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Unknown knowns - knowledge elicitation for multimedia in craft learning

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Biography

Nicola Wood is a professional interactive media designer and a research student at Sheffield Hallam University investigating the design of multimedia in learning. Her early background was in business and she has provided both organisational and creative support to a number of community-based and charitable organisations as well as to mainstream business.

She developed an active role in the preservation of rural crafts through working in partnership with her husband, who has been a pioneer in rediscovering lost woodworking skills. This has provided the background to her current research, which involves collaboration with craftspeople and learners as well as engagement with questions of multimedia design.

Abstract

Craft skills were traditionally taught through apprenticeship, a time consuming process both for teacher and learner in a situation that discouraged innovation and development. New technologies offer the opportunity for learners to draw upon the skills of experienced craft practitioners whilst still directing their own learning at a pace and style that suits their craft practice.

In my previous research (Wood 2003) I considered the design of multimedia to support learning of tacit knowledge; working with experienced practitioners who have some experience of teaching and have adopted strategies to overcome the problems. Skilled craftspeople are often not skilled teachers and my current research concentrates on eliciting knowledge from such people, who are unfamiliar with expressing what they know, and testing the veracity of the findings with learners.

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Background

Craft skills are usually taught by an experienced practitioner through observation, imitation and correction. Once sufficient skill has been gained, the learner can continue to develop the skill and adapt it to suit their own practice, though for some time may need continued support. At this stage the ability of the learner to adapt and innovate will depend upon the adaptability of the practitioner they are working with. My previous observations suggest that craft practitioners who do not have teaching experience are both unused to expressing the knowledge they possess, much of which is tacit, and not necessarily comfortable with adapting to learners' innovation.

I am developing a methodology for eliciting knowledge involving an iterative process of working with a craft practitioner and learners to delve into the layers of more explicit knowledge and discover the layers of increasingly tacit knowledge. During this process I have used a series of video recordings and interviews to promote cycles of reflection and analysis, allowing practitioner and observer to interpret techniques and seek out and understand variations. This was followed by further explorations with learners, using a simple, low-technology version of the proposed learning environment, to test the knowledge that has been elicited and highlight areas for further examination.

Rather than producing a prescriptive, step-by-step approach to learning a skill, I plan to distil the essence of the craft, capturing the vital elements and leaving the rest in the form of Zen koans. In Zen Buddhist education the koan is one of the key tools used to invoke the students' insight; a saying or act by a Zen master which is usually "of a paradoxical nature and cannot be grasped by the intellect" (Mitsuda 1998). In Buddhist monasteries the core of the spiritual element is acquired through "non-teaching", rather than reading and thinking, spirituality is gained through everyday life and through this thorough immersion the meanings of the koans become apparent. This will be explored in the next stage of my research when I consider how to enable the learner to identify, understand and solve problems, not only as a reflection on the task completed, but also whilst carrying out the task, in the manner of Schön's reflection in action (1991).

Craft practitioner

This investigation was carried out with a traditional craft practitioner because this is my particular area of interest, but the techniques used should be generalisable to any craft and during the next phase of the research the methods will be tested with a different application. The work also has implications for many other fields of education and training such as healthcare, performance, catering, construction and sport.

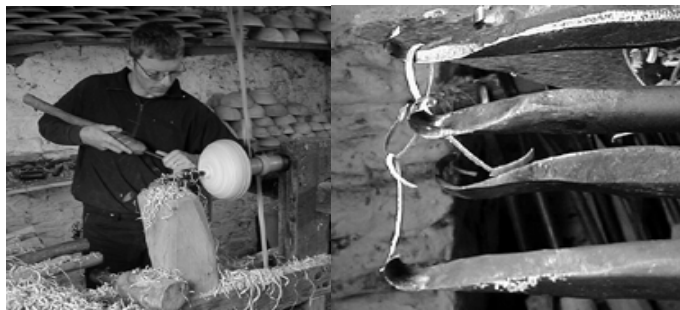


figure 1: craft practitioner and tools

The practitioner turns wooden bowls on a foot-powered lathe and was chosen for the study because, whereas the whole process from selection of timber to drying and finishing the bowls is time-consuming and complex, it is possible to learn the turning skill in isolation. This stage takes the experienced practitioner 10-15 minutes, so is suitable for

frequent observation. Also, a suitable level of complexity is offered by the hand-forged hook tools; it is difficult to describe the curved edge of a tool meeting the curved surface of the bowl, but subtle movements of the tool can greatly affect the cut.

Whereas the practitioner has experience of demonstrating his craft to the public, his teaching experience is very limited; as a consequence it was anticipated he would be comfortable with the observation process, but not be familiar with expressing his knowledge (Carter 2001).

