ORIGINAL RESEARCH

Exploring the black box of practical skill learning in the clinical skills center

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Received: May 12, 2015 **Accepted:** August 4, 2015 **Online Published:** August 28, 2015
DOI: 10.5430/jnep.v5n11p131 **URL:** http://dx.doi.org/10.5430/jnep.v5n11p131

ABSTRACT

Background: Learning in skills centers has a long tradition in nursing education. Nurse educators struggle to substantiate their opinions on the efficacy of simulation technologies over traditional methods of instruction and it is suggested that they should re-evaluate their methods when teaching psychomotor skills. A necessary step before evaluation is to unravel what the students are actually doing in the skills center. Purpose: The purpose of this study was to explore nursing students' practical skills training in the skills centre to label and define generic learning actions used during the learning of two specific skills; wound care and dressing, and sterile gloving.
Methods: A qualitative observational study of nursing students' practical skill training in the skills center was developed. Students across three cohorts were video recorded while practicing wound cleaning and dressing, and donning and removing sterile gloves. Verbal interaction on the video recordings was transcribed. The core analytical process was the joint listening to and watching of videos with following discussions of interpretations and development of categories.
Results: Seven categories of learning actions were developed: Parallel action and self-instruction, watch and copy, collaborating to find solutions, giving support, seeking support, recontextualising the skill, and humorous enactment with the equipment. The categories are exemplified and discussed in light of learning theory and research on aspects of scaffolding.
Conclusions: The learning actions described in this study are a starting point in detailing students learning actions during skills training. Students' learning in other practical nursing skills should be studied to accumulate more knowledge about students' learning actions and how peer interaction supports or hampers learning. The relevance of the learning actions should be explored in the clinical setting. A goal is to lay the groundwork for better design of learning in skills centers in nursing education.

Key Words: Skills center, Nursing students, Skill acquisition, Scaffolding, Peer learning

1. INTRODUCTION

Nursing students are taught and practice in skills centres in order to prepare for clinical placements. Learning in skills centres has a long tradition in nursing education,[1] is deemed vital in students' learning for practice,[2] and has increased in importance as clinical placement opportunities have been reduced.[1] There is a common understanding in nursing education that students must prepare through learning in skills centres before they move on to learn in the clinical setting. This order of learning is based on assumptions of transfer, *i.e.*, that practice in the skills centre will give the students both knowledge and skills that promote performance and further learning in the clinical setting.[3] This order of learning is also deemed necessary in order to increase patient safety

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related to student nurses' practice of skills in the clinical setting.[4] In this frame of understanding it is important to enhance students' learning in the skills centre. In a recent review Rourke *et al.*[5] stated that nurse educators struggle to substantiate their opinions on the efficacy of simulation technologies over traditional methods of instruction. Ross[6] suggests that nurse educators should re-evaluate their methods when teaching psychomotor skills. A necessary step before such evaluation is to unravel what the students are actually doing in the skills centre. In the present study we explored skills practice among first year nursing students in traditional psychomotor skill learning sessions in the skills centre. The purpose was to tease out the generic learning actions used by students while practicing specific psychomotor skills and thereby start to build a set of concepts of skill learning on a meta level.

Learning in the skills centre falls well within the situative perspective on knowing and learning.[7] In this perspective "...knowing is viewed as practices of communities and the abilities of individuals to participate in those practices, [and]...learning is the strengthening of those practices and participatory abilities".[7] In the skills centre setting students may use individual learning strategies, but this setting also promotes collaborative learning between peers because students are organized into small groups when they learn practical skills. Details about nursing students' learning processes are generally sparse because research in nursing education focuses on learning outcomes.[8,9] This is similar to the status of research in other fields of learning.[10] The educational value of collaborative learning between peers has been clearly demonstrated in children's learning,[11] and also somewhat at the university level.[12] In a systematic review of peer learning studies in nursing education Stone *et al.*[13] reported positive outcomes in confidence, competence and decrease in anxiety in 16 of 18 studies, however only one study was concerned with peer learning in a skills centre.[14] Eraut[15] proposed that learning in groups prepared health professionals for future learning with and from peers since further learning opportunities at work occur in a social setting. Putting students in groups does not necessarily induce collaborative learning.[16] Much of the potential for collaborative learning in groups lies in the interaction among group members through discussion, explaining and co-construction of conceptual knowledge.[17] Roscoe and Chi[10] found that a key to understanding the learning potential of peer tutoring lies in the details of peer interaction.

