



Cognitive tools across the curriculum

Dave Walters and staff at Clyst Vale Community College describe how they made developing cognitive skills a priority in all subject areas, and the enthusing effect this has had on their students.

Clyst Vale Community College (CVCC) is a medium sized secondary school in the south west of England. It is a true comprehensive in every sense of the word and has an inclusive ethos.

However, we decided something needed to change in 2009 in response to reflections at subject and whole-college level relating to high stakes testing and its impact on the learning process experienced by our students. In short, there was a growing feeling, backed up by evidence from internal and

external evaluations, that students were not developing the cognitive skills required for independent study and that learning and teaching leaned too much towards content and bare knowledge at the expense of higher-order cognitive skills. Students were passive in the learning process on the whole and were growing reliant on their teachers for much of their learning.

The predominantly traditional curriculum (GCSEs) presented a real dilemma for the college as there was evidence that some schools and colleges were pursuing alternative qualifications in response to similar pressures, not least of which was the need to improve league table performance. CVCC viewed that maintaining challenge for students meant a change of pedagogical approach rather than curriculum engineering, particularly as our curriculum was broad (albeit almost exclusively GCSE based) relative to our size and therefore should present an appropriate challenge for our students.

We perceived a need to move teaching and learning away from a content heavy model towards more cognitive approaches. As deputy principal, I had recently completed a professional doctorate in education at Exeter University Graduate School of Education under the expert supervision of Professor Bob Burden, Director of the Cognitive Education Development Unit, and so had recent high quality understanding of cognitive education, together with Exeter University's working association with Thinking Schools International. Extensive discussions with a variety of CVCC staff and community revealed optimistic support for becoming a Thinking School and we were confident of an 80 per cent 'buy in' from staff as this figure reflected the percentage of staff who had positive attitudes towards innovation.

Initially, we decided to focus on Hyerle's thinking maps, De Bono's thinking hats and Bloom's Taxonomy as the main cognitive tools, as we believed these struck a balance between variety and focus. Our main aim was to add a cognitive dimension to other pedagogical approaches already established, particularly those relating to formative assessment, or Assessment for Learning.

Our initial optimism of an 80 per cent 'buy-in' proved to be realistic, as feedback from lesson observations revealed a large majority of staff were routinely using thinking maps in particular. At least half of staff quickly soon began to extend their repertoire to other cognitive tools as appropriate.

But how did they do so? And how great an impact did this have on students' learning? From here, I hand over to six of our teachers. With specialisms ranging right across the curriculum, they will explain how they implemented various cognitive tools into their practice and what effect their efforts have had in the classroom and on school life as a whole.

A cynic is converted

I'll freely admit that when we first started exploring the ideas of meta-cognition and the possibility of becoming a Thinking School, I was more than a little sceptical. From the outset, these projects had many of the hallmarks I associate with the 'yet another woolly new initiative' school of educational programmes. And so I joined the programme largely as a self-appointed 'Doubting Thomas'. As it transpired, I couldn't have been more wrong.

As a subject teacher, the most important and positive aspect of this project has been the fact that it has generated a buzz and initiated discussion about teaching and learning in a way that many previous initiatives have failed to. The inherent challenge posed by the adoption of cognitive tools to our previously assured view of ourselves as reflective practitioners has been extremely stimulating. I'm from a generation of teachers trained to believe, as immutable fact, that teaching and learning are two sides of the same coin and that driving improvement in the latter always stems from the former. As a result, so much of our focus over the last decade has been on the quality of teaching, however as a school we've become concerned over the last few years by a widening gap between the two.

In ICT and Read to Learn (R2L - our literacy course), we've introduced the use of thinking maps. The uses of maps to classify, plan sequences, compare and contrast has been repeatedly modelled by teachers and a

consistent message that it's the thought process that's key to the activity has been continually reinforced. We've encouraged students to use the maps in a range of activities – describing the parts of a computer system using a tree map, planning the operation of a computer program using a flow map or comparing two characters from a book we've read in class with the double bubble map.

