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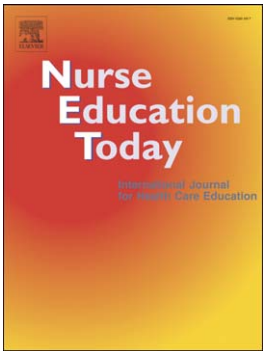

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A model to teach concomitant patient communication during psychomotor skill development.

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Introduction

In clinical practice, health professionals perform psychomotor tasks (also termed procedural, clinical or technical skills) that are unique to their discipline. Most clinical skills, when performed on a conscious patient require simultaneous communication with the patient, using a set of vocabulary distinct to the discipline (Nestel, Kneebone, and Kidd 2003; Nestel, Kidd, and Kneebone 2003; Kneebone et al. 2002; Pugh et al. 2015). Historically, priority has been given to learning the procedural task, i.e. accurate performance with correct sequencing and timing, before learning the inextricably linked and co-occurring communications skills. The decision by the educator to preference the teaching of the task before the linked communication skills has unintended learning benefits. This is because the learner derives, through practise, the experience of the sensory and tactile responses that are associated with performing the task steps. The learners need this knowledge of the sensory manifestations associated with performing a task before they are able to explain to the patient what they will feel, hear, see, smell, and importantly, at what time these will be experienced. However, having a knowledge of these sensory outcomes does not necessarily equip a learner with the vocabulary and the communication skills to be able to describe them to the patient.

Notably, little attention has been paid to how the learner gains this knowledge of sensory outcomes or the concomitant verbal communication skills that accompany a clinical task. In an era where the delivery of patient-centred care is now a focal point of health professional education it is vital that there is equality of both skills. That is, the skill of effective communication during task performance as well as being a competent practitioner. At the time of task performance, being an effective communicator is one facet of providing patient-centred care (Cushing 2015; Nestel and Kneebone 2010). Examples include: verbally engaging with the patient, disclosing and conveying relevant information related to task execution (Bearman, Anthony, and Nestel 2011), and using an engaging and empathetic style at the time a procedure is being performed (Cushing 2015; Deveugele 2015; Noble et al. 2007). For each new task performed, both the procedural and communication skills must first be taught, then acquired, and finally learned over time (Aspegren 1999; Burton and Dimbleby 1990; Nicholls et al. 2016). We suggest that the task should be learned in advance of the co-occurring communication skills. This approach enables the learner to first gain a knowledge of the real-time sensory and tactile norms linked to task practice, prior to practising the procedure. With advancing task proficiency, and the freeing up of working memory, the learner is more capable of paying attention to the educator's vocabulary and communication style which is used to describe to the patient the task steps and the expected outcomes as they occur.

More than a decade ago, a limited number of authors (Yoshida, Milgrom, and Coldwell 2002; Kneebone et al. 2002; Nestel, Kidd, and Kneebone 2003; Nestel, Kneebone, and Kidd 2003) pointed out that it was a rudimentary requirement of all health professionals to be able to communicate with the patient at the time a task was being performed. At this time, some educators believed that the skills to become an effective communicator for clinical task performance were taught during the undergraduate curriculum (Kneebone et al. 2002). However, Yoshida, Milgrom, and Coldwell (2002 p.1281) found that the educational practices used to teach communication skills to dental students attending American medical colleges were unstructured and loosely evaluated. Therefore, there were concerns that the students were not being equipped with effective communication skills for task performance. Similarly, Nestel et al. (2003) reported that nurses did not receive adequate communication training during their undergraduate education. Subsequently, health disciplines have made broad sweeping changes to their curricula in a quest to enhance health professional students' communication skills and equip them with the knowledge, skills, and attitudes to be able to deliver patient-centred care (Deveugele 2015; Cushing 2015). Paradoxically, there remains a limited literature outlining the pedagogical approach to teach and learn the concomitant psychomotor and communication skills for a given procedural, clinical, or technical task. Importantly, and to our knowledge, there is no model or method to specifically guide the acquisition of the communication skills linked to task performance. Therefore, it is unclear how these skills are taught and learned in clinical practice. A decade or more has passed since this body of work and little is known of the pedagogical techniques or best practice approaches to teach the communication skills that are inextricably linked to psychomotor skill acquisition and practice.

