

## A Guide to Using Cognitive Task Analysis in Education Research

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### **The Issue to Solve**

Experts are operating at a level where many aspects of a procedure have become automatic and much of the knowledge has become tacit i.e. experts are not necessarily aware of the knowledge they have or how important and valuable it is to a learner. For example, the expert pathologist will automatically filter out a whole range of background information from a slide allowing them to concentrate on the important diagnostic features. What seems obvious to the pathology teacher may not be at all obvious to the student who is having difficulty filtering out all the background visual information and is wondering which round structure is the nucleus versus the whole cell versus an artefact!

### **Cognitive Task Analysis; a Potential Solution**

Cognitive task analysis (CTA) has been used as a training aid in the manufacturing industry for many years. Detailed descriptions of tasks carried out by highly skilled workers are produced, which provide a more efficient means of instructing novices than purely following the master - the 'apprenticeship model'.

Clearly there are similarities to training in the health professions and CTA has been used in dentistry,<sup>1</sup> medicine<sup>2,3</sup> and during the development of the Haptic Cow<sup>4</sup>.

### **How CTA is Conducted**

You must have a specific task which you would like to use CTA for. The aim of the study would be to produce a list of steps that make up the task, and which will assist students in learning.

The focus of the study will be experts in the field of interest performing the specified task. The number of experts used in CTA studies ranges widely, from approximately five to twenty. As usual, the more participants, the more conclusive study you will be able to perform. But beware, observations and transcriptions are time consuming!

Remember: Consent must be gained from all participants. A standard consent form documenting the ability to withdraw, how the data is stored securely and the anonymity of results in any publications for example, must be produced and approved by the College's Ethics Committee.

The first stage of data collection involves observing the experts performing the chosen task. For example how a farm animal veterinarian performs a rectal palpation to find the uterus in a cow. The observations must be filmed for future analysis. This is especially important for normally unsighted

aspects of the task – for example what the pathologist sees down the microscope, the internal finger movements during digital rectal palpation of a virtual model or the ultrasound of bovine rectal palpation.

Typically, the experts should be asked to perform the procedure at least twice. Firstly, 'as normal' – without the observer present if possible, and without the need to describe what they are doing. Secondly, the real CTA, or 'talk aloud' – whereby the expert must describe every step they take, both physical and decision making. For example, a doctor may ask a patient if the examination hurts, if the response is yes, then they may decide to stop the examination there and continue later. Alternatively when a pathologist makes a diagnosis on a slide, the factors that led to the decision are important cognitive steps.

The CTA observations should then be transcribed. Every word spoken should be written. These transcriptions can then be compared across experts and the draft of steps for the task created. All steps described by all participants should be included. Note: this is likely to produce a long list! The list should then be checked against the first recordings of each participant, i.e. the 'as normal' observations. This will highlight any steps that the experts failed to verbalise, but which are still performed.

The list must then be checked by the experts. Try to hold a focus group with between 5-8 participants (or as many participants as you had, if less than 8). For those that cannot attend a focus group, send the list via e-mail, and request comments. During the focus group, you should discuss each step, and come to a conclusion whether it should remain as it is, whether it needs to be amended or whether it should be deleted. You may also wish to ask about how the list could be used in future teaching or learning.

Once all of your experts have provided comments, to a greater or lesser extent, amend the draft list of steps. Re-send this final list around the group for last checks.

If possible, you may wish to use the list with students performing the task and collect feedback via a short questionnaire.

## References

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