Cognition and Intelligence

What Is Cognitive Apprenticeship And How Does it Make Thinking Visible?

Getting students to apply knowledge from one context to another is the hardest issue in schools. John Tomsett describes how he used the book The Cognitive Apprentice: Making Thinking Visible, to transform his teaching

Finding out about Cognitive Apprenticeship

When I began teaching, I used to travel the 50 miles to work and back with Kate Darwin, a fellow English teacher.

Kate and I became specifically interested in the thought processes that occur *between* sentences. During our daily drives, we would chat about how we could make those thought processes explicit. We devised a lesson where we would take a paragraph of our own writing and insert between the paragraph's sentences our thought processes that shaped each sentence we wrote.

Our idea of articulating the thinking between sentences did not progress beyond that one-off lesson. I did not have the gumption to realise how important such thought processes are to student learning.

Little did I know that at the very same time, some 3,500 miles away across the Atlantic Ocean, Allan Collins, John Seely Brown, Susan Newman and Ann Holum were developing ideas similar to those Kate and I were bandying about within the cramped confines of my *Vauxhall Nova*.

In 1991 Collins et al. published *"Cognitive Apprenticeship: Making Thinking Visible". Nearly a quarter of a century later I encountered their paper. Since then, it has influenced my teaching immeasurably.*

In February 2015 I was prompted to approach Alex Quigley, our erstwhile Director of Research, when I was faced with the following problem: my students' AS mock examination results were poor – the most popular grade was a *U*.

The frustration was that *I knew they knew their Economics content*. My challenge was to answer the question, *How can I train my students' thinking so that they can apply their knowledge of Economics to solve the contextual problems they face in the terminal examinations?*

Alex suggested I read Collins et al'spaper which identifies that "domain (subject) knowledge…provides insufficient clues for many students about how to actually go about solving problems and carrying out tasks in a domain. Moreover when it is learned in isolation from realistic problem contexts and expert problem-solving practices, domain knowledge tends to remain inert in situations for which it is appropriate, even for successful students".

Explaining Cognitive Apprenticeship

There is no evidence-based, universal panacea to cure all teaching and learning ills. This is something Collins et al. clearly knew. In their research paper they conclude that, "cognitive apprenticeship is not a model of teaching that gives a packaged formula for instruction".

In their original paper published in 1991, Collins et al. took the traditional apprenticeship method – modelling-scaffolding-fading-coaching – and applied them to schooling. They focused particularly upon making the implicit, explicit, upon articulating aloud the unspoken. Because of the mass aspects of schooling, schools focus on teaching the explicit knowledge that has been accumulated in the textbooks and procedures that are taught in school. What is left out is the tacit knowledge that adults acquire over their lifetimes in solving problems and performing tasks.

When adults teach by apprenticeship, they convey tacit knowledge they are hardly aware of, by modelling how to do things and by coaching when they see the difficulties learners have in solving the problems, and performing the tasks that the adults have been wrestling with all their lives. The very thing that attracted me about cognitive apprenticeship was how it is "a model of instruction that works to make thinking visible".

The Principles for Designing Cognitive Apprenticeship Environments as conceived by Collins et al. are expressed within a "framework consisting of four dimensions that constitute any learning environment: content, method, sequence, and sociology". The characteristics of each dimension are outlined below:

CONTENT: Types of knowledge required for expertise

The fact that Collins et al. begin with content is important, because without knowledge there is no learning. ***Domain knowledge*** is where they start, but as they also point out, whilst it is "important, [it] provides insufficient clues for many students about how to solve problems and accomplish tasks in a domain". ***Heuristics***, or as Collins et al. describe them, '"tricks of the trade", are processes that usually work and provide a good starting point for addressing a challenge.

So you know your domain knowledge, and heuristics help apply that knowledge, but when heuristics do not work, you require ***control strategies***, or what we might call metacognitive skills, which help you think through different approaches to a challenge beyond the limited effectiveness of heuristics.

Finally, within this first dimension, you need to know different ways of ***learning*** any of these previous three types of knowledge.

METHOD: Ways to promote the development of expertise

For "method" read "methods of teaching". Here Collins et al. outline six elements of apprenticeship-style teaching, beginning with the teacher ***modelling*** a task or process and the students observing.

Scaffolding support helps the students complete a task. Next the teacher observes the student whilst ***coaching*** them to complete the task. The next stage of the teaching methods process, is for students to ***articulate*** what they know and how they think when they complete the task. When the task is complete, teachers show students how to ***reflect*** upon their performance and compare it with the performance of others.

The final "method" stage is to ask students to identify and then solve their own problems, where the level of teacher guidance is faded and the tasks allow greater student ***exploration***.

SEQUENCING: Keys to ordering learning activities

When it comes to sequencing activities, Collins et al. insist that you ***begin globally*** before looking at local skills. This gives the learner a "conceptual map…before attending to the details of the terrain". Tasks must be sequenced to ensure an ***increase in complexity,*** and then teachers must ***diversify*** tasks to help students explore the breadth and depth of the subject domain.

SOCIOLOGY: Social characteristics of learning environments

The fourth and final dimension begins with ensuring the learning is "situated", where students "carry out tasks and solve problems in an environment that reflects the multiple uses to which their knowledge will be put in the future". According to Collins et al. ***situated learning*** encourages students to actively use their knowledge rather than just passively receive it and they can see the purpose of their learning. They then encourage the development of ***communities of practice,*** where students find an intrinsic motivation for their learning which goes beyond pleasing teachers or gaining examination grades, and where the students ***exploit cooperation*** between each other to enhance the community's learning as a whole.