The purposes of this paper are threefold: 1) to evaluate the theoretical and instructional approaches currently used to teach basic communication skills; 2) to review the current skill teaching models and determine whether they make provision to teach the simultaneous communication skills related to a task on a conscious patient; and as a result of these findings 3) to suggest an instructional approach for educators to use to teach the communication skills required for competent task practice.

A review of the literature

A literature search was undertaken using the following data bases: Google Scholar, ProQuest, ERIC, CINAHL, and Medline, between 1990-2016. The keywords and phrases used for the literature search included: 'teaching', 'simulation', 'role-play', 'technical skills', 'procedural skills', 'clinical skills', 'psychomotor skills', 'non-technical skills', 'communication skills', 'teaching method', 'teaching model', 'education', 'medical', 'nursing', 'dentistry', 'allied health', 'postgraduate', and 'undergraduate'. Additionally, the reference lists of the retrieved papers were checked. Those

references which included 'psychomotor skill', 'procedural skill', 'communication' or 'non-technical skills' in their title or as a keyword were also included in the review. There were 103 publications retrieved. Identified references were excluded when: 1) the main purpose of the article was to report deficiencies in communication skills within a profession and/or to suggest these skills be included in the curriculum; 2) the central outcome related to assessment; 3) the non-technical skills described talking to fellow peers and colleagues and not patients; and 4) duplicate papers were identified. Following the exclusion process, 30 articles remained and they were thematically analysed to meet the paper's aims. Synthesis of the retrieved literature identified that the teaching of communication skills to health professionals requires a stepped and sequenced pedagogical approach (see Table One), and often delivered using role play and the receipt of end-of-task feedback. In contrast, there was a paucity of literature detailing the instructional approaches to be used by educators when teaching the co-occurring communication skills that are required when a clinical or procedural skill is performed.

The communication steps required to complete a clinical skill

Effective patient communication relies on the learner being informed of the distinct points-in-time that communication is needed when a clinical skill is performed on a patient. Importantly, Bearman et al. (2011) and Nestel et al. (2003) pointed out that performing a procedural skill on a conscious patient may require up to four discrete stages of verbal communication. The first step is to explain what the procedure entails and obtain informed consent. Following this, the clinician explains what they are doing during the procedure. Thirdly, there may be error disclosure (if necessary), and finally communication of any post procedure care needed (Bearman, Anthony, and Nestel 2011). To deliver this entire package of information to the patient, the clinician requires knowledge of the task, standards of practice, as well as effective communication skills. Furthermore, we suggest that the language and vocabulary used to inform the patient is often discipline specific. Therefore, the educator should attend to teaching the learner a glossary of words to accompany and simply explain the executed task, without using jargon. Adopting an inclusive approach with the patient enables them to understand what is about to occur. Furthermore, the open forum of communication encourages a rapport to be established, which fosters a pathway of two -way communication between clinician and patient.

Execution of skilful and effective communication, at the time of task performance, relies on the practitioner using both verbal and non-verbal elements (Lucander et al. 2012; Teutsch 2003). The non-verbal component is comprised of body language, voice tone, and mannerisms such as making

eye contact (Teutsch 2003). The focus of this paper is on acquiring and developing *verbal* dialogue skills which are used *at the time* a clinical skill is performed.

The benefits of being an effective communicator at the time of task execution

The real-time verbal interaction with a conscious patient, as a clinical skill is performed, is an example of a complex skill and involves the health professional being able to convey to the patient what the task involves as it is performed. The antecedent benefits of becoming an effective communicator are however only realised when learners have acquired the relevant communication principles and know how to use them effectively. At the time of task execution, this often involves explaining the task sequencing (where required), outlining how the patient may be required to assist during the task (such as holding their breath or swallowing), highlighting the sensory repercussions they may feel as specific steps are performed ("needle prick and then a sting now" or "you may hear a crunching noise now as the speculum is removed"), and checking on their wellbeing throughout the procedure. The provision of a commentary by the clinician provides a platform to establish a professional relationship with the patient, as well as building trust and co-operative investment (Maatouk-Bürmann et al. 2016). The latter is essential for those procedures that require patient participation to complete the task. For example, during a CT-guided percutaneous needle biopsy of a lung mass the patient is advised not to cough, wriggle or change their breathing pattern (Wu, Maher, and Shepard 2011).