Teaching the use of thinking maps to our learners in ICT and literacy has given us a fresh view of the tools and strategies they need to succeed, and represent a concrete attempt at rebalancing the intellectual workload between teachers and students. An absolute must as we try to move our school community towards being outstanding in the broad, the civilised and the narrower Ofsted sense.

Embedding the use of these approaches is certainly not without frustration and definitely not quick. It's been a timely reminder that whole-school change demands consistency. It's only because of the wide scale 'buy-in' from staff that change has been possible here. After an initial period of constantly referring to the thinking maps, constantly gesturing to the dog-eared wall displays, constantly correcting the instinctive desire to fall back on our previous habits, we're seeing some encouraging results. Some of our classes have moved closer to driving their own learning than they've ever been – they've become conscious of the process of their own learning. Most recently, it was delightful to witness that when faced with a new project, my students earnestly tell me in an unsolicited fashion that they'll need to use a circle map to define the problem and then begin to plan a solution using a sequence map.

Did I mention that because of thinking maps, I've discovered – or perhaps remembered – that my name's not Thomas after all?

Allen Bailey
Head of ICT

Getting philosophical

Since I have been using cognitive thinking tools both within my classroom and to aid my role as a Head of Green School, I feel it has created many benefits for me and the students I work with. One of the most noted improvements is the students' ability to understand and analyse their own work which in turn, has improved grades. It is amazing to become a catalyst of learning - first triggering and then stepping back to watch the students think in order to learn, is simply wonderful and the main reason why I became a teacher. I have felt that the thinking tools have added both a cognitive and fun dimension to my classroom.

There are many ways these tools can be implemented in learning. If we take a look at the thinking hats, these can be used to enable a student to analyse and think around a topic in order to allow them to make informed decisions. In a recent RE GCSE class of mine, I split the room into several stations which students had to work around. The theme was euthanasia. Students had to visit each station and complete a task:

- Red station – students wrote down their gut reaction about euthanasia.
- White station – students gathered information on euthanasia from a variety of sources including text books, short clips, newspaper articles, journals etc.
- Yellow station – students read several articles and discussed why euthanasia should be legalised in Britain.
- Black station – students used a variety of sources to discuss the negatives surrounding legalising euthanasia in Britain.
- Green station – students researched alternatives to euthanasia e.g. the hospice movement and palliative care.
- Red station – at the end of the lesson, students reviewed their beliefs about euthanasia to see if their opinion had changed during the lesson.

I have also used the thinking hats to help AS and A2 level students plan their philosophy essays, and this has really helped to focus them and make sure they are analysing and evaluating in each question.

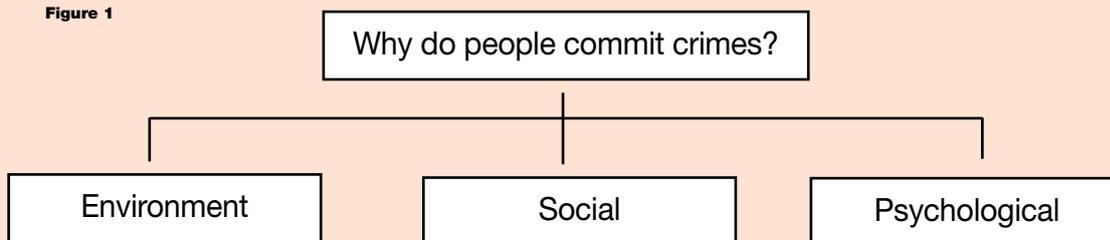
The use of hats has also been valuable within my role as a Head of School. Often I find I spend time dealing with incidents that have happened between students. Using the thinking hats has been a brilliant way of asking the students to evaluate the incident and move on:

- Red hat – What was my reaction, what did I do in the heat of the moment?
- Black Hat – What was negative about my behaviour?
- Green hat – How could I have changed my behaviour? What could I have done differently?
- Yellow hat – What would be a positive learning opportunity out of this situation?

