

Reflection on actions: Identifying facilitators of and barriers to using physical assessment in clinical practice

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ABSTRACT

Current research suggests that nursing students do not apply all sets of physical assessment skills (PAS) learned in their nursing education. The aim of this study was to evaluate third-year nursing students' process of clinical judgment using PAS in clinical rotation. Specific focus was on how the process of clinical judgment affected when the nursing students performed physical assessment, and which types of knowledge were implied in their practice. Ten nursing students performed PAS independently while in clinical rotation; these performances were audiotaped and observed. Shortly after, individual semi-structured stimulated recall interviews (SRI) took place. Regardless of the nursing students' stated level of PAS utilization, self-efficacy or scientific knowledge, clinical judgment was primarily based on contextual factors and personal prerequisites. This study contributes to in-depth knowledge about how nursing students perform physical assessment, how they describe their clinical judgment process and their strategies towards systematically and confidently using PAS. We conclude the paper with pedagogical strategies and learning activities that can facilitate reflection-in-action and reflection-on-action.

1. Introduction

Clinical skills acquisition is a fundamental component of undergraduate nursing education and lack of this competence can compromise patient safety and care (Zambas et al., 2016). Several studies indicate that inexperienced Registered Nurses (RNs) struggle to process large amounts of complex data (Levett-Jones et al., 2010; Gillespie and Paterson, 2009). Anticipating changes in patients' situations can be challenging when the complexity increases, as can differentiating between clinical situations needing immediate attention and those that are less acute (Price et al., 2017).

Physical assessment and health assessment are some of the core competencies in undergraduate nursing education forming the basis of RNs preparedness for demanding patient encounters (Laurant et al., 2018). Incorporating knowledge from human bioscience (anatomy, physiology, pathology, pathophysiology and pharmacology) is a prerequisite when assessing and interpreting data (Craft et al., 2013; Jensen et al., 2018). Hence, nursing education institutions must teach nursing

students how to integrate their knowledge of human bioscience into clinical judgment and decision-making processes during patient encounters (Hoffman et al., 2009; Douglas et al., 2015).

Successfully integrating physical assessment subjects in the undergraduate nursing curriculum remains challenging (Douglas et al., 2015). This might explain why nursing students and newly graduated RNs do not perform all of the Physical Assessment Skills (PAS) learned during their education (Egilsdottir et al., 2019; Douglas et al., 2015; Cicolini et al., 2015; Birks et al., 2013). Recent studies show that the main barriers are the pedagogical methods used in their training, as well as the clinical contexts in which students perform these skills (Douglas et al., 2015; Egilsdottir et al., 2019; Zambas et al., 2016). Literature on students' clinical judgment of physical assessment while in clinical rotation is limited. This needs further exploration, as contextual setting in clinical rotation profoundly impacts students' use of PAS in detection of cues or deterioration in the patients' health situation (Osborne et al., 2015; Craft et al., 2013; Gerry et al., 2017; Odell et al., 2009).

Additional barriers to RNs' performance of physical assessment have

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been identified, including lack of role models, lack of confidence, and doubts about the utility of the assessments (Douglas et al., 2015); however, student's development of PAS has not yet been explored to understand why they do not perform the skills they have learned. Thus, improved understanding as to what influences students in their physical assessment performance, but also which clinical judgment processes students act upon is needed.

Students need to be able to initiate a clinical judgment process to perform adequate physical assessment (Burbach and Thompson, 2014). Clinical judgment is described as an ongoing problem-solving activity, and includes as circular process of interpreting patient's needs, concerns, and health problems; deciding to take action; and using or modifying standard approaches appropriate to the patient's response (Tanner, 2006). The final stage is reflection-on-action: reflecting on clinical findings used to inform future clinical judgments. Reflection-on-action involves what students learn from the experience, and contributes to the development of their competence in clinical judgment. It is salient to explore what actually happens when students perform PAS in real patient encounters, and to further understand what students act upon (and why) in the clinical judgment process (Burbach and Thompson, 2014; Levett-Jones et al., 2010).