Being an effective communicator involves the clinician being cognisant of a patient's cultural aspects (Jayawardene and LaDuca 2014), and being able to understand the patient's tone of voice, behaviour, and style of verbal communication (Nestel, Kidd, and Kneebone 2003). Additionally, it is important to have the nuanced communication skills to engage with patients when they are angry, in pain, or asking difficult questions. This skill becomes particularly challenging to execute for all practitioners when there is a language barrier (Catana 2014), or if the patient is intellectually disabled, stressed, or anxious (Kai 2005). There are numerous benefits derived from effective communication with patients. These include improved patient satisfaction and compliance (Teutsch 2003), efficient assessment of patient history, and a reduction in patient distress and anxiety (Yoshida, Milgrom, and Coldwell 2002; Jayawardene and LaDuca 2014). Importantly, the outcomes of being an effective communicator include reduced patient complaints (Deveugele et al. 2005; Maguire and Pitceathly 2002) and fewer post-operative complications. In contrast, poor communication may result in negative patient responses and outcomes. These may develop when the clinician communicates unnecessary and superfluous information that causes patient anxiety

(Jayawardene and LaDuca 2014) or alternatively they may flounder, not knowing what to say to the patient (Noble et al. 2007), so providing insufficient information. Consequently, the patient experiences a loss of confidence in the clinician and is reluctant to accede to instructions provided by the health professional (Maguire and Pitceathly 2002).

The limitations of working memory: overload from teaching communication skills with task performance

Silverman and Wood (2004) suggest that communication skills are more complicated, therefore more difficult to teach and learn, than the majority of procedural tasks. This is an important consideration because multi-part and complex procedural skills are difficult to teach and learn (Nicholls et al. 2016). Therefore, when the educator attempts to simultaneously teach the co-occurring communication skills linked to task practise, and the skill is multipart, the educational outcomes become tenuous. In this teaching setting, there is real potential for the educator to place the learner into cognitive overload, when the task steps and communication skills are taught concomitantly. As this practice overloads the finite capacity of working memory, when the tasks are new and unfamiliar to the learner. This is because learning a new and multi-stepped task involves a large amount of data being placed on the "clip board" of the central processing unit of the brain (or working memory) which requires processing. When the data is both novel and large in volume the brain becomes "bottlenecked" and then overloaded, due to the limited processing capacity of working memory. The constraints of working memory is referred to in cognitive load theory, and they have noteworthy teaching and learning outcomes (Leppink and Heuvel 2015; van Merriënboer and Sweller 2010; Young et al. 2014; Spruit, Band, and Hamming 2015). In a clinical practice setting, overloading working memory results in protracted learning outcomes, erred student performances and practice renditions (van Merriënboer and Sweller 2010; Young et al. 2014; Leppink and Heuvel 2015), as well as attention paid to performing one task at the exclusion of another (Spruit et al. 2014). Therefore, when the task being taught is both complex (multipart) and difficult, the content should be delivered in sequential, logical, and small chunks using an uncomplicated teaching format (Leppink and Heuvel 2015). Hence, psychomotor and communication skills linked to task practice should not be taught at the same time, but rather as distinct skill sets taught and learned separately, with a transition to integrated whole-task performance.

Two studies were identified which exposed the educational outcomes of learners striving to learn to communicate with a conscious patient at the time of task execution. Kneebone et al. (2002) explored the performance of second and third year undergraduate medical students who were tasked with