The use of the maps has also been a wonderful learning tool in the classroom. I have used many of them in a variety of ways, for instance:

- Circle map – I often use this to gather what students know about a topic before we have begun. For instance, if we were looking at abortion, this would allow me to see what the students know, allowing me to effectively plan my teaching to the ability of the group in front of me. The circle map can also be used at the end of the unit to assess how much the students have learnt.
- Bubble map – I have used these frequently to describe feelings of a person towards a particular moral issue. In this circumstance, I would use a frame of reference in order to stipulate the particular point of view.
- Double bubble map – This is a wonderful tool to help students in my classroom compare and contrast religious points of view towards any contemporary issue.
- Tree map – This map is very useful when I want students to break down a topic into categories. I have recently used this when teaching the main reasons why people commit crimes. (See figure 1)

Figure 1



I would certainly advise trying a few thinking hats and maps in your own classroom. Activate the learning and watch the benefits unfold in front of you.

Chen Battishill
Head of Green School, Beliefs and Values, and Child Protection

Cognitive tools in geography

As a teacher of geography who is new to the profession, I have found the use of cognitive tools to be an essential part of the learning. They are tools that enhance the students' thinking as well as their ability to solve problems. These tools have become personally meaningful for the learner as they can identify certain thought processes with specific tools, giving them the confidence to challenge themselves. The cognitive tools I have used are Bloom's Taxonomy, Edward de Bono's thinking hats and thinking maps.

Thinking maps

When I introduced thinking maps to my classes, I introduced a different map each week. I emphasised that the students must identify the thought process and the name of the map they would be using before physically drawing it. I believe this is important as it gets them thinking independently about what they need to do and develop an awareness of the learning processes.

In geography, we use the flow and the circle maps quite often. When students are required to understand the formation of a feature, a sea stack for example, they must think about the events that lead to its formation. When the students have identified the thought process (sequencing), they need to identify the appropriate map. When this has been done, they then physically put the sequence together. I have found that when the students, especially the more able students, become confident with the different maps, they can automatically identify the thought process and map for certain activities. I have found that these maps enhance thinking and encourage the student to be independent and proactive in their learning. My

students have responded very positively to thinking maps and when doing independent project work, they will automatically include thinking maps that are appropriate for the task in hand.

Thinking hats

I use Edward de Bono's thinking hats in most of my lessons for group discussion or independent thinking. They encourage students to think in ways outside their usual approach and consider ideas from a number of different viewpoints. I encourage the students to think about what they are trying to achieve and pick the appropriate hat that will support their thinking.

When introducing the hats, it is important to introduce them individually, outlining in detail when each is appropriate. I find the hats very useful when putting together an extended piece of writing as students can break it down into paragraphs that correspond with the different hats, therefore including a number of perspectives and making their final piece more rounded. I have found that KS3 students have responded very positively to the hats as visual aids and enjoy wearing a different colour as they consider different perspectives on a topic.

Bloom's Taxonomy

When I am setting my learning objectives for lessons, I use Bloom's Taxonomy and believe it is fundamental to doing so effectively. It encourages students to think critically about their ideas and the ideas of those around them. I also use it to differentiate the outcomes of the lesson. Bloom's Taxonomy is particularly effective for me at GCSE level where my students have responded very positively to it.

Edel Keaney

Teacher of Geography

A thoughtful approach to scientific enquiries

In 2010, I began a project to improve the quantity of dialogical talk in the classroom. I wanted to introduce and provide an environment and a set of conventions to allow children to participate in enquiry – both through talking and reflecting. I intended to give my students the opportunity to learn from each other, as opposed to solely from the teacher, and perform their own Philosophical Enquiry. This was closely linked to our college's move towards Thinking School status and provided my teaching with guilt-free flexibility to experiment with Philosophical Enquiry as well as begin to implement some thinking tools.