PAS are taught in a three-year undergraduate nursing programme at a Norwegian university. PAS considered to be basic competencies for bachelor's degree students at the university are referred to as basic PAS (B-PAS) in the curriculum shown in Table 1. Students are instructed in the use of B-PAS curriculum during their first year and learn to use these sets of skills to scaffold their B-PAS development throughout their nursing education (Egilsdottir et al., 2019). B-PAS are integrated in courses such as human bioscience, theoretical nursing (Basic Care Nursing and Critical Care Nursing), practical skills learning in labs and during clinical rotation (General Nursing Care, Surgical/Medical Nursing and Community Health Care Nursing). Throughout these courses, students practise B-PAS based on a progression model (Appendix A). Learning activities emphasize theoretical foci, clinical

Table 1
Overview curriculum Basic Physical Assessment Skills (B-PAS).

Organ system	B-PAS curricula
Heart and peripheral circulatory system	Inspect extremities for skin colour/hair growth Palpate distal pulses Count pulses Palpate for edema Palpate and inspect capillary refill Estimate skin fold Evaluate extremities for skin sensation Assess fine motor skills Take blood pressure Auscultate heart sounds Auscultate carotid artery
Respiratory system	Inspect thorax for shape, breathing effort Inspect thorax for skin colour/scar Palpate thorax wall for thoracic expansion and vocal fremitus Percuss the lungs Auscultate lungs Assess SpO ₂ *
Abdominal system	Inspect abdomen Auscultate abdomen for bowel sounds Abdominal palpation Percuss the abdomen Percuss for kidney tenderness
Neurological system	Evaluate mental status Evaluate CN I-XII** Evaluate muscle strength, atrophy, tone Evaluate sensation of touch Assess coordination and balance Evaluate patella and plantar reflexes

*SpO₂- Blood oxygen level.

**CNI-XII- Cranial Nerves Number 1–12.

on-campus simulation and digital simulation with virtual patients, and provide effective arenas for learning and mastering practical skills. By linking the assessment with human bioscience knowledge through different modes of simulation training, the students are provided with guidance and support whilst becoming confident and proactive in their nursing.

1.1. Aim

The overall aim of this paper is to explore and identify facilitators and barriers in third-year nursing students' process of clinical judgment in relation to physical assessment while in clinical rotation. We seek to answer the following research questions:

1. To what extent do third-year nursing students use B-PAS in patient encounters while in clinical rotation?
2. How does third-year nursing students' judgment influence which physical assessments they perform?

This paper is part of a larger research project exploring the implementation of physical assessment in clinical rotation to enhance clinical competence and patient safety in Norwegian nursing education.

2. Method

2.1. Design

The study used an explorative qualitative design, and used two data collection methods to explore the aim of the study (Table 2): a) observation and audio-recording nursing students in a patient situation, followed by b) stimulated recall interviews based on the audio-recorded patient interaction.

2.2. Data collection

2.2.1. Sample and setting

Between October and December 2018, ten nursing students in their fifth semester and from one campus participated in the study during their clinical rotation period in community health care. Fifteen students who had their clinical rotation placement in a pre-defined nursing home and home care site were invited to contact the clinical rotation coordinator if they were interested in taking part in the study. After receiving detailed oral and written information, 10 students agreed to participate. Ten patients also agreed to participate, and signed the consent form before the researcher was introduced. Data collection was conducted in week seven or eight of the clinical rotation period (a total of 8 weeks/240 h rotation period). This was the first of the students' two clinical rotation periods in a community health care.

2.2.2. Observation and audio-recording of students in a clinical situation

The first author (KRB) observed and audio-recorded the students' use of B-PAS in a clinical situation, focusing on the physical assessment of a patient; students could use checklists of learned B-PAS (Appendix B) if they so desired. Structured observational notes based on the B-PAS curriculum (Table 1) were taken to assess systematically which (and how) skills were performed. Direct observation by the researcher was considered necessary, as several assessments are not communicated verbally and thus would be undetected during the SRI. The researcher explained to both patient and student that her role was that of a non-participating observer. However, the researcher's presence as an observer may have affected the nursing student and patient, their interaction and the student's use of the B-PAS. If emotional distress from the student or patient was observed during the encounter, the researcher continued observing from a different part of the room to mitigate any impact of her presence (Corbin and Morse, 2003; Creswell and Poth, 2018). Moreover, the researcher did not wear a uniform during the

Table 2
Data collection method.