Actual practical skill learning in nursing education is sparingly studied,[18] and therefore neither easily laid out for discussion or reform. Strand *et al.*[18] focused on how same level students experienced their learning in the skills centre. Peer assisted learning allowed for playfulness and humour which in turn promoted creativity and motivation. Collaboration in role play implied including each other's experiences in understanding of the skill. They saw differences in actions which increased their understanding of their own actions. Three other studies report on collaborative learning in peer learning schemes in the skills centre between younger and older nursing students. These studies however, were more focused on the students' perceptions of outcomes from this collaborative scheme than the actual learning processes going on. Owens and Walden[19] used a peer instruction scheme during skills training over a period of three years. An evaluation form was completed by 270 students and showed that students perceived a reduction in anxiety in relation to psychomotor skills testing, and an increase in confidence in skill performance. Goldsmith *et al.*[14] also reported that students valued a peer learning partnership in terms of personal growth, receiving feedback, and perceived improvement of their performance of practical skills. Students' satisfaction with peer learning was reported in an anecdotal manner in a study by Bensfield *et al.*[20] Students perceived decreased stress and anxiety due to peer guidance and indicated that older peers were a source of motivation and engagement.

Practical skill learning in nursing education today is grounded in traditions stemming from the period when schools of nursing were divorced from their "mother" hospitals.[21] The traditional way of organizing psychomotor skills teaching and learning was to offer a teacher mediated demonstration of the skill(s) in question, to let students practice on each other in small groups,[22] and for the teacher to give some form of feedback or evaluation.[21] Basically this organization prevails today in traditional skill learning, although all phases of teaching and learning can be supported by new technology such as technology-based demonstration of the skill, video-monitoring and feedback, and role play with peers can include task trainers and static manikins. Traditional skill learning and low-fidelity simulation are characterized by less pre planned and fixed alternatives of action than intermediate- and high-fidelity simulation, and are more open to initiatives from the students themselves. The purpose of this study was to explore nursing students' practical skills training in the skills centre to label and define generic learning actions used during the learning of two specific skills; wound care and dressing, and sterile gloving.

2. METHODS

2.1 Design

The present study is part of a larger study exploring peer-learning during skill learning in the skills centre.[23] The

study had an open and exploratory design since there exist little knowledge about what specific learning actions nursing students engage in when learning practical skills.[24]

2.2 Sample and setting

In the larger study, nursing students across three cohorts (year 2006-2008), in one Norwegian nursing college, were invited to join in the study by the teacher responsible for skill learning. Three groups of students in each cohort agreed to be video-recorded during their practice in the skills centre. In the nursing college where this study was performed, first year students learned basic nursing skills in 11 sessions in the skills centre during their first semester. Four of the sessions were self-directed learning with a teacher present that could answer questions. An electronic nursing skills program covering all basic nursing skills was available on large monitors in the centre.[25] During the rest of the sessions third year nursing students (as part of their curriculum) tutored the first year students. Each session lasted for three hours and was organized into three parts. First a group of 8-10 first year students and 2-3 third year students acting as tutors met to discuss and reflect on the skills planned for that day's session. Then the first year students split up into smaller groups of 2-3. Together with one tutor they gathered around one bed and practiced the designated skills. A teacher was also in the simulation room as a support for the tutors if needed. The teachers did not intervene in the tutors' teaching. After the practice session the whole group gathered again and reflected on their learning experiences that day. The teacher was not present in this debriefing. In the present study we used data from video-recordings of the students' actual practice in groups of 2-3 first year students and one student tutor.

