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Situated cognition and cognitive apprenticeship: A model for teaching and learning clinical skills in a technologically rich and authentic learning environment

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Summary The acquisition of a range of diverse clinical skills is a central feature of the pre-registration nursing curriculum. Prior to exposure to clinical practice, it is essential that learners have the opportunity to practise and develop such skills in a safe and controlled environment under the direction and supervision of clinical experts. However, the competing demands of the HE nursing curriculum coupled with an increased number of learners have resulted in a reduced emphasis on traditional apprenticeship learning. This paper presents an alternative model for clinical skills teaching that draws upon the principles of *cognitive apprenticeship* [Collins, A., Brown, J.S., Newman, S., 1989. Cognitive Apprenticeship: teaching the crafts of reading, writing and mathematics. In: Resnick, L.B. (Ed.) Knowing. Learning and Instruction: Essays in Honor of Robert Glaser. Lawrence Erlbaum Associates, New Jersey, pp. 453—494] and *situated cognition* within a technologically rich and authentic learning environment. It will show how high quality DVD materials illustrating clinical skills performed by expert practitioners have been produced and used in conjunction with CCTV and digital recording technologies to support learning within a pedagogic framework appropriate to skills acquisition. It is argued that this model not only better prepares the student for the time they will spend in the practice setting, but also lays the foundation for the development of a clinically competent practitioner with the requisite physical and cognitive skills who is *fit for purpose* [UKCC, 1999. Fitness for Practice: The UKCC Commission for Nursing and Midwifery Education. United Kingdom Central Council for Nursing Midwifery and Health Visiting, London].
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Introduction

Background

The teaching and learning of skills is a fundamental aspect of any practice based profession not least nursing. Nearly two decades ago and around the time when many schools of nursing were first integrating with higher education, concern was expressed that emphasis on this vital aspect of the pre-registration curriculum was in decline (UKCC, 1986). In the years that followed, this concern took on a clinical focus with suggestions that new graduate nurses were deficient in skills deemed necessary to be regarded as competent and fit for practice (Wilkinson, 1996; Bradshaw, 1998).

To address this issue, *Fitness for Practice: The UKCC Commission for Nursing and Midwifery Education* (UKCC, 1999) recommended the need for nurse education to better integrate the teaching of theory and practice and to place greater emphasis on skills. As such, the acquisition of a range of diverse clinical skills is now again a central feature of the pre-registration nursing curriculum. Prior to exposure to clinical practice settings, it is essential that students have the opportunity to practise such skills in a safe and controlled environment under the direction and supervision of clinical experts. Such activity not only prepares the student for the time they will spend in the practice setting, but also lays the foundation for the development of a clinically competent practitioner who is fit for purpose. Recognition of this fact has led many nursing schools to invest in purpose-built facilities devoted to clinical skills learning. Hilton (1996) reports the success of such developments and, in a later article, describes the benefits of a dedicated technical support worker role to optimise the learning experience (Hilton and Pollard, 2004).

The Dearing report placed much emphasis upon the use of information and communication technologies within higher education (Dearing, 1997). This has since been further endorsed by the UKCC (1999) in their recommendations for the pre-registration nursing programme. Indeed, Recommendation 19 of the report draws the links between the development of practice skills, the use of skills laboratories and access to information technology. Such sentiments are shared and supported through a strategic initiative driven by the National Assembly for Wales (NAfW 2000). Indeed, it may be argued that the briefing paper challenges education to use and exploit information technologies for the purpose of greater responsiveness and flexibility of the curriculum.

The clinical practice suite

The establishment of a clinical skills learning facility is a complex undertaking. Bradley and Postlethwaite (2003) provide a detailed blueprint for such a project which addresses not just the physical environment, but also issues concerning appropriate pedagogy, user groups, and the choice of appropriate equipment and technologies to support learning.

The School of Care Sciences at the University of Glamorgan has made a considerable investment to provide a clinical practice suite (CPS) where student nurses can be taught essential skills in preparation for their practice placements. The CPS comprises a large dedicated teaching space set up in such a way as to represent a range of typical clinical settings. These include:

- Two general wards (4 beds each) with associated treatment and sluice areas.
- A critical care bed area (1 bed).
- A paediatric care bed area (1 bed).
- A maternity care bed area (1 bed).
- A cardio-respiratory assessment laboratory.

It is widely recognised that many of the complex and invasive techniques used in diagnosis and treatment are best learned and practised away from clinical areas. The CPS provides a safe, authentic environment and socio-cultural context for learning (Brown et al., 1989) that is free from the range of stimuli that would normally compete for the attention of learners in the practice setting. It allows for many clinical procedures to be simulated on mannequins and for high levels of proficiency to be acquired before students are required to practise on real patients.

