics departments and two modern foreign language PGCE course where trainees had some IAW training and these agreed to be part of the research.

We considered how far PGCE courses might go in order to move their trainees as far as possible in order to help them reach the enhanced interactive stage during their PGCE experience. We have assumed that to do this involves a mixture of

- explicit teaching of IAW skills and techniques
- explicit education in the pedagogic aspects of how to use an IAW to enhance one’s teaching
- exposure to, at the very least, examples of best practice where they might see the IAW used in an enhanced interactive way with both themselves (i.e. by the teacher trainers) and in teaching practice schools by mentors and teachers with pupils.

The investigation aimed to ascertain the extent to which trainees benefit if there is a complete immersion in a training environment in which the IAW is always available. We hypothesised and were made aware that progress is improved by the setting of high expectations in terms of IAW skills and pedagogic application. In the two departments teaching mathematics and the one teaching modern languages the availability of the IAW as normal classroom equipment clearly heightened the expectations of trainees selecting their first teaching posts. Eighteen of the 22 mathematicians, and five of the seven linguists, requiring IAW access in their first posts came from these departments – the remaining five from partnership schools with developed IAW pedagogies.

The resultant data included:

- 12 interviews with trainers in schools
- 8 interviews with trainers from PGCE courses
- 66 video-recorded lessons offering a range of practice from teachers (49), trainers (11) and trainees (6)
- questionnaire evidence from trainees (to date) from 124 mathematicians and 47 linguists
- documentary evidence of provision from participant PGCE courses, and
- a comprehensive literature review.

It was hoped that the outcomes of this analysis would contribute to a view of best practice in trainee training that would also be of relevance to teachers already in post.

It should be noted that some of this evidence has come from other projects and that more evidence is still being analysed.
Provision of training
1. Teacher trainers, just like class teachers using IAWs in schools (Miller et al., 2004), appear to go through three stages of development in technology use from the use of the equipment to support didactic teaching, to the achievement of competence in the use of IAW techniques and then to pedagogic change based upon the understanding of interactivity.
2. The effectiveness of teacher training in IAW use within institutions is enhanced or otherwise according to the opportunities, support and understanding of the mentoring staff in schools during placement.
3. There is evidence that despite changing attitudes from senior leadership teams in schools, there is great variation in the provision of equipment and training for all staff within the schools used by PGCE partnerships. As a result some trainees in mathematics, and most in modern languages, will have seen the technology at work but have had only limited experience of ‘hands on’ use.
4. The variety of different IAWs available in schools creates difficulties for institutions who may have expertise in the use of only one make of IAW, so that although pedagogy might be considered the lack of explicit training in the use of specific IAW software can create tensions and frustrations for trainees, trainers and mentors.
5. Currently, specific software is not available to support teacher trainers in their craft in same way that subject specific material is available in school-based subjects (e.g. Geometer's SketchPad in mathematics). This reduces the range of entry opportunities and requires teacher trainers to be creative in using IAW tools if the IAW is to be used as something more than just a projection screen.
6. Software providers do not generally supply examples of any software, including examples of software developed for IAWs, to ITE establishments at minimal cost. As a consequence most ITE institutions lack such software.

Content and process in course provision
7. Effective training requires more than simply demonstrating techniques for IAW use and is dependent upon supported experiential learning of both techniques and pedagogy with experienced practitioners.
8. Initial training in computer connection, class arrangement and IAW calibration together with the potential for Internet and video links appears to be a fundamental starting point for all trainees, though some aspects will vary according to subject.
9. Brightness of presentation based upon the use of ‘colour, shading and highlighting’, together with the use of ‘drag and drop’ and ‘hide and reveal’ appears to promote pupil motivation. This is only effective where technological competence is such that trainees are seen by pupils to be fluent users of the technology.
10. Sustained motivation is however, dependent upon the way in which the IAW is used to underpin interactive learning. This requires understanding of the learning process and the use of the variety of techniques opened up by the IAW according to the variety of preferred learning styles within a class. Effective training appears to identify the way that this can be promoted to ensure differentiation of material, challenge and liveliness of response at individual, group and class levels.
11. Subject specific learning utilises the potential of the IAW in different ways, e.g. by rotational movement in mathematics, and by the addition of sound for work in modern languages. Evidence suggests that effective trainers at whatever stage, structure their teaching upon conceptual understanding and use the IAW to illustrate this but then build upon pupils' understanding to provide a framework for cognitive development.

