Cognitive Apprenticeships and their Application to Trades based Apprenticeships


Selena Chan, NZ Baking Training Centre, Christchurch Polytechnic Institute of Technology, Christchurch, New Zealand.
chans@cpit.ac.nz

Abstract

Cognitive apprenticeship (CA) is a term coined in the late 1980s by Brown, Collins & Duguid (1989). CA was based on observations and study of craft based models of teaching and learning in skilled trades and crafts whereby skilled craftspeople helped their apprentices learn a trade. However, CA is now mainly used as a teaching process in school based teaching and learning. There has been little work done on investigating if CA processes are used extensively in trades based training of apprentices and of strategies that may be successful in introducing the concepts of CA into trades based training both in on the job and off the job training. This paper investigates the origins of CA and its potential role in improving trades based training in competency based training.

Introduction

This paper discusses the concepts of cognitive apprenticeships (CA), a term first used by Brown, Collins and Duguid (1989). They used the term to describe how learning at school could be improved by using concepts observed in craft based apprenticeships whereby craftspeople passed on their skills to apprentices learning the skills of a trade. Various definitions of the concept of cognitive apprenticeship may be found (Bjork, 1991, Berryman, 1993, LeGrand, Farmer & Buckmaster, 1993). However the following definition of CA is used to provide a foundation for this paper:-

“Cognitive apprenticeship is an instructional model that seeks to emulate the opportunities for extended practice on authentic tasks that apprentices have while working under a master craftsman”. (Wilson, Jonassen and Cole, 1993)

A brief review of the literature tracing the origins and philosophical groundings for CA is presented in this paper along with a discussion on how the principles of CA might be of more use in training of apprentices and in particular the role of CA in helping apprentices establish an identity as tradespeople.

How did cognitive apprenticeship come about?
Cognitive apprenticeship arose as a theory of learning to improve teaching and learning in classroom situations. The argument was that humans learnt naturally through the traditional model of craft apprenticeships that were based on modelling a skill, one on one coaching to
ensure that the skill was learnt and then fading of the coaching support to allow the learner to perform the skill on their own. (Collins, Brown & Newman, 1989).

The eventual work on cognitive apprenticeships came about through over a decade of work by various researchers. Scribner’s (1984) work on workers in a dairy factory found that the workers used cognitive strategies that were different to the ones that might be used in conventional arithmetic to work out how various sized cartons (in imperial measures of pints and quarts) were organised into specified orders for loading on to milk floats. Her work was in part, a follow on from interest in the precepts of constructive cognition that were based on the socio-cultural learning theories advocated by the Russian psychologist, Vygotsky. (Scribner & Cole, 1981)

Scribner’s work then influenced several other researchers to use authentic observations of actual workplaces to produce work that included Lave and Wenger’s (1991) Theory of Cognition in Practice, Rogoff’s (1990) Theory of Apprenticeship in Thinking, Resnick’s (1991) Theory of Situated Cognition as Socially Shared Cognition, Clancey’s (1993) Theory of Situated Cognition as Coordination without Deliberation and Wenger’s (1998) Communities of Practice. Aziz (2003) uses the term socio-cultural theory of learning (and these have roots in the philosophical learning theories of Vygotsky, in particular his concept of the ‘zone of proximal development’) to encompass the situated learning group of learning theories. Examples of learning practice that fit under situated learning include anchored instruction, traditional apprenticeships and cognitive apprenticeships.

The differences between traditional apprenticeship and cognitive apprenticeship are detailed by Brown et al (1989) and Collins, Brown and Holum (1991), with traditional apprenticeship based on simple tasks, physical skills and processes, one to one learning in the workplace, tasks performed by observation, learning by doing the physical tasks, and from modelling, coaching and fading performance and the job determined by the task. Cognitive apprenticeship revolved around complex tasks, cognitive and meta-cognitive skills, learning with several students in a classroom or laboratory, tasks and processes performed by reasoning, learning by externalising thought processes in diagnosing problems and from modelling, coaching, fading, articulation, reflection and exploration of ideas and learning that is determined by learning goals.

**How has cognitive apprenticeships impacted on school based teaching?**

Cognitive apprenticeship models, along with Vygotsky’s (1987) concepts for improving learning in children, have largely been used in classroom based teaching. In particular, CA
teaching methods have been used in the teaching of mathematics, science and reading and writing to students at the primary school level. (Clay & Courtney, 1990).

Beyond the primary school years, CA teaching methods have been used to improve the learning outcomes for community college students learning technical mathematics (Johnson & Fischbach, 1992), improving writing skills for tertiary level students (Flower, 1993 & Duncan, 1996) and learning computer programming at university level (Chee, 1995).

A small number of articles were found on using CA principles within a trade based training context. The effectiveness of introducing cognitive apprenticeship models into the teaching of automotive students attending training courses at a vocational college was studied by Cash et al (1997). A comparison was made by pre and post testing students on the topic of air-conditioning systems in cars. Students who were lectured scored lower than students who were taught using cognitive apprenticeship techniques of modelling, scaffolding and fading. An interest in the use of Vygotsky’s zone of proximal development within vocational and adult training contexts is also described by Bockarie (2002). This article encourages the use of situated learning principles along with CA to improve adult vocational programs and on-the-job training systems. Duncan (1996) puts forward an argument for using the principles of CA to improve the learning of writing skills by technical college students.