2.3 Data collection

Practice sessions were video recorded by three of the authors of this paper during 3-5 days with each cohort. Video recordings provided extensive data on the students' actions, as well as opportunities for collaborative analysis in the research team.[26] The material supporting this article is video recordings from one session with each cohort where the students were learning two specific skills: wound cleaning and dressing, and sterile gloving. A hand held video camera was used to record the students. Video recordings from 5 groups of students were used due to a lacking quality in the sound on some of the recordings. These recordings involved 14 students and 5 student tutors, in addition to two teachers (one in the background and one interfering with one of the groups).

2.4 Ethical considerations

The study was approved by the Director of the nursing program and the Norwegian Social Sciences Data Services. Students were informed both verbally and in written form. Those who agreed to participate signed a consent form. Transcripts of video-tapes did not include information that could identify the students.

2.5 Data analysis

All verbal interaction on the video tapes was professionally transcribed, and then corrected by the research team to make them as precise as possible. Copies of video recordings and transcribed material were made for all researchers. The analysis was inductive and iterative. It was inductive in the meaning that the patterns and categories came from the data, and not from pre-set coding systems.[27] It was iterative in the sense that the analysis was a reflexive process where the researchers in a loop-like process moved back and forth between joint and individual analysis as well as between video recordings and transcripts of verbal interaction.[28] In the joint analysis all researchers sat together listening to and watching the videos with following discussions of interpretations and development of beginning categories, as well as categorisation of the transcripts. In the individual analysis of the recordings the researchers watched the recordings on their own and brought back suggestions of new categories or refined definitions of categories to the next joint analysis session. The process of analysis resulted in seven learning action categories (see Table 1).

The learning actions in Table 1 are presented in the results and exemplified with excerpts from the video tapes.

3. RESULTS

3.1 Parallel action and self-instruction

Students engaged in parallel action and self-instruction by guiding themselves through an action in a step-by-step manner, such as when one student started to open the cover of a pair of sterile gloves. "I can touch here – on the outside" (unfolded the paper at the bottom), "and here – on the outside" (unfolded the paper at the top), "and here – is also the outside" (unfolded the paper from the middle). Another student tried to get the first sterile glove on to her right hand. While she took hold of the bottom and upturned part of the glove with her left hand, she lifted it up and tried to wriggle her right hand into and she said: "OK, this I can touch, then I lift it up and I try to get my hand inside... hm". This learning action occurred mostly when the students were practicing tasks that demanded individual action such as donning and removing sterile gloves. However, it also occurred while they performed a skill on a fellow student. They talked themselves

through the part of an action as if reading from an instruction text or assuring himself or herself of the correct sequence or action: "I start here close to the wound and clean with the swab outwards. Back, take a new swab and hold my right hand so the solution does not run down my hand on its way to the wound. Another circle with the swab a little further out. . . ".

3.2 Watch and copy

Students watched peer students as well as their tutor and tried to copy their movements. Sometimes the watching was covert, as if they were saying to themselves: "I should be able to do this on my own without watching the others". Other times it was open, and encouraged by the peer or the tutor. Look, the tutor said, and took a pair of gloves out of its wrapping to show the student: "You put your finger inn here to turn it down", and the student tried to do the same movements. Or a tutor said while she gesticulated with her hands: "hold your hands away from your body when the gloves are on", and we saw the student holding her hands in the same way. We saw that this learning activity only occurred when the students were practicing a skill individually such as sterile gloving or practicing injections on a pad. In skills where they practiced on and with a peer their attention was concentrated on what they were doing with the peer and there was no time to look around at what the students were doing at other beds.

Table 1. Learning actions categorised from the video tapes

Learning actions	Definitions
Parallel action and self-instruction	Students talk themselves through an activity in a step-by-step manner and are fully concentrated on their own decisions and actions.
Watch and copy	Students watch peer students or tutor and try to copy their movements.
Collaborating to find solutions	Uncertainty occurs about how to perform an aspect of the skill, and students collaborate to find a solution.
Recontextualising the skill	Students imagine and problematize how the skill should be performed in another context.
Seeking support	Students seek advice and feedback from each other and the tutor.
Giving support	Students and tutor give advice and feedback to each other.
Humorous enactment with the equipment	Students handle the equipment in a playful and humorous way, making each other laugh.