Associated learning technologies

Each bed area of the CPS plus the ward treatment area has been provided with a high quality closed-circuit television (CCTV) camera and microphone so that activities at the bedside can be monitored and/or recorded in real time. Each camera is controlled remotely via a computer workstation in a central media control room adjacent to the CPS. Activities at any bed area can be recorded by videocassette recorder (VCR) to standard VHS tape or can be captured digitally in MPEG1 and MPEG2 formats directly to the hard disk of a dedicated computer workstation for subsequent review and editing. Microphone and audio facilities at each bed area allow for two-way communication with staff in the media control room.

In addition to the capture of real-time video, the technology also allows for clinical simulations to be set up and professionally recorded and for a comprehensive library of digitised materials to be developed. The materials can then be incorporated as media clips within PowerPoint presentations or used in the design and authoring of multimedia applications for delivery via CD-ROM or DVD.

This paper will go on to describe an example of work in progress that concerns the development of a multimedia DVD, used in conjunction with the technologies described, to support the teaching and learning of moving and handling skills with pre-registration nursing and midwifery students. A brief overview of the cognitive apprenticeship model that provides the pedagogic framework in which to locate this activity follows.

Cognitive apprenticeship

'Cognitive apprenticeship' is a term originally coined by Collins et al. (1989) to describe an instructional model derived from the metaphor of the apprentice working under the master craftsperson in traditional societies. In the traditional master-apprentice model, the master craftsperson will typically perform a psycho-motor skill which is first observed by the apprentice. The apprentice then goes on to attempt the skill under guidance and help from the master. Initially the apprentice is totally reliant upon the master. However, in time, the dependency begins to decrease as the apprentice acquires the skills and knowledge necessary to deal with increasingly more complex and diverse tasks (Hennessy, 1993; Jarvela, 1995; De Bruijn, 1995). A key difference between this traditional model and the cognitive apprenticeship model lies in the notion of task visibility. In traditional apprenticeship, the process of carrying out a task or skill to be learned is usually easily observable. In cognitive apprenticeship, whilst the task or skill in itself might be observable, emphasis is placed upon the thinking that must precede and be part of the task, and accompany any necessary observations made after its completion. Thus, in cognitive apprenticeship, one needs to deliberately bring the thinking to the surface, to make it visible (Collins et al., 2004).

The approach also adopts the premise that learning and instruction are influenced and enhanced by social processes that incorporate active participation within culturally organised environments and activities (Collins et al., 1989; Lave and Wenger, 1991; Jarvela, 1995). Central to this idea is the belief that learners develop conceptual understanding by participating in problems related to their real-world activities while interacting with experts (De Bruijn, 1995). This perspective of learning through activity that is perceived authentic and requiring interaction within a socio-cultural context is evidenced in the notion of '*situated cognition*' or '*situated learning*' (Brown et al., 1989), and is a central tenet in Lave's (1988) description of learning within a '*community of practice*'. Both ideas assert that *context* is crucial for learning and instruction to be effective. This compliments the underlying premise of many adult learning theories and in particular the notion that an individuals readiness to learn relates to knowledge one requires in the real world. This facilitates the creation of meaningful wholes that adults tend to rely upon for effective learning to take place (Rogers, 1996; Quinn, 2000).

Collins et al. (1989) describe the following six main components or techniques within the cognitive apprenticeship model that are used to support and organise learning activity:

- *Modelling*: This involves the expert performing the skill so that the learner can observe and build a conceptual model of the processes required to accomplish it.
- *Coaching*: Here the expert observes the learner perform the skill and offers hints, feedback, reminders, and perhaps further modelling — aimed at bringing the learner's performance closer to that of the expert.
- *Scaffolding*: Learning is supported according to current skill level, and activities are organised to assist the learner to progress to the next level. Support is gradually removed (fading) until the learner is able to accomplish the skill alone.
- *Articulation*: This involves any method of assisting the learner to articulate their knowledge, reasoning, or problem-solving processes e.g. questioning; explaining what they are doing and why they do it that way.
- *Reflection*: Enabling the learner to be critical of their own performance and problem-solving processes and to compare these with those of an expert, another learner, and ultimately, an internal cognitive model of expertise.
- *Exploration*: This involves pushing students into a mode of problem solving on their own — critical if learners are to adapt to new problems in the real world.

Central to this process is the teacher's ability to assess the learner's current needs, knowledge structure and performance characteristics (Hennessy, 1993). Therefore, critical for success is the expert/teacher's overall understanding of the skills and knowledge required for independent competence.

Applying the model

Application of the cognitive apprenticeship model will now be described in relation to the teaching and learning of moving and handling skills within the technologically rich and authentic learning environment of the CPS.