Pedagogic change within the classroom
12. There is evidence that issues of classroom management need further consideration so that trainees do not fall into the trap of using the IAW as just another form of illustration but consider all elements of group structure, classroom layout, exercise and textbook use, behaviour management and gender issues to maximise pupil involvement and learning.
13. To this end all trainees need to be aware of the potential of both commercial and self-developed software in their chosen subject area. Where there is plenty of material available, as in mathematics, trainees need an understanding of how to judge ‘high quality’, and where this is of limited availability as in modern languages, trainees need help in creating materials and understanding the rapid integration of other sources of material so that lessons are enlivened and learning is ‘real’.
14. Issues of differentiation, assessment, individualised learning, and lesson structure underpin much trainee comment on IAW use. However there is need for further investigation of the potential for teaching and learning enhancement with IAW use, and how this might be incorporated into training, since this technology will affect all trainees at some stage in the not too distant future.

Appropriate professional development for all teachers
15. Evidence from trainee evaluation and tutorial workshops indicates that training is most effective where it is programmed in such a way that:
a. Demonstration of the capability of the technology is used as an opportunity for full discussion of the advantages and disadvantages of IAW use as a prelude to and motivator for, further work. Videorecorded, or actual, lessons taught by capable practitioners are of considerable value at this stage.
b. This then increases trainee awareness of the potential of IAWs for their own teaching.
c. This is a further motivating feature and trainees appear anxious to pursue a programme of experiential learning based upon a succession of technological procedures, understanding and using a variety of basic presentational techniques, and then structured reflection on materials development related to learning objectives.
d. Effective trainers work with small groups or individuals, offer challenges to meet differential learning needs based upon individual ICT competence, and then serve the needs of the trainee as he or she progresses through each stage of acquiring pedagogic competence and confidence. This stage of training is essentially a coaching rather than a lecturing experience.

16. Teachers who have been offered support from ‘Missioner’ members of departments (Miller & Glover, 2001) are ready to develop and share materials, thus meeting the recurrent problem of time taken in developing a personal library of software or PowerPoint, Flipchart or Notebook materials (the last two of these are examples of IAW software specific to the IAWs most commonly in use in schools and institutions). There is evidence that they are also asking evaluative questions that go beyond the technology and classroom management issues to ask how the teaching of applications, ideas, and concepts can be enhanced through programmed interactivity. In doing this they change their approach to teaching and learning and demonstrate understanding of technology, software capability and cognitive development appropriate to the age, stage and preferred learning styles of pupils.

Recommendations
Although our report is based upon limited evidence this has been drawn from secondary PGCE trainees at all stages of incorporation of IAW technology. At the same time we have been made aware of the variety of in-school provision experienced by trainees. It would seem that there is a risk that the technology will either be ignored or inexpertly used by teachers at all levels unless the following are considered:

a. There is an extensive dissemination of the results of this work and follow up seminars.
b. All trainees undergoing training should be given an introductory experiential course of at least 5 hours in IAW use during their PGCE course. Consideration should be given to extending this to between 5 and 10 hours in length.
c. Such training needs to be designed with clear reference to guidelines pertaining to the development of technological competence, the creation and use of teaching materials and the integration of IAW technology into subject specific courses, perhaps as a specific ICT subject-based module.
d. Such training should be supported by technologically competent technical and tutorial staff without whom there may be problems. Whilst one-to-one coaching is expensive it is clearly the most effective training opportunity at all levels of teaching seen during our investigation.
e. Such training should include structured opportunities for peer-to-peer work where trainees share and reflect jointly on experiences, resources and associated ideas.
f. There is need for subject specific investigation of good practice using IAW technology. In addition there is a need to focus on generic awareness of the relationship between tools and techniques in order to ensure the incorporation of learning styles and cognitive development through interactive learning.
g. A planned installation strategy in institutions, focussing on one particular type and make of IAW, allows those using the IAW to share and discuss techniques and resources in a way that is not possible when a range of IAWs is available.
h. It may help to consider the IAWs in use in partnership schools and resource and plan accordingly.
i. Consideration should be given to help institutions purchase relevant, expensive software.