communicating with a simulated patient whilst performing a procedural skill. One of their objectives was to investigate whether the co-occurring communication and procedural skills could be taught and practised concurrently, thus avoiding disassociation of two inextricably linked skills (when learned separately). The clinical task being undertaken was either urinary catheterisation or wound closure. For each scenario**,** a simulated patient with an attached latex phantom was used to create an authentic practicum. The participants had received prior clinical training (during a six-week clinical placement) to both perform the procedure and communicate effectively. However, the study provided no details of the method used to equip the participants with the necessary skills or vocabulary to communicate with the patient nor how to integrate the two activities. The authors stated that " ..all participating students had received communication skills teaching, prior to entering the study" (Kneebone et al. 2002 p.629). A major finding of the study was that the participants could either execute the procedure or communicate with the patient**,** but not perform both activities together (Kneebone et al. 2002 p.633). A further outcome of the study was that none of the participants completed the tasks in the allotted time of ten minutes. These findings suggest that the integration of communication and psychomotor skills, for this cohort of novice practitioners, was cognitively demanding. This inability to complete an integrated task in a pre-determined time frame suggests that the learner's cognitive processes became overloaded. Furthermore, the results highlight that these students were incapable of attention splitting which has also been recognised by Spruit et al. (2014). Thus**,** the majority of the learners elected to complete only one of the two tasks.

In the second study, Nestel et al. (2003) taught a multi-part procedural task (ellipse excision of a skin lesion and wound closure) to a small group of eight experienced nurses. The focus of the training was on the nurses' procedural skills and not specifically the communication abilities that accompanied the task performance. In particular, the nurses had received neither prior communication skills training or specific verbal training to accompany the tasks being performed (Nestel, Kneebone, and Kidd 2003 p.293). They found that despite the nurses being proficient practitioners in their usual context, they suffered anxiety when the new tasks were performed together with communication. The results of this study raise some noteworthy considerations. First, the opportunity to practice skills using a structured teaching and feedback method was invaluable. However, when two complex tasks were executed simultaneously, the participants made unconscious technical mistakes, exhibited skill regression below their pre-course level, and experienced anxiety (Nestel, Kneebone, and Kidd 2003). This suggests that the cognitive demands of performing two complex tasks together placed an excess burden on their working memory, and resulted in cognitive overload. This limited evidence suggests that it is important for the student to learn procedural skills in context to the concomitant communication skills linked to task practice.

However, the evidence also suggests these skills should not be taught concurrently, because doing this places both inexperienced and experienced clinicians into cognitive overload.

An implied skills-teaching curriculum

Currently, psychomotor skills are taught and acquired in simulation-based or patient-based learning environments using a range of skill teaching models (for examples see George and Doto 2001; Walker and Peyton 1998; Raman and Donnon 2008; Hammond and Karthigasu 2006). Some of these models include an instructional routine which requires the learner to verbalise the skill step(s) before performing the task (for example Walker and Peyton 1998; George and Doto 2001). The purpose of the instructional routine is not to develop the learner's communication skills which are linked to task performance, but to ensure the student knows the requisite sequencing, timing, and motor actions to perform the procedure before executing them. However, when the patient is conscious, most clinical skills are not performed in a vacuum of silence. Yet there are no educational frameworks, that we could identify, which outline an approach to teach the concomitant communication skills. This suggests that the skill is taught and learned on-the-job as part of an implied skill-teaching curriculum. Nevertheless**,** there are scattered publications on the methods and approaches used to teach the verbal communication skills required by health professionals. The review of the articles will now be presented, identifying seven steps that are needed to teach communication skills in health education.

The theoretical principles to teaching communication skills

The review of the retrieved seminal and contemporary skills teaching literature, as presented above, identified seven instructional steps to effectively teach communication skills. Deveugele (2015 p.1288) points out that communication skills should be intentionally taught, using a logical and chronological approach. Therefore, these steps (along with the rationale and strategies for each stage of the teaching and learning process) are shown in Table 1. Teaching a learner how to become an effective communicator can be deconstructed into four main steps: 1) pre-skill conceptualisation; 2) teaching the theory and principles to effectively communicate at the time a procedural skill is performed; 3) role modelling the standard of performance, and 4) acquiring and learning the communication skills linked to task practice - from role-plays to on-the-job practice and the provision of feedback.