As well as Philosophical Enquiry, I've introduced a number of other thinking tools that have greatly enhanced my practice and subsequently, the pupils' learning. My favourite and most useful within a science context are the thinking maps, purely as a means of extending, differentiating, creating and yet providing structure to students' work. They have become an intuitive part of many lesson segments and provided they are not overused, are embraced by the pupils. Their implementation was gradual and, as there are a number of conventions for each thinking map, I concentrated on Key Stage 3 so that we could create the expectation that they would be used throughout their school experience. The children's feedback has, for the most part, been positive and the promotion of more analysis and reasoning with content means that a deeper and richer understanding seems to have been reached.

We are certainly working towards a time where students will be expected to select an appropriate map for analysis and synthesis of content.

Hints and tips:

- Using thinking maps will not take up any extra time, merely a few moments of thought. Think about the content that you wish students to learn, then try and 'fit' thinking maps to the task. If it's not appropriate, don't use one.
- You won't use them all, some subjects don't use certain ways of analysis. A bridge map is used for seeing analogies – perfect for comparing the metaphorical aspect of scientific models, but not so for other subjects.
- Allow children to share their ideas and help complete each other's maps. Learning is not an individual pursuit.

- Thinking maps will afford reflection, creativity and analysis of content. This is difficult to assess in the immediacy – it is the process that's important, not the outcome.
- Have posters of thinking maps clearly displayed and incorporate their language into your practice.

The wider role of Philosophical Enquiry and thinking tools in creating a thoughtful and considered approach to the world needs to be recognised by the educational community and not merely as a 'bolt-on' activity to broaden the curriculum.

Carl Hubbard
Teacher of Science and Literacy Coordinator

Extending thinking in science

I have used many thinking tools with my science groups and feel that one of the most beneficial towards student progress and individual learning are the thinking maps. I introduced the thinking maps with classes in each year group and have found that they are generally accepted more at KS3 than KS4. However, where KS4 students have taken them on board and used them, they have realised their benefits. In some circumstances, they have found them to be a useful revision tool.

I have now been using thinking maps for a couple of years and can see the development of the use of maps throughout early KS3. As these students progress, they will continue to come into contact with the maps, which should provide them with very useful skills when it comes to revision for GCSEs. By using these maps and understanding the thinking processes behind them, they are also likely to become more independent learners, which will obviously benefit them in their examination years.

I introduced each mind map to the class by first talking through the type of processing that they are using with certain pieces of information. I then introduced the map as a method of getting the thinking onto paper. After using the thinking maps a couple of times in this way, I am now able to present students with the information and they are generally able to derive and complete the correct thinking map. I am confident that with further use, the students will choose to use the correct maps without any guidance, and in some instances this has already been the case. More capable Year 7 students are already asking to put information into the thinking maps without prompting.

The next step and one that I am currently working on is the use of the 'frame of reference' which extends the thinking and can be used to increase complexity of the task. Where this has been used, students have been very keen and the process has clearly increased their thinking skills. It can be used to differentiate work and provide extension tasks for higher ability students.

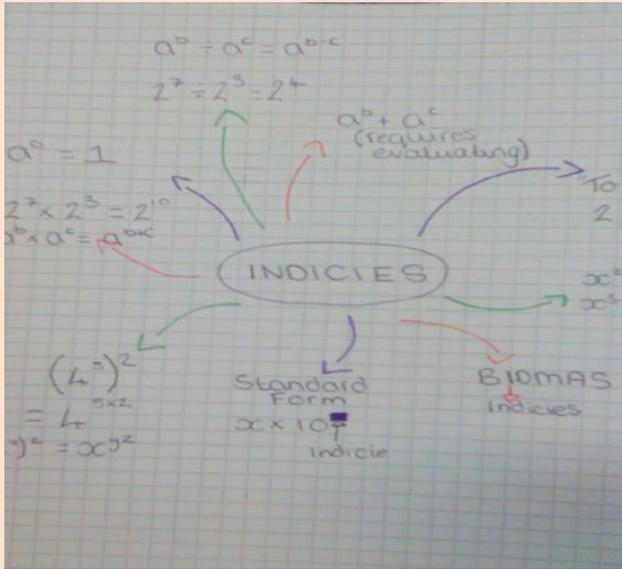
When using thinking maps, I've found it essential to plan the lesson objectives first and then choose the correct maps to suit the processing skills needed for each lesson. The use of thinking maps just for the sake of using them is likely to do more harm than good. As a whole school measure, they are most effective when introduced to KS3 as I have found them to be more receptive. The skills will then be taken up through KS4 and beyond by the students.