Explicit-tacit continuum

My experience of the nature of knowledge in the context I am working leads me to agree with Shadbolt and Milton (1999) that “knowledge is often neither exclusively tacit nor exclusively explicit, but lies on a continuum between the two”. For any part of a skill, what on the surface might seem to be quite simple, is often far more complex the further it is delved into.

The picture becomes more complicated still as the different areas of skill overlap each other and I have been experimenting with different elicitation techniques and testing the outcome with learners to work deeper into the craft practitioner's knowledge. From this I have been able to identify the vital elements essential to learning the portion of the skill I have studied.

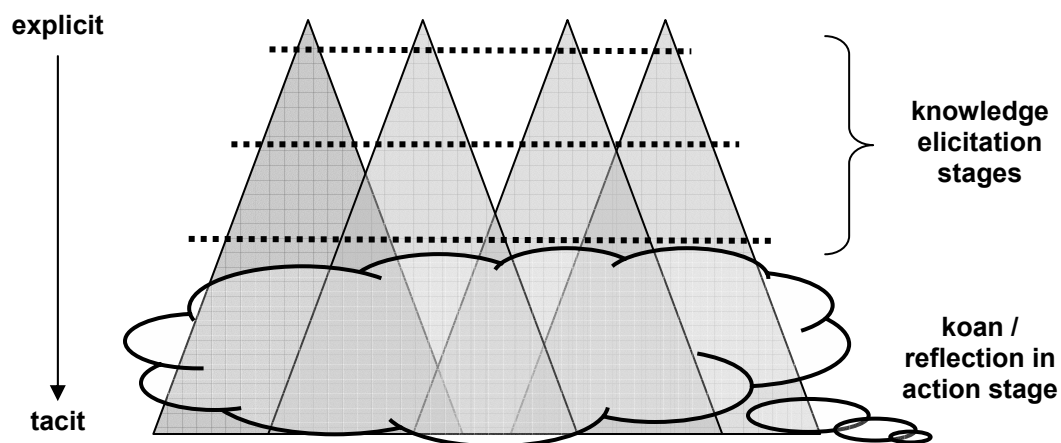


figure 2: skill representation

Stimulated recall and concurrent verbalisation

In my first elicitation session I anticipated identifying knowledge that the practitioner was easily able to articulate at the more explicit range of the spectrum and also hoped to access more tacit knowledge through use of digital video recording. As the turning process naturally divided into two comparable stages, I decided to experiment with two different elicitation techniques; stimulated recall and concurrent verbalisation (Cooke 1994). The intention was to see which the practitioner was more comfortable with and to see if either technique promoted a greater discussion of the more tacit knowledge.

In the stimulated recall session a video recording was made using a digital video camera of the first part of the process (turning the outside of a bowl) with the practitioner working in his normal manner. The video was then transferred to a computer, allowing fast, easy access to it. The practitioner and I then watched this recording together and discussed our observations, which in its own right was videoed to allow later analysis. In the concurrent verbalisation session the practitioner was asked to describe what he was doing whilst he

was working (turning the inside of a bowl) and the process was videoed. I also videoed us watching this recording together, to see if this would elicit any further knowledge.

As observed by other researchers in similar situations (Edwards 2003, Shadbolt & Milton 1999), when pressed into talking about elements that he did not have immediate answers for, the practitioner's initial reaction was to give quick responses that did not reveal the complexity of the situation, which he also had a general tendency to do in the concurrent verbalisation session. Where further probing was possible during stimulated recall, use of the video then promoted a more in-depth discussion and greater understanding of the issue. The video's navigation bar could be dragged to rapidly scroll through the clip, finding instances of the behaviour under discussion and freezing frames to see exactly how the tool was positioned.

For example, when asked why he changed tool at a particular point the practitioner's initial response was that simply the other tool was sharper. When prompted for more detail, he modified this to the second tool cutting better, but this time did not offer an explanation as to why it was cutting better:

- OBSERVER: *So, what's the difference between those two tools?*
PRACTITIONER: *There's no difference between those two tools - the difference is sharpness - this one's been sharpened more recently.*
OBSERVER: *So they are both quite big hefty hooks?*
PRACTITIONER: *They're a similar shape, but that one's cutting better ... you can hear it's cutting better.*

Later discussion on a similar point revealed that the shape of the tool was also at issue and seemingly identical tools had very subtly different shaped cutting hooks:

- OBSERVER: *Can you just pause it there? The thing that I notice there is that with this tool ... you're cutting with the back edge with the curl sticking up, whereas with the other tool ... you were the other way up ... weren't you?*
PRACTITIONER: *Um er ... it ... er ... yeees ...*
OBSERVER: *So if we go back to the beginning [scrolls back through the video] here ... then your tool is that way up, isn't it?*
PRACTITIONER: *Yes it is.*
OBSERVER: *Why?*
PRACTITIONER: *I think it's probably something to do with the way this particular tool is shaped. The very fine ... um ... that this point, the under ... underside edge is probably more in line with the shaft ... so ... and the result of that, and the very fine angle is that when you use it this way up it just pulls into the wood nicely, whereas if I turn it over then this back edge ... I think you can actually see it ... this line coming straight down here [pointing with the mouse on the screen]. The back edge would be more out of line with the centre of the shaft so you get more twisting motion so it doesn't pull itself into the wood in quite the same way.*

With this practitioner I concluded that the stimulated recall situation was most fruitful, the video being of great use to stimulate more in-depth discussion, but the depth of the knowledge elicited was dependent on the ability of the observer to draw the practitioner into discussion rather than pressing for quick answers. This will be explored in further research with other practitioners.

First stage learning resource

Following thorough review of the video taken during the elicitation process, several inconsistencies between what was described by the practitioner and the observed practice became apparent. To gain a broader picture of the practice, three more videos were made on successive days of the practitioner working in his normal manner and these repeat observations observed closely to highlight similarities and differences. This information

was then used as the basis for a semi-structured interview, this time asking the practitioner what he thought a learner would need to know to start practicing the craft.

Using the framework developed during my previous research (Wood 2003) a "learning resource" was constructed on my understanding of the craft practice. This was a deliberately low-technology construction, so it would be quick to put together and easy to adapt to the learners' needs; an adaptation of the "cardboard computer" methods of Ehn & Kyng (1991). My aim was to act as a passive "user interface", mediating between the learner and the information rather than actively teaching using the materials. At this stage I had selected a short video clip to give a general overview of the process and handwritten notes illustrated by sketches to give strategies and the stages of the process. Several tools and completed bowls were also used to assist with explanations rather than undertaking specific photography.

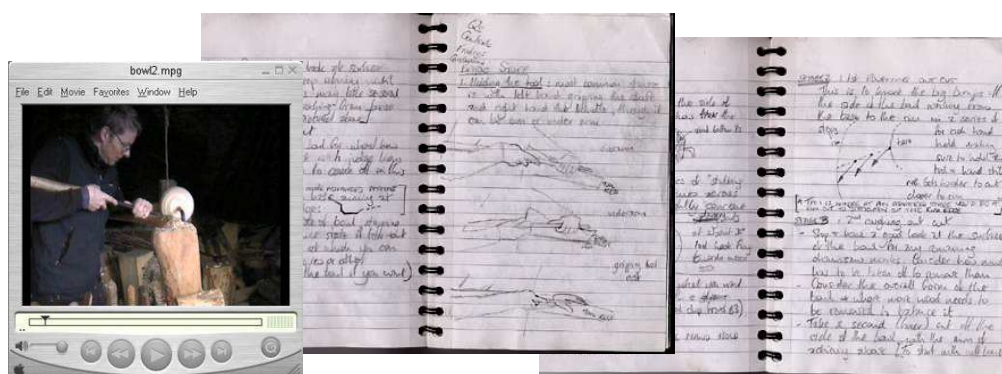


figure 3: first stage learning resource

First session with learner

The learner was encouraged to spend as much time as he needed examining the material before the practical session, which was recorded on digital video for subsequent analysis. When first confronted with the lathe, the learner expressed concern over how fast he should be treadling, a basic issue I had taken for granted having been so focussed on the cutting of the tool, but was able to show him suitable video clips on the computer to give him the confidence to start.

The learner then spent approximately 15 minutes turning the outside of the bowl, paused to watch the video again, then spent a further 25 minutes turning. During this time he gained a familiarity with the working of the lathe, managing to treadle and cut at the same time, but suffered with the tool frequently digging into the wood and was unable to work out why. He showed a keenness to experiment with method, but little sign of obviously thinking about what he had seen the practitioner doing.

This too was the limit of my knowledge. During the structured interview the practitioner had attempted to explain how the different ways of twisting the tool affected the cut but, partly due to the difficulty of establishing an effective vocabulary and partly due to my lack of experience of the process, I had failed to understand this point. I had hoped that all would become clear once I started working with the learner, but it did not, so after some discussion we decided to invite the practitioner back into the workshop for assistance. The practitioner again attempted to explain the different ways of twisting the tool, which again neither I nor the learner fully understood. As the learner continued to turn, the practitioner increasingly twisted the tool in the learner's hands to the correct position, finding words of explanation inadequate. By the end of the session, the learner had improved significantly,

but was still being frequently corrected by the practitioner and it was unclear whether he had understood enough to correct his own mistakes.