Dissemination
The outcomes of the project will be disseminated freely to all partners involved in the research by email and use of the Internet. They will also be made widely available by the same means to the TTA, other ITT institutions, the KS3 Strategy ITT Groups, professional associations and training school partnerships.

With additional funding items could be made available to include materials that have been used and considered to be suitable for wider distribution.

In order to increase the impact we recommend that seminars and training sessions could be arranged and organised by the TTA and others. It is our belief that by so doing it would allow the next generation of mathematics and modern languages teachers to move into the profession as confident users of the IAW. We believe that many of the findings in these two subject areas offer potential for improved staff training at all levels in other subjects.
The core materials for this dissemination work are attached as an appendix are as follows:

- guidelines for IAW use developed from the summary attached as outlined for Mathematics users in the appendix to this report - found on the website: http://www.keele.ac.uk/depts/ed/iaw/
- a limited number of examples of IAW subject based resources with a commentary

However, with additional support the following could also be made available:

- self-evaluation instruments to allow trainees, and school and PGCE staff to assess their personal progression towards enhanced interactivity in the use of IAWs as the focus of classroom teaching
- lesson observation structures for dissemination to interested professional development agencies thereby allowing schools to review the effectiveness of IAW use
- a video compilation of good practice in action both in training and in the classroom for a range of subjects
- a detailed list of useful sources and resources

References

Becta (2003) *What the research says about IAWs, Research Bursary Reports*, Coventry.


ENHANCING MATHEMATICS TEACHING THROUGH NEW TECHNOLOGY
THE USE OF THE INTERACTIVE WHITEBOARD
ADVICE FOR TEACHERS OF MATHEMATICS
http://www.keele.ac.uk/depts/ed/iaw/

In the beginning it helps if:
• you get some initial training on how to switch it on, load software and write on it
• you buy some ready-made IAW designed software – since it takes time to prepare all your own, and this should give you ready-made lessons as well as ideas of what can be done (see later for recommended software)
• you find out about training opportunities, especially about how to adapt your teaching to make your lessons interactive
• you talk to colleagues about sharing materials so that you don’t all develop the same things
• you are aware that the more you use the board, the easier things become
• you use it and tell pupils you will learn with them, making sure that you let pupils come to the board and write on it so that they learn to use it
• you don’t worry too much about making technical mistakes, the pupils can usually help you
• you consider the use of the Internet (if connected)

When planning lessons it helps if:
• they have clear aims and learning objectives and you think about how the use of the IAW might enhance your teaching and pupils’ learning
• you plan to allow for a variety of learning styles by incorporating colour and movement making use of ‘drag and drop’, ‘hide and reveal’, ‘immediate feedback’, ‘overwriting’ and ‘step-by-step animation’
• you plan to make use of backgrounds available on the IAW (different graph paper, squared paper, dotty paper)
• you plan to allow for more discussion, conjecture and pupil explanation
• you use the ready-made IAW designed software you have bought (such as EXP Maths from Nelson Thornes, the Interactive Teaching Programs, from the DfES, and Interactive Mathematics from the Association of Teachers of Mathematics)
• you use other mathematics software (such as a graph plotter, geometry program, Logo, spreadsheet or wordprocessor), this depends on your expertise
• you expect pupils to draw, mark, predict, write and move things on the IAW

When you first have the IAW it helps if you find out how to:
• write on it, rub things out, go back (and forward) a step, move and change the size of objects and delete things
• open, close and save the IAW specific software, often referred to as flipcharts or notebook files depending on your make of IAW
• use it in the (usually) three different ways: with ready-made software; overwriting a piece of software or what’s on the screen; and using the IAW specific software
• use the ready-made IAW designed software you have bought, reading the teacher notes, since these should offer advice on teaching strategies
• use other mathematics software on the IAW
• use the camera or snapshot facilities available to copy on-screen objects
• use the keyboard from the IAW and not the computer’s keyboard