Modelling

The *modelling* component involves the student observing expert performance — this is achieved by two means. First, at the outset of the programme, each student is to be provided with a copy of an in-house developed multimedia DVD that illustrates moving and handling skills performed by expert practitioners. The medium provides students with the opportunity to access the study material at a time, place and pace that suits them best. In turn, this facilitates the pre-loading of essential content that helps them begin to develop a conceptual model of the processes required, and a frame of reference for the activities they are to see and learn. Subsequently, during skills sessions within the CPS, this is augmented by the teacher/expert introducing the skill and demonstrating the process involved while giving explanations and reasons why it is performed that way. This is important as it provides an opportunity to reveal and discuss tacit knowledge that can facilitate the student's development of the cognitive processes that underpin problem solving (Wilson and Cole, 1996).

Coaching

Following this is the *coaching* phase where the student attempts to perform the task or skill with the assistance and guidance of the teacher. This will typically involve small group collaborative working with fellow students which facilitates the social sharing of ideas and understanding required for task completion. However, care is required at this juncture in the learning process. Whilst the objective is to create a context in which students are encouraged and feel able to explore their experiences, the teacher must also be cognisant of identifying those students who display poor technique or performance because of ignoring suggestions and principles or systematically misunderstanding them (Hennessy, 1993). This is of particular concern in skills teaching as the health and safety of all students needs to be considered and indeed that of their future patients. Use of CCTV to record student activities at this stage in the model provides the basis for reflection and discussion later. The nature of the camera locations and configuration of their control means that the same 'performance' can be recorded simultaneously using multiple cameras — thus providing different perspectives of the same activity. In addition, powerful pan and zoom features enable the cameras to track student movements and provide access to a level of detail hitherto impossible to achieve.

While engaging in feedback the teacher can highlight and encourage the student to acknowledge intrinsic or kinaesthetic feedback that generates from muscles and joints during the performance — for example, are they comfortable, does it feel right (Quinn, 2000) — this is of particular relevance when students are engaged in moving and handling activities. Understanding the principles and problem solving processes related to this aspect of care is fundamental to ones own health and well being, as well as to colleagues and patients alike. Unfortunately, one only has to read the literature to appreciate how vulnerable nurses are to injury (Hignett, 1996; Smedley et al., 1997; Brown Wilson, 2001; Nelson et al., 2003).

Scaffolding

An individual's ability and pace of learning will have an influence on how much support or *scaffolding* is required for the achievement of competence at a particular skill level. Typically, as a learner's ability improves, direct support can be gradually removed or '*faded*' out. However, in different contexts, the student may require support again by way of methods such as conversational interaction (Jarvela, 1995). This presents opportunities to assess that students are not just memorising for mechanical application, but rather, they are able to transfer the skills and knowledge acquired to diverse situations in practice. Influential factors in this process are the authenticity of the problem, the quality of social interaction within the group and its readiness to explore and exchange ideas (Collins et al., 1989).

Articulation

The use of *articulation* encourages the student to self monitor, explore and explicate the rationale for strategies and actions employed, thereby rendering their tacit thinking explicit (Corcoran et al., 1988). To facilitate this, students are encouraged to think aloud while performing specific aspects of practice. This element of the model not only helps to consolidate the knowledge and skill for the individual, but also assists the student to compare and contrast problem solving abilities with those of peers or of the teacher/expert. Whereby, the interaction that ensues becomes less teacher-centred to one that reflects a more collaborative problem solving activity (De Bruijn, 1995).

One influential aspect for this to be effective is the concept of '*situated cognition*' (Brown et al., 1989). The group activities in the clinical practice suite are able to provide a meaningful social context for learning to take place. They provide the students with an opportunity to observe, practise and receive feedback within an environment that authentically replicates the clinical setting.

Reflection

The use of *reflection* as a learning tool is well established within professional education and stems from the work of Schön (1983). Since then it has been widely advocated by nurses and is firmly embedded within both pre and post registration curricula across the UK and beyond. In this phase of the model *reflection* requires the expert/teacher to direct and encourage the student to analyse and be critical of their performance/experience. This may be undertaken immediately following the activity by asking reflective type questions such as, ''*how do you feel that went?*'' ... or ... ''*why did you choose to do it that way?*'' The CCTV footage also supports such activity by providing a visual record of a student's performance. The recording serves a number of important and useful purposes:

1. It can be used as a basis for critiquing overall performance whereby replay can occur as many times as is necessary to promote understanding. Critical appraisal and what Schön (1990) has called '*reflection-on-action*' might be facilitated through the use of a personal reflective journal of observations made or through group activity and discussions led by the teacher.
2. Used in conjunction with the high quality DVD demonstrating expert practice, techniques such as *abstracted replay* can be used to allow the critical features of expert and learner performance to be compared and differences highlighted.
3. Over time, successive recordings provide a permanent visual history for the student that can demonstrate progression and achievement of competence at the '*shows how*' level of Miller's (1990) hierarchy.