Kelly Knight
Transition Coordinator and Teacher of Science

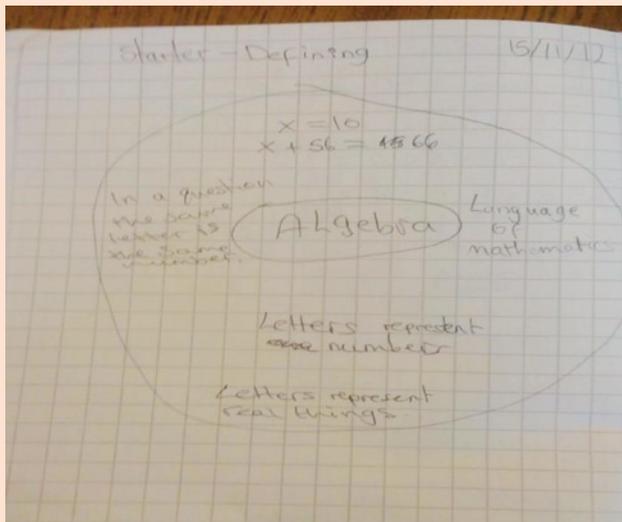
Maps in the maths room

I have found that the easiest thinking map to introduce into the maths classroom is the circle map, representing defining in context. I use it regularly at the start of a new topic. The students are given the topic in the centre circle and then as a starter activity, asked to fill in everything they know about it. There are no restrictions given and students can use words, comments, examples, pictures and of course, numbers. This activity encourages them to access the lowest rung on Bloom's revised taxonomy – 'remembering' – upon which all new learning is built.

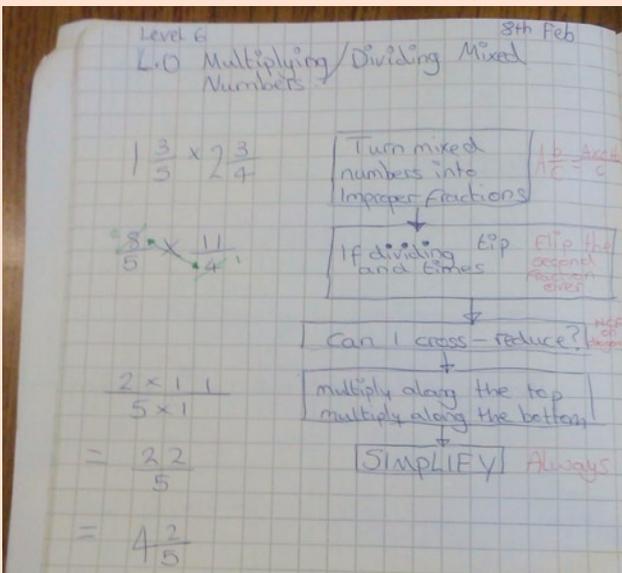
While the students are working, I circulate the room, asking questions, offering praise and returning to



A circle map on indices



A circle map on algebra



A flow map on multiplying and dividing mixed numbers

the board to put up the students' ideas. Class discussion follows, and the board is further updated during the discussion. Misconceptions can be addressed here if appropriate, or if not, at a later time. The questioning is crucial at this stage as it moves students up another level in Bloom's taxonomy to 'understanding', and can even inch into the next level, 'applying'. This third level is more usually addressed in the main body of the lesson though.