It helps if all lessons have clear aims and objectives and:
• are planned on a stepped basis to ensure development of objectives
• are developed to allow for a variety of learning styles
• incorporate different approaches planned to reinforce conceptual understanding
• include meaningful interactive activities that will help improve pupils’ understanding of mathematical ideas
• have informal and formal assessment integrated in the lesson
• allow for the frequent review of learning that would include going back to earlier screens from the lesson
• begin with a starter to ensure immediate involvement
• include a main section where you can explore ideas, expect conjecture, allow for discussion, provide examples and develop practice to further understanding
• finish with and a plenary section drawing ideas together and offering some form of cognitive review

Recommended IAW specific designed mathematics software
EXP Maths 7 and 8 from Nelson Thornes
http://www.nelsonthornes.com/secondary/maths/marketing/books_exp.htm
Interactive Teaching Programs (ITPs) from the DfES
http://www.standards.dfes.gov.uk/numeracy/publications/#Interactive%20teaching%20programs
Interactive Mathematics from the Association of Teachers of Mathematics
http://www.atm.org.uk/buyonline/products/software/sof065.html
**The enhanced interactive mathematics teacher**

It usually takes time to become an effective teacher using the IAW and this should be recognised. Our evidence suggests that effective teachers usually start with a combination of commercial / professional and their own approaches in the development of their use of the IAW.

**We believe that teachers will be more effective if:**

- there is a recognition that there will be progression in the development of ones’ pedagogic and technological skills to maximise the advantages of using the IAW
- consideration is given to appropriate CPD in terms of pedagogic as well as technological skills
- the purchase of materials that are designed to be used interactively on an IAW is taken into account as the IAW is purchased
- plans are made early on to integrate gradually the use of a wide variety of generic mathematics software (geometry package, graph plotter and spreadsheet) into lessons
- materials are designed so that they incorporate interactive features such as drag and drop, hide and reveal, immediate feedback, movement and animation, and allow for high-lighting and over-writing
- the classroom layout allows good visibility of and easy access by pupils to the IAW
- other media are integrated into the lesson – to include associated worksheets (especially if linked to the work on the screens), textbooks and other source material
- pupils are encouraged to explain things to each other and the class, using the interactive nature of well-designed IAW materials
- assessment processes are adapted - typically a more interactive style means that understanding is checked more frequently, so pupils will write less in books
- opportunities are taken to print off material from the IAW screens

**Enhanced pace and active pupil involvement are usually achieved through:**

- the use of a variety of techniques so that ideas are underpinned by reinforcement in presentation
- the integration of visual stimuli such as colour and shading with movement to basic conceptual frameworks
- the involvement of pupils in an active way either through response to IAW stimuli, board completion activities undertaken by the pupils, or through the simultaneous use of pupil mini-whiteboards as an indicator of understanding
- the use of concepts as the framework for cognitive learning, usually in plenary activity towards the end of the lesson
- the use of recalling earlier screens as a means of assessing, reinforcing and applying learning.

**Classroom management**

In enhanced interactive lessons the focus shifts from that of the conventional classroom through:

- directing attention to the IAW rather than the teacher
- improved motivation as pupils see ‘higher’ quality materials especially when they involve pupil activity and immediate feedback
- the orchestration of pupil participation with the IAW as the medium
- the facilitation of group, pair and individual activity with the board, not the teacher, as the mediator
- greater use of discussion, questioning, and requests for pupils to explain ideas, conjectures and reasoning
- enhanced pace because teachers are more aware of the timing and structure of their lessons
- maintaining pupils’ interest by teachers’ improved ‘technical’ skills
- the use of ready-made IAW software and other mathematics software
- teacher awareness of techniques for stimulating learning and ensuring interactivity and the integration of these into lesson delivery as a means of maintaining attention

**Other recommended software**

- **Geometry package**
  Cabri-Géomètre or Geometer’s SketchPad.

- **Graph plotter**
  Autograph or Omnigraph.

- **Logo**
  MswLogo.

- **Presentation**
  PowerPoint is one example.