Insert Table one here

Pre-skill conceptualization

Step One in the educational process is to identify the communication script and skills to be taught. The selected skill should then be broken down into the knowledge, task, and professional practice attributes related to its execution and into teachable portions – also termed cognitive task analysis (Jabbour et al. 2011; Sullivan et al. 2007). This is an important step to avoid overloading the learner's working memory during the initial stages of knowledge and skill acquisition. Step Two is to undertake a needs assessment for the learner. Evaluating the student's current communication skill level and ability is necessary (Bearman, Anthony, and Nestel 2011; Cushing 2015) to ensure the selected teaching and learning activities are aligned with the capabilities of the participant. This instructional step is essential to avoid learner disengagement.

Teaching the theory and principles of effective communication

Step Three involves teaching of the theoretical principles of verbal communication using pedagogical techniques suited to the learning context (Bylund et al. 2008; Heaven, Clegg, and Maguire 2006; Maguire and Pitceathly 2002). It is important for the learner to understand and know the theoretical principles that are required to become an effective communicator, and this can be achieved through a range of pedagogical approaches. The delivery of theoretical principles is then followed with teaching the formal knowledge to perform the verbal communication, and the linking of the communication skills required for task execution.

Role modelling the standard of performance,

In Step Four, the communication skill is performed by an expert using a live or video exemplar of performance to role-model the standard of performance. It is crucial that the behaviours and monologue for the task are correctly depicted and meet professional practice standards (Deveugele 2015). The visual and auditory exemplar serves as a standard of performance for the learner (Anderson and Sharpe 1991; Cushing 2015).

Acquiring and learning the communication skills linked to task practice

The next three steps are inter-connected. There is consensus among researchers that communication skills are acquired and learned *only* through active and experiential learning (Bylund et al. 2008; Maguire and Pitceathly 2002; Deveugele 2015; Maatouk-Bürmann et al. 2016), and the provision of feedback is instrumental to develop and reinforce correct skill acquisition (Berkhof et al. 2011). Therefore, Step Five is to provide the learner with facilitated *skill practice using role-play* (with and/or without simulated patients and inclusive of feedback), followed by Step Six which is to transition to supported practice in the clinical setting. It is essential that these encounters are

assisted by accomplished and trained educators in order to be able to effectively facilitate the student's task advancement from role-play to workplace practice (Bylund et al. 2008; Heaven, Clegg, and Maguire 2006). Practice opportunities allow the learner to scaffold their knowledge from "knowing" to "showing how" (Cushing 2015), and it is through role-play that skills can be safely rehearsed, remodelled, and refined (Berkhof et al. 2011). Conscientious practice is required to acquire and then reinforce new knowledge and behaviours (Cushing 2015). Step Seven, the final aspect, is to provide *feedback*, and wherever possible by using a recording of the learners' own performance for both self-assessment and educator feedback. Following the practice episode, the educator provides guided reflection, where the learner reviews and listens to an audio or video recording of their practice performance, and the educator supports them to explore what they did well and what could be improved at future attempts (Bylund et al. 2008). Additionally, trained simulated patients are a valuable resource to provide feedback to the learner on their clinical practice behaviours and attitudes (Maguire and Pitceathly 2002). This feedback can then be used to refocus the learner's goals for the next encounter, and foster the development of their self-assessment skills. With ongoing practice and facilitated reflection, skill acquisition can be scaffolded from initially using role-plays to then performing the skill on a simulated patient (Pugh et al. 2015), and finally in the workplace. Teaching a communication skill culminates with the educator providing objective feedback on whole task performance. This is instrumental in effecting and galvanising the required changes in the learner's behaviour and attitude to become an effective communicator, as well as supporting skill transfer into the clinical setting (Bylund et al. 2008; Heaven, Clegg, and Maguire 2006; Berkhof et al. 2011).

To avoid the effects of cognitive overload when learning two contrasting and multi-part skills, the procedural and communication skills should be taught and learnt separately, and then combined. For clarity of presentation, the model to teach communication skills in figure 1, omits the important relationship between teaching the procedural task and the concomitant communication skill. We suggest that the psychomotor task should be taught and learnt *before* the communication skills linked to the procedure. This is because the learner must first have a solid understanding of the clinical skill and they must know the likely sensory elements that will be experienced by the patient before they are able to describe the chronology and timing of the task steps (and the likely sensory repercussions the patient may feel or hear).