3.3 Collaborating to find solutions

Many decisions had to be made during practice and students collaborated to find solutions. One goal of this type of collaboration was to decide a way or process of action. An example of collaboration to reach a small but important way of performing was how to extract a bandage from its jacket to cover a wound without contaminating it. Students also collaborated to reach an agreement about a concept or understanding of a piece of knowledge. One example was how students discussed their understanding of how to move the swab according to the status of a wound (clean or contaminated). In the following scenario student 3 was the "patient".

Student 1: You start where it is cleanest don't you? The tutor: I have harped on this all day and now suddenly I can't remember.

Student 2: When it is contaminated (the wound) you start furthest out.

Student 3: Because there it is cleanest.

Student 2: Yes. And then you start outside and move inwards. But with a clean wound you start closest to the wound.

Student 1: So, then you start there (pointing to the wound), at the cleanest place.

Student 2: Always start at the cleanest place.

Student 1: It is easier to remember now.

3.4 Recontextualising the skill

Students tried to recontextualise the procedure into other contexts of application. These contexts were mostly taken from the nursing homes or homecare where students worked part time parallel to their studies. One student who worked in homecare got involved in a discussion with the tutor about using sterile gloves during wound care:

Student 1: I have never seen anyone in homecare use a regimen in wound care such as this.

Tutor: Can you think of a reason why.

Student 1: Well, even if it isn't sterile circumstances at home one should follow the guidelines.

Student 2: There are fewer bacteria in the home.

Tutor: The book says that it isn't necessary to use an aseptic procedure.

Student 1: It did not say why though. Is it because the bacteria are less dangerous?

Student 2: Danger of contamination of others is smaller.

Student 1: But when we use a sterile procedure it's the patient we think about, not the others...

And this discussion went on until the tutor involved the teacher who tried to tie up the loose ends of the discussion. In this case however, neither teacher nor tutor caught onto student 1's relevant observation of when to use a sterile procedure with the patient. They continued to mix the use of sterile gloves and wound dressing, probably because they were the two procedures practiced on that day. In other sequences students brought in scenarios in recontextualisation discussions such as: wet hands that hindered donning of gloves, consequences for patients if their wounds stayed open to long, and how they should get rid of contaminated gloves in different settings.

3.5 Seeking support

Students actively sought support from each other and from the tutor, and this went on continuously. From the outside the skills looked deceptively simple. One student voiced this "I have seen you do it two times, but I still sort of... how am I going to do this". Students posed questions all the time, about details in their actions as well as reasoning behind doing this or the other: "Can I take a hold here?", "What do I do with this?", "If I accidentally touch the sterile part, should I change at once?" Often such questions were posed without an addressee, and both peer students and tutors tried to answer.

3.6 Giving support

Students practiced at the same time or watched each other take turns, and spontaneous advice and feedback was given all the time. A student commented to a peer student in her group who was removing the sterile gloves: "You could be a bit more careful when you take them off, in case there is a lot of infectious stuff there". The tutor gave more advice in the same situation: "Look, it's smart to do this", "Maybe, roll the gloves into each other before you dispose of them". During wound care the observing student who had practiced first showed with her hand and said to her peer: "Hold the tweezers like this". There was a buzz of chatter and laughter going on all the time. The tutees also acknowledge the help they got: One tutee has managed to put on the sterile gloves correctly, she gazes seriously at her lifted hands and says – "there, I am all sterile". She looked at her two fellow students and said – "you helped me all the way".

3.7 Humorous enactment with the equipment

The training sessions were taken seriously and equipment was handled carefully and with awe. However, there was a lot of humour between the younger students, mostly while handling equipment during the procedure but also just goofing around, for example twirling the gloves to fill them with air to help pop the fingers out. One student had finished putting her gloves on, looked at her fellow student and signalled to her with her glove-covered hands: "OK, I'm ready, hop into bed". Another had put the gloves on, laughed and said to the others while she touched the inside of the sterile cover several times: "And now I can touch here and here". A third looked at her gloved hands, looked into the video camera and pretended to touch her own cheeks, laughed and said: "And now I am not sterile any more".