- **Spreadsheet**
  Excel is one example.

- **Wordprocessor**
  Word is one example.

**Further information**

- **Keele interactive whiteboard site for teachers of secondary mathematics**
  http://www.keele.ac.uk/depts/ed/iaw/

- **Interactive whiteboard CPD for mathematics departments**
  http://www.keele.ac.uk/depts/ed/cpdactivities/eimt.htm

- **The REVIEW Project**
  Advice for those new to interactive whiteboards
  http://www.thereviewproject.org/index.htm

- **The National Whiteboard Network**
  A numeracy website

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Exemplar Material and Commentary

Our work suggests that typically trainees arrive with little or no experience of working with IAWs and therefore hold a restricted view of their use in a pedagogical context. If they are not exposed to the potential of the IAW and left to their own devices to work with it, we believe that they would, at best, follow the stages of development outlined earlier.

There seems little point in allowing this development in an unstructured manner, rather it should be a priority that every endeavour should be made to move trainees as quickly as possible to the ‘enhanced interactive’ stage of use wherever possible. In order to do this we believe it is self-evident that tutors and mentors need, at the very least, to have an understanding of this stage of development even if they do not frequently use an IAW in their teaching.

Historically, the introduction of ICT into curricula has been a matter of deciding the most effective model of delivery. The discrete model has the ICT component of a subject ‘delivered’ in specific timetabled slots. The diffuse model has ICT used when appropriate in subject-based sessions. Each of these has advantages and disadvantages. In the discrete model much of the work is taken out of context and often focuses on technical skills but generally is built on teacher expertise and appropriate resources. On the other hand the diffuse model ensures that the ICT is used in an appropriate context – which adds validity – but assumes (often incorrectly) that adequate resources are available for all, that teacher expertise is uniformly of a high level and that ‘the message’ and ‘technical competence’ are understood.

We believe that it is advantageous to offer elements of both these models. It helps if trainees are taught the basic technical skills of the use of the IAW and given opportunities to use and demonstrate these skills within their group in discrete sessions. Furthermore, it may help if teachers with considerable experience and skill in the subject context teach IAW classes thereby adding validity to the use of the IAW in the trainees’ eyes.

If this is then complemented by tutors in subject sessions using the IAW as part of their ‘normal’ teaching, such use not only ensures that the use of the IAW is seen in proper and significant teaching contexts but also allows the tutor to demonstrate the nuances of the use of the IAW that cannot be regarded as ‘technical’ or simply ‘hints and tips’. In addition it is possible to make explicit links to the teaching and learning processes in a subject context.

We therefore supply examples that represent only a small section of the material observed during the period of this research. Whilst in each case the visual presentation of the material might not be of the highest quality, it is the way that the material is used that makes it relevant at the ‘enhanced interactive’ level. In each of these cases, the material has been used to promote learning in trainees or pupils rather than demonstrate technical wizardry at the IAW. It is clear that the features offered by IAWs offer opportunities to interact with trainees/pupils in a way, and at a level, that it not possible with other presentational media. These brief examples give some indication of how this might be possible.

Example 1

Figure 1: Pages 2 and 3 of a modern languages tutor’s interactive whiteboard resource

Here, at the start of a course, a modern languages tutor uses an IAW resource with trainees for the first time. In this presentation, colour-filled text boxes are placed on plain coloured backgrounds, which were different for each page. A change of page colour indicates a change of focus within the session. The text boxes are used here as a device to focus trainees’ attention on the title and the key issues. The pages are used in conjunction with the ‘hide and reveal’ manipulation, enabling the tutor to control the rate at which text was
seen by the trainees, thereby allowing the possibility for conjecture and discussion before answers are revealed.

Page 2, left screen of Figure 1, provides a heading and space underneath for trainees to write their own contributions, with the tutor’s own suggestions following underneath. These suggestions are hidden until the class suggestions are made. The manipulation ‘colour, shading and highlighting’ is used during discussion on the issues. On page 3, right screen of Figure 1, text boxes were linked together by the trainees. Page 4, not shown, provided space for a thought shower plenary on the issues discussed. All additions made during the session were saved.