Conclusion

There is an acknowledged need that health professionals should be able to effectively communicate with a patient at the time a procedural skill is performed. This paper synthesises the literature on the

teaching and learning approaches required by the educator to develop the basic communication skills concomitant with clinical skill performance. A seven-step model to teach concomitant communication skills has been presented. We suggest that the co-occurring clinical skill is acquired and performed before teaching the related communication skills in order to minimise the effects of cognitive overload. To our knowledge this is the first time an explicit pedagogical approach has been posited to teach the concomitant communication skills that are linked to performing a procedural task.

Conflict of interest

There is no conflict of interest.

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Table One: The pedagogical steps to teach verbal communication skills for clinical skills

Steps to teach a communication skill	Educator strategies and rationale
1) Identify the verbal script and skills to be taught	List the skills, knowledge and vocabulary required by the learner to perform the task. Break the skill down into sections to avoid the effects of cognitive overload and to identify teachable portions (Haji et al., 2015; Jabbour, Reihsen, Sweet, and Sidman, 2011; Leppink and Heuvel, 2015; Sullivan et al., 2007; van Merriënboer and Sweller, 2010; Young et al., 2014).
2) Perform a needs assessment of the learner	Establish the communication skill level of the learner. Assists correct assignment of learner activities to their ability. Avoids learner disconnection or overloading them (Bearman et al., 2011; Cushing, 2015).
3) Teach theoretical knowledge and principles	Identify the key words or vocabulary that are linked to the clinical experience and teach/make explicit to the learner. Provide an overview of the theory and principles required to be an effective communicator (Bylund et al., 2008; Heaven, Clegg, and Maguire, 2006; Maguire and Pitceathly, 2002).
4) Role-model the standard of performance	Real-time demonstration of a standard of performance for the skill (learners must first observe the behaviour before being able to replicate the standard) (Anderson and Sharpe, 1991; Cushing, 2015).
5) Role-play with and without simulated patients	Provide a safe and interactive learning opportunity. Participants practice and refine: word selection, dialogue, delivery, timing, and new behaviours (Cushing, 2015; Deveugele et al., 2005; Lane & Rollnick, 2007; Maatouk-Bürmann et al., 2016). No requirement to simultaneously pay attention to the clinical needs of the patient (Kneebone, 2003; Kneebone, Nestel, Vincent, & Darzi, 2007). Simulated patients can be used to further develop the participant's talking, listening and situational awareness skills (Yule et al., 2008). Simulated patients are costly (Lane & Rollnick, 2007); therefore, peers and colleagues may assist with role-plays (Back, Arnold, Tulsky, Baile, and Fryer-Edwards, 2003)
6) Skill practice	Provide multiple practice opportunities. Participants acquire, perform, and refine new behaviours and language skills. Skill transfer from the simulated environment to the clinical setting is contingent on guided educator supervision (Anderson & Sharpe, 1991; Ericsson, Krampe, & Tesch-Romer, 1993; Heaven et al., 2006; Lane & Rollnick, 2007)
7) Feedback using a video or audio tape of skill practice, or from other agents	Provide the learner with an opportunity to compare their own observed practice with the model of expected performance. Consider analysis of word selection, voice tone, and the speed at which the learner delivers their words. Feedback when using role-plays should follow these principles "learner first, positive first, constructive alternative". Procure feedback from the simulated patient (when beneficial to the learning experience) (Bylund et al., 2008 p. 433). Objective evaluation, facilitated by the educator, is an important tenet of skill practice and feedback because self-reflective practice alone can be unreliable (Yule et al., 2008).

Research Highlights

1. Most clinical skills, when performed on a conscious patient, require simultaneous communication with the patient, using a set of vocabulary distinct to the discipline.
2. To become an effective communicator, both the vocabulary and skill must first be taught, acquired, and then learned.
3. Communication and clinical skills are both complex and difficult to learn, and therefore they should not be taught concurrently.
4. A seven-step model is posited as a guide for educators to teach the communication skills required at the time a clinical task is performed.
5. The development of effective communication skills requires the learner to: have a standard of performance role modelled for each core communication skill; intentionally practise the skill; receive feedback on their performance; and be supported as they transfer the skill into the clinical setting.