Using Cognitive Apprenticeship in my subject

In order for my Economics students to use the subject knowledge I knew they possessed, I had to teach them what Collins *et al*. define as "*Strategic knowledge*: the usually tacit knowledge that underlies an expert's ability to make use of concepts, facts, and procedures as necessary to solve problems and carry out tasks".

I was the expert in the room. I knew subconsciously the skills required to apply my subject knowledge to solve an economics problem – the trouble was, I had not consciously taught my students those skills. What I had to do, according to the paper, was "delineate the cognitive and metacognitive processes that heretofore have tacitly comprised expertise".

I had to find a way to apply “apprenticeship methods to largely cognitive skills”. It required “the externalization of processes that are usually carried out internally”. Ultimately, I had to develop an apprenticeship model of teaching which made my expert thinking visible.

In response to the research paper, here is what I did: in the first lesson after the mocks I completed the same examination paper, not answering the questions but writing on the paper what my brain would have been saying to itself, question by question, should I have attempted the paper. I did this in front of them, live, with what I was thinking/writing projected onto the whiteboard via a visualiser.

What I wrote on the paper I insisted they wrote down verbatim on their own blank copy of the paper, a key feature of this learning experience.

The exercise showed them just how alert my brain is when I am being examined. I was teaching them, apprenticeship-style, how to *apply their domain knowledge to a new context when under pressure.* I was *making my thinking visible*.

In the second lesson after the examinations, I surprised them with a new mock paper they had not seen before. They completed the paper. The numerous students who attained a U grade first time round all improved by three or more grades.

The important thing to emphasise is that the students made these impressive gains in their examinations *without being taught any more Economics A level content*. They improved because I taught them the mental processes required to retrieve the knowledge they had learnt from their long term memories and apply that knowledge in an efficient, precise way which answered the examination questions.

I obsess about the *golden thread* from intervention to students’ outcomes. Skip a year and in the summer of 2016 those same thirteen A2 Economics students surpassed themselves, attaining a grade B on average, which was 0.27 of a grade higher on average than their aspirational target grades. On the A Level Performance Systems (ALPS) the class performance was rated Outstanding.

Spreading the word about Cognitive Apprenticeship

As Collins et al. conclude, “Ultimately, it is up to the teacher to identify ways in which cognitive apprenticeship can work in his or her own domain of teaching”.

Thinking hard about your subject discipline is intellectually challenging. Many teachers I know were originally inspired to teach by their subject, and debating the subjects they love needs to be privileged in schools. Providing the time for colleagues to engage in such conversations makes the job of being a teacher in our country’s schools more attractive.

Collins et al. focused upon the cognitive apprenticeship teaching processes required to make thinking visible to students in reading, writing and mathematical problem solving. When I first came to cognitive apprenticeship, I focused upon the metacognitive processes required to answer Economics A Level examination questions, the general types of reasoning that help you apply your subject knowledge to tackle academic tasks.

What has come to interest me as much, however, having worked with Collins et al’s ideas for many years, is defining the expert thinking processes for each subject in the curriculum. *What is it to think like an expert physicist or chef or musician?*

So, when I introduced my Huntington colleagues to the original *Cognitive Apprenticeship* paper, and challenged then to identify the unique expert thinking processes

in their individual subjects and to describe how they make those thinking processes visible, it was a hugely provocative question.

When it came to identifying the unique expert thinking processes in their individual subjects, their answers were rooted in domain knowledge. Unique expert thinking processes and content are inextricably linked.

Over the years I have worked with a number of subject departments; consequently, I know that consensus amongst teachers is a rare – and arguably an undesirable – thing. Debating the curriculum with your colleagues is at the heart of curriculum development; indeed, *informed debate is the fuel of curriculum development*.

How to teach your students how to think like a subject expert is at the heart of cognitive apprenticeship. Making your expert thinking visible is key, once you have agreed as a subject team exactly what constitutes expert thinking in your subject. If you consider three questions, they constitute a clear three-stage process for you and your colleagues to work through:

1. How do you think like an expert (very specifically) in your subject discipline? **(Think through and collectively agree your expert substantive and disciplinary knowledge)**;
2. How do you make that expert subject disciplinary thinking visible to students? **(Decide how to articulate your expert thinking to your students)**;
3. How do you teach your students to be expert subject disciplinary thinkers? **(Decide how to teach your students to think like a subject expert using the four dimensions of cognitive apprenticeship)**.

The four dimensions of cognitive apprenticeship will sound familiar to many teachers. It would be easy for them to conclude that they are already using cognitive apprenticeship techniques in their classroom. But that is not really the point.

I will finish provocatively with a final question for them to answer, and that goes something like this: “How *faithfully* are you using the four dimensions of cognitive apprenticeship in your teaching?” If you tackle that question along with the other three I have posed above, you’ll have fuel aplenty to drive curriculum development in your subject, and make disciplinary thinking visible to the benefit of your students.

About the Author

John Tomsett taught for 33 years in state schools and was a teaching headteacher for 18 years. Until August 2021 he led Huntington School in York. He writes a blog called *This Much I Know*, and has written extensively about school leadership. He has previously published five books: *Love over Fear: Creating a Culture for Truly Great Teaching*; *Mind Over Matter: Improving Mental Health in our Schools*; *Putting Staff First: A Blueprint for Revitalising our Schools* (with Jonny Uttley); *An Angler’s Journal*; and *Cognitive Apprenticeship in Action (editor).*

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Copied from: Teaching Times - What Is Cognitive Apprenticeship And How Does it Make Thinking Visible? | Teaching Times

October 2021