This example is a presentation about good practice in lesson planning in modern languages. Although its apparent purpose is to provide an outline structure for a session, while providing a ‘board’ for trainees to write on, the concept of ‘embedded pedagogy’, both for modern languages and IAW use underlay its creation and use. The software is operated by the trainees throughout the session, in order to give them both a model of use for the classroom and to enable them to gain familiarity with the mechanics of using the IAW.

All the pedagogic techniques used - focus on specific text, change of focus, linking ideas and thought showering, and how these could be simply achieved with the IAW technology, are made explicit to trainees at the end of the session. Trainees were then encouraged to think of an A level modern languages lesson plan incorporating these ideas.

Example 2

Figure 2: Two pages from a mathematics tutor’s interactive whiteboard resource

In an early session the mathematics tutor presents a resource with a structured front-page (left of Figure 2). The page contains ‘chapter’ headings each of which deals with the developing nature of the session. Each chapter title is associated with a hyperlink (a variation of the manipulation ‘hide and reveal’) that takes the user to the appropriate part of the resource. In a similar manner each page of the resource is embedded with a hyperlink option to return to the front page. The use of hyperlinks in this fashion serves two purposes, first the front page shows the overall structure of the session and the tutor is able to refer to this as the session progresses thereby setting each part in the context of the whole; second its use maintains the pace of the session. The focus on structure and pace is then something that can be discussed at the end of the session as the intrinsic pedagogy is developed.

Also in this example (right-hand screen of Figure 2), we see the use of the manipulation ‘drag and drop’. Here it is used in connection with developing a particular topic in mathematics. However, in using ‘drag and drop’, the tutor is able to demonstrate to trainees how to orchestrate question and answer techniques with pupils. The section is concerned with finding patterns and general terms related to numbers in a number grid. As different templates (in this case ‘letter’ shapes) are dragged and dropped around the background grid questions such as “What is the sum of the numbers here … and here?”, “What is the same and what is different about the number patterns with the template in each of these positions?”, “Where is the sum of the numbers 315?”, “Is this the only position at which that occurs?” are posed. In discussing questions of this nature at a later stage, the tutor is able to highlight the importance of encouraging pupils to make and test conjectures, seek and clarify alternative ‘solutions’ and unpick misconceptions. The use of the dynamic ‘manipulations’ of the IAW is central to this type of approach.
Example 3

Figure 3: A modern language resource of a modern languages tutor

The presentation in Figure 3 is used to show trainees how the manipulation of ‘matching’, could be used in resource construction.

Different colour textboxes emphasise the two languages. The intention here is to use the mother tongue language to support comprehension, focusing attention on the form of the target. Trainees are asked to come out to the IAW and, using ‘drag and drop’, to match up the phrases in French and English. The person at the IAW acts as prime manipulator, and responds to suggestions by the other trainees in the class. When the meanings are established, trainees are asked to suggest an appropriate order for the language on the page, i.e. in which order might this classroom language occur in a real lesson. Trainees are thus made aware of a technique that allows quite complex new language to be read, understood and ‘manipulated’ by pupils, thus promoting some interaction between class, IAW and material.

Example 4

Figure 4: Sequencing a story: a modern languages resource produced by a trainee

The activity shown in Figure 4 was produced by a trainee in response to the presentation in Example 3. The trainee adapted the idea of matching to that of sequencing language that is more complex than the intended audience (year 7 or 8) might be able to produce. Pupils’ attention is focused on the story that can be created by re-ordering the text blocks containing target language sentences.

Example 5

In this resource a mathematics trainee is working with year 12 students on the topic of differentiation. The resource used to structure the lesson contains sections of a graph paper background that was collected from elsewhere using the camera facility of the software. In addition, straight-line segments are used, also from the software, and these have been edited in order to match the graph paper.

The first page (on the left of Figure 5) is used to discuss with trainees the notion of gradient. Several straight-line graphs, accurately drawn on a square grid, are presented along with numerical values for the gradients. In the lesson students are invited to suggest which numbers go with which lines and move them into position accordingly. They move the numbers and discuss how their decision is justified, promoting interaction within
the class between student and student, and student and teacher. This process is supported and strengthened by the accuracy allowed by the resource software.