4. Discussion

This is the first observational study describing in detail the learning actions that nursing students are engaged in when they practice in the clinical skills centre. In most of the learning actions we developed from our observations, students continuously interacted with peer students and/or tutors. In opposition to learning in the clinical setting where students are peripheral legitimate participants in practice,[29] students in the skills centre have the opportunity to be similarly active and equal in their possibilities for learning. The learning actions we observed exemplify both how knowledge was distributed among the individual students and tutors, and embedded in the artefacts they used during learning. The examples illustrate how knowledge was activated and used in multiple dialogues and actions performed during practice of the different skills.

When students are in charge of their own learning, the teacher's authority is removed,[30] and there is room for more explorative and diverse approaches than in traditional teacher-controlled instruction. Although the tutors in this study were older students and in some ways took the place of the teacher, the excerpts we have included from the video recordings are typical and show that students were at ease both with their peers and with their tutors. Other research has shown that students tutored by older peers most often found it easy to ask questions and express uncertainty,[31] appreciated tutors who had recent experience with what they were learning,[32] and experienced more interaction and collaboration since there were more tutors available than when teachers were responsible for the learning sessions.[33] Peer learning schemes are known to reduce anxiety in learning.[20] Students experienced the two skills as complex, demanding concentration and detailed attention. We suggest that humorous enactment with the equipment functioned as debriefing. Laughing, making jokes and playing around with the equipment may reduce stress and anxiety and in general lighten the intense atmosphere created by efforts to do everything right. Having a good time does not in any way detract from the fact that the students were seriously engaged in their training of the skills.

In general we saw that the learning actions involved different forms of scaffolding where students both guided themselves and others as a way to master the skills they were practicing. The term scaffolding was introduced by Wood, Bruner and Ross[34] as a metaphor illustrating Vygotsky's[35] concept of the zone of proximal development (ZPD).[36] ZPD is the transition area where a learner can move on in learning with help (different forms of scaffolding) from more experienced others. In the nursing education context in the present study scaffolding strategies such as intrapersonal speech,[35] feedback, modelling, questioning and instruction[37] were used. Intrapersonal speech is exemplified in the category labelled parallel action and self-instruction. In our data the students talked to themselves as from a manuscript, oblivious of the others present. Spouse,[36] referring to Vygotsky and Luria,[38] suggested that speech functioned as "a memory aid that gives action context in time and space". Talking helps the student to organize own behaviour and gives an opportunity to use concepts and typical vocabulary in the practices one is learning. At a later stage it is replaced by inner speech. In this respect the skills centre is an excellent place for students to voice their emerging understanding of knowledge and actions and invoke the process of integrating specific nursing knowledge, development of dexterity and patterns of action. The quotes in most categories showed how students focused on details in their actions of handling equipment to secure the accurate use, following hygienic principles, and seeking to acquire an understanding of why they were supposed to act in a special way.

There was a lot of exchange between students and tutors that included feedback. Feedback was both asked for (seeking support) and given spontaneously (giving support). The feedback involved how to manage practical aspects of different steps in the procedures and how to think about or understand what they were doing or were about to do. The feedback came in the form of physical exemplification, or as verbal advice or statements. Feedback is acknowledged as one of the most important influences on learning and achievement.[39] Although Hattie[39] has studied feedback in general schooling, we also recognize the importance that health profession students place on feedback, especially corrective feedback (see for example Goldsmith *et al.*,[14] Ashgar[40] and Cushing *et al.*[41]). Hattie and Timberley[42] describe feedback as information regarding aspects of one's performance or understanding that reduces the discrepancy between what is understood and what is aimed to be understood. This highlights that feedback that is not conducive to reducing a discrepancy may not support learning or even be negative. Feedback is not always correct, especially from peers.[42] Compared to research in other pedagogical contexts[39] there is very little research in nursing skills education on the effect of different forms of feedback.