Revision of learning resource

After discussion with the practitioner, he agreed to explain and demonstrate how the twisting of the tool affects the cut at the lathe, whilst I videoed. His movement of the tool is tacit; he responds instinctively to what he can see and hear to get a true cut. To explain this knowledge, he had to simplify what is a dynamic movement into three separate movements and establish a vocabulary for explaining the differences. This time I understood the principle, partly because the practitioner had improved his explanation having been through it several times with myself and the learner. Partly because, having experienced the learner's difficulties with using the tool incorrectly, I was now able to unravel the koan and see what was being explained.

Having seemingly understood the knowledge, the next step was to see if I could distil it; to find the essence that made it communicable. I took a series of stills from the video and annotated them to illustrate the points raised by the practitioner and in addition edited a portion of the video for the learners to watch.



figure 4: second stage learning resource

In addition, I added to the resource a further video clip generally showing the working of the lathe and the practitioner working at a steady speed as background information. This time I tried to lessen my role as "user interface" and make the material more accessible by having the written information on printed sheets rather than in my notebook and the video clips available via icons on the desktop.

Second session - new learner

This learner too was given as much time as she needed examining the learning resource, then went to the workshop. It took her much longer to get to grips with the working of the lathe than the previous learner, but a significant factor in this was that she was considerably smaller than both the practitioner and the previous learner, and she was left handed. She was far keener than the previous learner to engage with the learning resource materials and in all the session lasted 1 hour 40 minutes, an hour longer than the previous learner spent before calling on the practitioner to help. During this time she learnt two out of the three tool movements and made explicit her thought processes, clearly connecting what she was doing to the material she has observed. The third movement was not achieved, partly due to physical difficulties; standing on a small block of wood, the learner found it very difficult both to treadle and hold the tool in the necessary direction.

Third session - returning learner

The returning learner was very confident that he could make a bowl on his own this time. He looked briefly through the revised material when it was offered, but mostly I feel to humour me, rather than really wanting to. As soon as he started he experienced difficulties with the tool digging in as he was using it at the wrong angle. We watched the video through once more, then he returned to the lathe but still had the same problems. We looked at the video again, this time discussing what we thought the practitioner was doing and it became apparent that we had different interpretations of what we could see. The learner returned again to the lathe and tried again as he thought he could see on the video with the same result. He then changed to what I thought we could see in the video and, although the cut was rough, the tool started cutting rather than digging in.

The session continued for about 1 hour 25 minutes, during which time the learner was highly inventive in trying many different angles to get the tool to cut smoothly, but resolutely refused any offers of help or hints from the resource or myself. During this time he had learned one of the three tool movements, but not the other two. For this learner too the reason was partly due to the physical difficulties of holding the tool at the desired angle whilst standing on a small block of wood and treading.

Conclusion

The use of digital video has proved highly effective to stimulate reflection for both the observer and craft practitioner, on both his own practice and that of the learners. The construction of a low-technology learning resource has been an effective tool for recording my understanding of the knowledge elicited and testing its veracity.

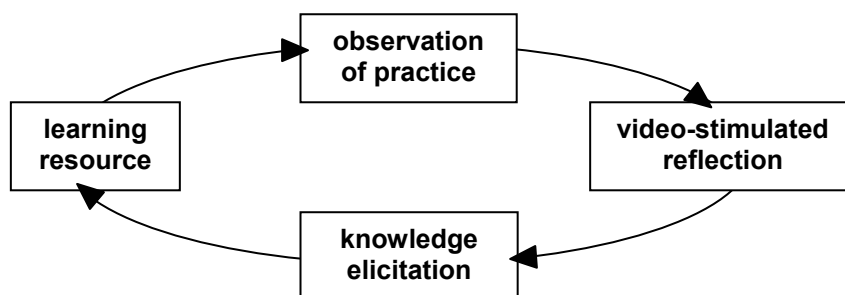


figure 5: knowledge elicitation cycle

To conclude this phase of the research one more iteration of elicitation with the practitioner is needed, followed by revision of the resource and testing with learners. After watching some of the video and discussion of the learners difficulties, the practitioner has made a practical modification to make the lathe easier to use (for himself as well as the learners!) and proposed a further explanation to assist the learners' understanding of the tool movement they are struggling with, which I shall video. To overcome the problem of interpreting what was seen on the video, I plan to revise the photographs on the printed sheets with line drawings for greater clarity. I shall then test the material again with both of the existing learners and recruit a new one to see how an inexperienced learner responds to the accumulated material.

In future research I plan to explore further the koan/reflection in action part of learning craft skills and to test the generalisability of the framework on other areas of craft knowledge.

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