Figure 5: Two pages from work on an A level mathematics resource

The second page (on the right of Figure 5) continues with its reliance on the accuracy of the resource backgrounds as students are invited to match straight-line segments of various gradients to accurately drawn curves. As students move the line segments to their required position the interactivity generated in the classroom allows the trainee and the students to explore the conditions at which a tangent meets a curve. Misconceptions are clarified and learning takes place.

Later pages in the resource allow the trainee to develop what has been learnt by writing, in this case, x-values in a pre-prepared table and thereby leading pupils to the required generalisations.

Example 6

Figure 6: Two pages from a PowerPoint resource of a modern languages tutor

This extract from a session on the use of the IAW and PowerPoint is used to show trainees how it is possible to consolidate presentation material and support oral work. Embedded pedagogy is not used in this session, which sought to demonstrate material that had been created for, and used in, the classroom.

Here, ‘basic shapes’ with a colour fill were used on a white background of a blank layout. Shapes were filled with images or text. The underlying principle is that if the language is already known, and is being revised or consolidated, pupils can work straight from images. If the language is new, it can be presented through text first and then images substituted. The manipulation ‘movement and animation’ can be used so that text flies into the speech bubbles. Pupils can then be asked to guess what might appear in the next bubble, either before an initial showing, or after it, as a memory test. Sound files of the words can also be used, either before, simultaneously or after seeing the word, depending on the emphasis of the lesson.

Interactivity is achieved by pupils reading and anticipating language, and then using the images or words on the IAW to support, for example, pair-work.
Example 7

Figure 7: A mathematics resource used to demonstrate questioning techniques

The extracts in Figure 7 are from a session with trainees that is used to demonstrate the richness of open-ended questions. The tutor uses the first page (not shown) to consider how pupils might respond to a simple open-ended question. Trainees are encouraged to discuss not only the various mathematical solutions to the problem set but also the reasoning and thinking skills required to resolve the challenge completely.

In the left-hand screen of Figure 7 we see that the IAW offers opportunities for different arrangements of the numbers to be considered with ease. The use of ‘drag and drop’ allows sensible discussion as numbers are moved around the screen. As trainees (later pupils) manipulate the elements at the IAW, they are asked to explain and justify their movement of the numbers. This in turn engages others in the session who might have different approaches and different solutions.

The right-hand screen of Figure 7, again using ‘drag and drop’, allows trainees to discuss the nature of equivalence as equal areas are framed on differently marked grids. Thus it is possible to show that any quarter of the square – as defined by the manipulation ‘colour, highlighting and shading’ – is equivalent to twenty-five out of one hundred (25%), regardless of where it is positioned.

Enhanced interactivity is achieved here by allowing tutor/teacher and trainee/pupils to consider the range of possible solutions available before moving on to discuss the explanations and justifications that underpin the solutions. Teacher-learner and learner-learner discussion at the IAW enhances the quality of this interaction.

Example 8

Figure 8: Interactive whiteboard resource of a mathematics trainee

This extract from a KS3 lesson taken by a trainee (Figure 8) shows that feature of enhanced interactivity where pupils are required to operate – usually in groups – at their desks with materials that are replicated virtually on the IAW. In this case pupils are asked to determine how simple tiles – in the shape of regular polygons (right-hand side of Figure 8) – will combine together to make regular and semi-regular tessellations. After an appropriate time pupils are then invited to the IAW to demonstrate and explain their pattern to others. The screen provides white space in which the pattern can be developed and multiple copies of the tiles (only partially shown to the left and top of the screen) that can be dragged and dropped as required.
Examples of materials: Screens from a mathematics tutor’s interactive whiteboard resource
Differentiation: an interactive whiteboard resource of a mathematics trainee for a year 12 lesson

**GRADIENTS**

You now have a gradient of m. Sketch each of these 4 graphs and label the gradient on each:

-1 -2 2 -1/2 1/2 1

**The Quadratic Gradient Function**

Below are straight lines with their gradients next to them.

-2 -1 1 2

Your target: what is the rule between the gradient and x?