The only ‘work-based’ training example of using CA was in a Canadian research study (Ruggero & Roth, 2001) that reported on an ethnographic study entailing one of the authors, undertaking an apprenticeship as an electrician. A comparison was made between ‘traditional apprenticeships’ which the authors described as the ‘school of hard knocks’ and a CA that resulted when the author underwent a section of his apprenticeship with a more enlightened journeyman electrician. The main focus of the report was to improve the current time based electrician apprenticeship model in the state of British Columbia to allow for opportunities for the recognition of current and prior competencies, to link off-job and on-job training schedules more effectively and to modernise the apprenticeship to take into account new skills and technologies that were now required in the electrician’s trade.

**What can CA contribute to trades based learning?**

There are two major emphases ascribed to CA (Collins et al, 1989). The first is directed at teaching learners the processes that experts use to handle complex tasks. The complex task, should be situated within the context in which they would normally and naturally be carried out. The second focus is on the actual cognitive and meta-cognitive processes that have to be undertaken, in order for the complex task to be learnt. In a workplace based learning environment, the first focus of situating the task to be learnt into the context for
which it will be used is generally straightforward, however, the second focus, of improving and learning the cognitive and meta-cognitive processes that underlie the tasks are more challenging.

In order for the above two teaching / learning outcomes to eventuate, CA uses six teaching methods. These are modelling, coaching, scaffolding, articulation, reflection and exploration. The first three methods, modelling, coaching and scaffolding, are the central core of CA and help to provide students with cognitive skills and meta-cognition via observation of ‘experts’ and practice that is supported by ‘experts’. The second group of two methods, articulation and reflection, are to be used to bring the student’s attention to their observation of expert practice and to help them think out ways in which their own problem solving strategies work. The last method, exploration, is to encourage the learners to become autonomous and to seek out problem formulation and solving by themselves.

Collins et al (1991) postulate that traditional apprenticeships tend to be strong on the first three teaching models – modelling, coaching and scaffolding and that these are suited to learning simple tasks that involve learning by doing physical tasks. However, there are also many cognitive and meta-cognitive skills that are important for a trades apprentice to learn. Therefore, the other three methods for teaching and learning in CA – articulation, reflection and exploration of ideas – are just as important in trades based education.

Harris and Simons (2003) report a survey of 595 apprentices / trainees in two industries in Australia (hospitality and automotive) to find out their perceptions of their workplaces as learning environments. Half to one third of the apprentices / trainees felt that the following factors were absent from their workplaces. Factors included trainers / employers taking time to talk to the trainees about their job, trainers / trainees organising work so trainee was able to work at their own pace and trainers / employers planning work so that the trainee was able to work at the level that fitted in with the trainee’s experience level. The lack of these factors in many workplaces, points to a lack of opportunity for the apprentices / trainees surveyed to have even the first three CA teaching methods (of modelling, coaching and especially scaffolding) occurring at their workplace training site. Half to one third of the apprentices / trainees also perceived that the following were lacking from their workplaces. These include trainers / employers showing interest in the trainee’s future, challenging trainees with new or different ways of doing things, trainees being provided with the opportunity to talk to trainers / employers about what they would like to learn and being able to have competency formally assessed at work. The perceived lack of these supportive
factors in the apprentices / trainees workplaces, again points at a lack of opportunity to make use of the principles of CA in their workplace learning.

**Conclusion**

Although CA arose via observation and reflection on the concepts that were used by trades based craft people to train apprentices and acculturate apprentices into the trade, the principles of CA are now used mainly in off-job learning or in class room based situations. The ideals of CA revolve around providing classroom bound students with the opportunities that mirror what was observed with apprentices being trained (usually one on one or with very small groups) and then applying these concepts to use in the classroom.

However, does the quote (Wilson et al, 1993) used at the beginning of this paper hold? Personal observation of apprentices learning in the workplace and the report by Harris and Simons (2003), provide some evidence that CA principles are not always present in workplace based learning / training environments. There is still a need to bring the strategies advocated by CA to improve learning opportunities for apprentices learning their trades. However, most of the work that has been undertaken in using CA to improve student learning have been school or off-job based. The concept of using CA teaching methods is still largely unexplored in the context of workplace learning. Therefore, the area of using CA principles to improve the learning opportunities for apprentices in the trades is an area that is rich in possibilities.

As a beginning, it will be interesting to find out how many workplaces naturally actually afford apprentices the opportunity to use CA strategies to learn their trade better. It will also be of value to find out if CA strategies can be encouraged for trainers and apprentices to help them improve on the quality and effectiveness of apprentice learning in the workplace. The agents of CA need to also be investigated, should all apprentices be provided with the strategies of CA to improve their learning during their apprentices? Or should trainers, employers or modern apprenticeship coordinators be the mentors using CA to help improve the New Zealand bakery industry community of practice. Would providing apprentices with the skills to use CA strategies be more effective or would training trainers, employers etc. be more effective in propagating the merits of using CA? Are apprentices ready to take control of their own learning and be ready to apply the principles of CA to their own workplace practice? What support factors in the workplace support CA learning strategies? What personal qualities in apprentices and their trainers encourage the use of CA during workplace interactions? There is therefore, much scope for research into the area of using CA to improve training and learning outcomes for trade based apprentices.