Personally, I find the use of the circle map incredibly useful as it informs me of what the students can actually recall independently or through nudges from their peers, and lets me know where I initially need to pitch the topic. The frame of reference in this map is unused in this type of activity, as the 'How do I know what I know?' is all too often answered with 'Because my teacher told me...' or 'I learnt it from Mr so-and-so last year'!

Some teachers in the department get the students to return to their circle map to add their new learning to it in different colours once the topic is finished, while others use other tools to reinforce and consolidate learning.

Often in the main body of the lesson, I will use the flow map to identify a strategy that students need to follow for a particular process, such as adding/subtracting fractions. The flow map should be written from left to right, but since maths moves down the page, it makes more sense for the flow map to be written downwards. This is very useful as it ties up nicely with board work showing an example.

Having the strategy as a sequence of events provides the students with the opportunity to become more independent. All too often, we finish the teaching part and students put their hands up and say 'Miss, I don't get it'. If the strategy in their books is clear, concise and can be directly linked to an appropriate example, they have no excuse and I invoke the 'C3B4ME' rule. This is where the students need to try three things to help get themselves unstuck before asking me for help. It does take a little patience and training, but the students do get there and begin to develop the skills of looking back in their notebooks to remind themselves of earlier learning when they get stuck.

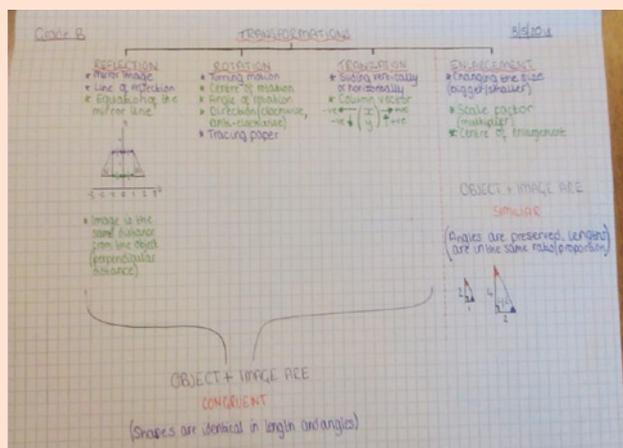
In the maths department at Clyst Vale, we operate a policy of each student having three books – an A4 book for taking notes, a work book and a homework book. The students are responsible for copying down notes accurately. If notes are poor we give oral feedback (I write OFG– Oral Feedback Given – in their book and expect the student to respond with a written comment about what they are going to do about it). I have found that as students progress through the school, they will often add their own additions to the notes, taking more responsibility for their learning which helps to prepare them for independent note taking at A level.

When summarising learning, I have found the tree map (for classification) very useful as it clearly identifies key learning points. My KS4 students and higher ability KS3 students are now beginning to develop the skills to produce their own as homework. I do also give some marks for presentation.

The bubble map (for describing using adjectives) can be a tricky one to use in maths. However, we have cross-bred it with the spider diagram and it is used by many in the department for the teaching of mental methods to find percentages of amounts.

The students enjoy producing posters and they do make a good wall display.

For younger students and those who find maths more challenging, I have found that they respond enthusiastically to the production of a whole class thinking map for a wall display. Particularly successful so far have been a giant tree map, headed with 'data', with 'qualitative data' and 'quantitative data' as the next level down, and bridge maps showing connections between fractions, decimals and percentages or the connections between integers, square numbers and cube numbers. These do have the added advantage of not only being a reference point for that particular class but for all your classes and the students do use them as such.



A tree map on transformation



A bubble map on percentages

Encouraging creative thinking

Bloom's taxonomy coupled with Costa's questioning has been a fantastic vehicle to deliver differentiation. It brings a subtlety to questioning and through this, creates challenge for all students within a class. Like most schools, we set in maths, but there is always a range of abilities and the key verbs allow for a more personalised learning experience.