**The Cubic Gradient Function**

There are 2 values of x where the gradient is 3 (why?)

0 3 3

Your target: what is the rule between the gradient and x?

**Differentiation**

Differentiation can be described as "what we do to functions to turn them into their gradient functions".

<table>
<thead>
<tr>
<th>function</th>
<th>x</th>
<th>x^2</th>
<th>x^3</th>
</tr>
</thead>
<tbody>
<tr>
<td>gradient function</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Predict what happens to higher powers of x.

Can you spot the general rule? (called Wallis’ rule)

**The most important thing to remember from today:**

If $y = x^n$, then \( \frac{dy}{dx} = nx^{n-1} \)

\( \frac{dy}{dx} \) is what we call the gradient function

Notice that the co-ordinate of the second point must be \((x+h,y+h)\) — think about it!!!

But the gradient is always \( \frac{\text{difference in } x}{\text{difference in } y} \).

So, the gradient function must be \( \frac{y+h-x^n}{h} \)

\( = \lim_{h \to 0} \frac{x^n + nx^{n-1}h + \cdots + (nx^{n-1}h + h^n) - x^n}{h} \)

\( = \lim_{h \to 0} \frac{nx^{n-1}h}{h} \)

\( = nx^{n-1} \)

Now, as the gap between the points (h) gets smaller, h gets closer and closer to 0.

So, we can write: as \( h \to 0 \), the gradient function \( \to nx^{n-1} \).

\( \to \) means "tends to"
La Martinique

Vincent a onze ans.

Il habite une île française des petites Antilles, la Martinique.

Il habite dans la capitale, Fort-de-France.

Il ne fait jamais froid en Martinique.

Vincent habite près de la mer.

Suite

Il se baigne tous les soirs.

La nuit, il y'a beaucoup de moustiques dans sa chambre, et il fait très chaud et humide.

Parfois, il ne peut pas dormir.

Le samedi, il va au marché avec sa grand-mère.

Page une

Page deux

Page trois

Ils prennent le bus.

Souvent, le bus a une heure de retard.

Personne ne s'énerve.

Tout le monde a l'habitude !
Good practice: an interactive whiteboard resource of a modern languages tutor, including additions by trainees, from a session very early in a course

Planning for good practice
1. What is good practice?
   - Plan to learn (see example)
   - Progression
   - Feedback

2. How do you do that?
   - Have a clear idea of what you are teaching
   - Know who you are teaching
   - Make the 'essence' of what you are teaching accessible

What, to whom, how?
what?
Métro, Module 2, Unité 4, and/or Actif Unit 2 Section 7 based on OCA SoW Unit 2 En Famille, Year 7

To whom?
A mixed ability Year 7 class of 26 pupils

I have to take Progression to where?

How much time do I have?

I can think about the differences in the students and about common ground

Using my own experience so far and 'Planning MFL learning' I need to

How?
• PPC
  • Plan-TE
  • Progression (Obs) of what
  • Resources Learning styles
  • Time for each part
  • Transition flow

Classroom language: PowerPoint presentation from a modern languages trainee

1. Qu'est-ce qui manque? Reliez le français à l'anglais
   - Guess!
   - Devinez!
   - Open your books!
   - Fermez les livres!
   - Put down your pens!
   - Posez vos stylos!

2. Je ne me sens pas bien... I don't feel well.
   - J'ai oublié mon cahier.
   - Excusez-moi: je n'ai pas de livre.
   - Excusez-moi: je n'ai pas compris.
   - Je peux aller aux toilettes?
   - Can I go to the toilet?

3. Put away your pens!

   - Ecoutez!

   - En silence, s'il vous plaît!
   - Write!
   - Ouvrez les livres!

4. I want! Met l'anglais à côté du français
   - Je ne me sens pas bien...
   - I don't feel well.
   - I have forgotten my exercise book.
   - I have no book.
   - I'm sorry.

   - I'm sorry I'm late.
   - I didn't understand.

   - une
   - deux
Supporting speaking: PowerPoint presentation from a modern languages tutor to exemplify how PowerPoint can be used in an enhanced interactive manner