Exploration

The final phase of the model is *exploration*. The objective here is to encourage students to consider how skills and knowledge they have learned can be adapted to new situations in the practice setting. For example, how do moving and handling skills taught in the context of a general ward translate to an intensive care setting where patients may be attached to a ventilator and numerous other items of equipment? Similarly, can the same principles be applied and techniques used when caring for patients in their own home when working alone and in the absence of lifting equipment? Clearly there is a strong argument here for continued learning from clinical experts in a range of practice settings. Indeed, because of the complexities of the practice placement and the student's requirement for acceptance into this arena, it has been argued that a student's capacity to learn from established members of this community is a crucial aspect of the learning process (Cope et al., 2000).

Discussion

This paper has set out a model for teaching and learning clinical skills in a technologically rich and authentic learning environment. However, implementation of this model in practice raises a number of important issues and presents new challenges to both student and educator.

Technical support

Such a model is doomed to failure without adequate technical expertise and support. The CPS has a dedicated full-time audio-visual technician whose role extends far beyond the maintenance and operation of the CCTV and audio equipment. Associated activities will include such things as digital video editing, digital library management and

CD-ROM/DVD production, all of which require skills in various specialist software applications. Systems need to be developed to enable students' ease of access to their digitized video files. At Glamorgan this is accomplished via a centralised digital library with powerful cataloguing, search and retrieval features, capable of access from any networked PC on campus. In time, the intention is to develop a web-based interface that will extend access off-campus and provide greater flexibility for learners.

Staff development and training

There is currently a team of four staff within the CPS whose time is devoted solely to teaching clinical skills and supporting the needs of students during their time in the suite. Each has undergone a basic level of training to operate the CCTV, audio and recording technologies should the need arise. In addition to this, other lecturing staff will typically be involved in skills teaching at various points within the curriculum. Working with students in such an environment presents many new challenges. For example, consideration must always be given to the optimum positioning of facilitator and participants in relation to camera and microphone locations to ensure that the best possible recording is made. Using video as a basis for critical appraisal will be unfamiliar to many educators and requires the development of new, or adaptation of existing, skills and techniques.

Curriculum integration

One of the biggest challenges for adopting such an approach concerns that of curriculum integration. Producing high quality DVD to demonstrate expert practice can be a time consuming activity. Whilst the capture of the CCTV footage itself need not overly extend the typical time required to teach or perform the skill, adequate time must be found within the timetable to review the recorded materials and provide supportive feedback to the students. Roter et al. (2004) describe an innovative video feedback technique whereby the recording is digitized, analysed and coded by experts using specialist software. The results are copied to a CD-ROM which is then used to provide individual feedback to learners. However, with large cohort sizes of around 150 students, this may not be a practical solution. Clearly there is a need to be selective about the skills which are best taught utilising this model. It has been described here in relation to the teaching and learning of moving and handling skills where evidence of achievement of competence is a pre-requisite for attending clinical placements. However, various factors may well place emphasis elsewhere in the curriculum. Another approach would be to develop a range of patient scenarios or clinical simulations that require learners to demonstrate effective teamwork — cardio-pulmonary resuscitation of a patient provides a good example. Review and feedback can then be facilitated with a group as opposed to with individuals, thus reducing the time required overall. Evidence would suggest that the use of video as a basis for reflection on clinical skills learning is evaluated positively by educators and students alike (Minardi and Ritter, 1999; Anderson and Stickley, 2002; Docherty et al., 2005). Thus one could argue that finding ways to overcome any timetabling difficulties would be time well spent.

Conclusions

The acquisition of a range of diverse clinical skills is a central feature of the pre-registration nursing curriculum. Prior to attending practice placements, it is essential that students are afforded the opportunity to practise and develop such skills in a safe and controlled environment under direct supervision from clinical experts. Information and communication technologies can be used effectively in various ways to support and enhance the learning process. This paper has shown how DVD, CCTV and digital recording technologies can be used to support the teaching and learning of moving and handling skills. The clinical practice suite described provides a technologically rich and authentic context in which to plan, structure and deliver skills teaching in a systematic way.

However, the use of technology needs to be located within a framework for learning appropriate to the acquisition of skills. The cognitive apprenticeship model provides such a framework that emphasises the cognitive processes of problem-solving and makes them visible components of the learning experience. This enables emphasis to be placed upon both the 'psycho' and 'motor' elements of the skill and enables the student to acquire an integrated set of skills through the processes of observation, guided practice, articulation reflection and exploration.

Implementing the model requires considerable investment not only in terms of equipment cost, but also in terms of technical expertise required, staff development and training, and time—time to consider the optimum way to integrate and effectively deliver the model within the curriculum.

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