Crucially, in my opinion, it leads to students accessing the two highest levels of thinking, 'evaluating' and 'creating'. I believe in secondary school maths, we have a tendency to shy away from these, especially

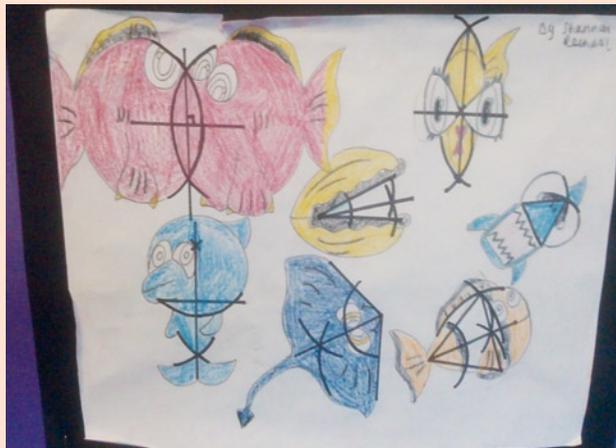


A bridge map wall display on fractions, decimals and percentages

creating. But the benefits reaped from providing the opportunity for creativity are wide ranging. Activities that I have used to begin to foster creative thinking include creating your own treasure hunt using bearings for directions, drawing a picture using specified constructions and following angle facts, and writing your own journey story ending with a question, using at least three forms of transport and mixed numbers only. Students also need to provide the solution.

Unsurprisingly, the quality of the work that is produced varies tremendously. Peer assessment and evaluation, with teacher input and a whole class involvement does help to lift effort and achievement, particularly at the bottom end, and this offers a great opportunity for praise. It can also result in students making connections with other aspects of maths and offering up some interesting thinking.

Finally, I believe the best way to get students to think is to let them get stuck and not allow them to give up – give them hints and then leave them. Keep doing that until they get unstuck. If they can't get unstuck at all, then you have picked the wrong task. Lessons like that require a high level of interaction even though you don't need to reinvent the wheel with the planning (Websites such as Bowland Maths, NRICH, GAIM, UKMT and more are a great help) and the students need to be given the skills. The balance needs to be between teaching, drill and practice, and thinking. As for the results? Well, we are seeing a new generation of learners emerge.



Mel Prance

Teacher of Mathematics and Key Stage 3 Coordinator

So has it worked?

We used the then Year 8 cohort at the start of implementation as our mechanism for monitoring impact, and student achievement outcomes for this cohort are high. In fact, the internal college data for these students, currently in Year 10, indicate that they are poised to achieve well above the national attainment and progress figures, such that they would set an all time college record. Furthermore, their attitude to learning in terms of enthusiasm and enjoyment is excellent compared to previous cohorts.

The following quote from our Thinking Schools accreditation visit in September 2012 confirms that we have been successful in our initial aim set out at the beginning of this initiative: 'Clyst Vale Community College provides a good example of how the cognitive approach to learning can complement other pedagogical approaches in seeking to meet the educational needs of students, while at the same time enhancing a values-led approach to education. In doing so, it fully warrants accreditation as a Thinking School and is afforded that status by Exeter University's Cognitive Education Development Unit.'

Ultimately though, I must say that I believe becoming a 'Thinking School' is somewhat of a myth... The journey never ends and one can only lay claim to continuing to *develop* as a thinking school.

Dave Walters is Deputy Principal at Clyst Vale Community College, Exeter.

Knowledge trails

- 1) **Strategies for thinking** – How do we encourage reluctant thinkers to progress beyond the basics and develop their higher-level thinking skills? Paul Fleming reports.
library.teachingtimes.com/articles/strategiesforthinking.htm
- 2) **How we became a Thinking School** – Kevin Steel explains the important role thinking maps played in his school's journey towards becoming an accredited Thinking School.
library.teachingtimes.com/articles/ctlhowwebecameathinkingschool.htm