Students and tutors in this study often combined modelling and instruction; "you hold your hands away", "you put your finger in there", "it is smart to do this". Modelling and instruction are typical aspects of scaffolding,[37] but are, as feedback, susceptible to the actual competence of those who model and instruct. In one excerpt we showed that the tutor and the teacher might not remember essential details in the routine of cleaning wounds. The few studies on peer learning in nursing skills centres do not even mention the challenges inherent in using peers in teaching and coaching related to level of knowledge and pedagogical competence. This is a pedagogical challenge that needs more research as peer learning schemes increase in nursing education.

The learning action we have labelled recontextualisation is an action only instigated by the younger students. In the results section we describe how one student mentally tried to place her ongoing actions into a homecare context where the same activity (wound dressing) was performed. Recontextualisation is an expression we have appropriated from van Oers.[43] He used recontextualisation as a term for the recognition of an opportunity for an alternative realization of an activity in another context. Another context does not necessarily imply physically moving to another context. It can be an imaginary or known (other) context. Recontextualisation is an interpretative activity.[43] Students think about, imagine and discuss what it is like to perform in another context. In other words, recontextualization pinpoints that exercising a manual includes cognitive processes of imagination and reinterpretation. In our example the student's recontextualisation led to discussions about similarities and differences in use of sterile gloves, differences in bacteria and in patient contexts. It implies that the process of transfer was inherent in the learning action. We showed in our findings that the reasoning in some occasions was faulty by all parties involved, again illustrating the problem of lacking competence and knowledge. If we take this learning experience to be the only one that students encountered on sterile gloving and wound care we could expect that the students left the session with faulty knowledge and understanding on how to handle wound dressings. However, in general the action of recontextualisation is a worthwhile action to encourage in student discussions as van Oers[43] suggests that the mental action of recontexualisation is a form of transfer that starts in the original setting of learning itself. It expands the frame of reference of wound dressing training. Viewing this learning event as an early step into the community of professional nursing practice the recontextualisation process may prepare

for further refinement of the students' understanding and skills.

Different forms of clinical skills simulation are very much the fashion today,[6,44] but we contend that there still should be room for traditional skill learning. The cost of high-fidelity simulation is very high,[45–47] and the need to discriminate between situations where traditional skill learning is as effective as simulation is necessary. In our opinion the need for traditional psychomotor skill learning and low-fidelity simulation will continue. Outcomes of high fidelity simulation are partly contingent on the students' aptitude in basic skills such as measurement of blood pressure, checking other vital signs, performing injections or positioning the patient. A lack in proficiency in basic skill may hinder students to make use of the learning potential in more complex simulation scenarios.

Methodological consideration

In this study we used a video camera to collect data. We acknowledge that participants may modify their behaviour due to the camera as well as to the presence of a researcher. This is an explorative study as detailed investigation of skills learning in nursing is lacking. However, only two practical nursing skills have been investigated in detail. Other types of skills need to be included in further studies to corroborate that the learning actions presented in this study really are generic in students learning in the skills centre.

5. Conclusion

This study offers the description of a number of learning actions that are involved when students practice nursing skills in the clinical skills centre. We consider our results as a starting point in unravelling details in students learning actions during skills training. The students in this study practiced two different practical nursing skills; wound cleaning and dressing, and donning and removing of sterile gloves. Most of the learning action categories we found were evident across both skills practiced, although a few were typical when learning only one of the skills. The learning actions involved different forms of scaffolding. We have uncovered that more experienced tutors, and also teachers, do not necessarily have the knowledge or skills necessary to ensure that the tutees leave the training session with an accurate understanding of the procedure. According to former research it is essential that modelling, instruction and feedback rely on correct knowledge and performance. However, taking learning to be an on-going chain of interpretative, meaning-making and evolving processes including peers' negotiation of understanding as well as precise instruction, some level of incorrect information and misunderstanding is to be accepted, perhaps even appreciated. More research is needed in this area of skill development as well as peer learning activities. Students' learning in other practical nursing skills should be studied to accumulate more knowledge about students' learning actions and how peer interaction supports or hampers learning. It is also relevant to study the relevance of these learning actions when students move on to the clinical setting to further perform and develop their practical skill. A goal is to lay the groundwork for better design of learning in skills centres in nursing education.

Conflicts of Interest Disclosure

The authors declare that there is no conflict of interest statement.

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