	Data collection methods	
	Clinical situation	Stimulated Recall Interview
Student focus	Performing B-PAS*	Reflection on action
Research focus	Observation notes Audiotaping	a) Nursing students' perceptions about the use of B-PAS* in clinical situation. b) Factors influencing Nursing students B-PAS* performance. c) How Nursing students described their clinical judgment in their decision to use B-PAS* in that situation.

*Basic Physical Assessment Skills.

clinical situation, to delineate her role as an observer rather than a health care provider.

2.2.3. Individual stimulated recall interview (SRI)

KRB conducted an individual SRI with each student after the clinical situation to ensure immediate recall. The interviews lasted between 5 and 20 min, took place in a private room and were audio-recorded. While the students situated at nursing homes were able to participate in the SRI shortly after the observation, the home care students had to wait until they had returned to a suitable interview location.

Using the SRI as a methodology during students' clinical practice allowed us to reliably assess students' behaviours, and to address how they reflected upon their own actions while performing physical assessments. The SRI involved interviewing students while listening to audio-recordings of the clinical situation. Students were instructed to pause the audio-recording whenever they felt like sharing their reflections. The researcher suggested pausing the recording when significant events occurred that needed further elaboration. The student or researcher would stop to reflect on concurrent thinking during the clinical situation (Shubert and Meredith, 2015). As a data collection method, the SRI targeted reflections upon the actual incident, contextual elements, and metaphors students used when they spoke about different incidents. Furthermore, the SRI enabled in-depth exploration of the event from the students' perspective (Dempsey, 2010). The interview guide with open-ended questions included the following themes: a) students' perceptions about the use of B-PAS in clinical situations, b) factors influencing their B-PAS performance, and c) how they described their clinical judgment in their decision to use B-PAS in that situation.

The researchers' awareness about the imbalanced power relationship between student and researcher is crucial (Karnieli-Miller et al., 2009). Students' comfort can be challenged when asked to reflect upon their own actions, knowledge and skills, and may feel unsure how to articulate these (Corbin and Morse, 2003; Karnieli-Miller et al., 2009). The researcher was aware of these factors, and worked to build rapport, use careful wording, and attend to own and the students' body language to reduce discomfort (Butterfield et al., 2005; Guillemin and Heggen, 2008). To reduce the risk of observer bias, students were explicitly encouraged to correct the researcher while listening to the audio-recording and reflecting on their performance during the SRI.

2.3. Research ethics

The Norwegian Centre for Research Data (NSD) (Project No. 196758) approved the study. All involved municipalities and institutional leaders approved the study. Eligible patients received written

and oral information from the students and their preceptor about the aim of the study and data collection method (i.e. direct observation supplemented with audio-recordings). Students were instructed to only invite patients able to consent to participation, and the focus of data collection was on the student's performance of PAS. We did not collect data from the patients.

As the first author is a member of the faculty at the university and had met the students in that role, the students were informed that she had no influence on the formal evaluation of the clinical rotation course. The faculty member responsible for the formal evaluation of the students during the rotation did not discuss their performance with the researcher.

2.4. Data analysis

2.4.1. Analysis of stimulated recall interview (SRI)

The analysis of each SRI was based on the critical incident technique (CIT). CIT is a systematic, inductive process of analysis that aims to explore human interactions and behaviour in a clearly defined situation (Schluter et al., 2008). Here, the focus is not on a specific 'critical incident', but rather on several incidents that represent a significant activity (Hughes, 2007). This approach can highlight similarities, differences and patterns that provide insight into how and why people engage in a given situation (Hughes, 2007; Kain, 2004). CIT offers a clearly defined and sequential analytical process for handling several sequences of activities, and is thus well-suited to analysing students' reflections on their use of B-PAS and their performance of physical assessment.

Audio-recordings of the SRI were transcribed verbatim. Two researchers (KRB and EAB) independently read through all transcribed interviews several times to become familiar with the data, which were then analysed inductively using NVivo 12 Pro (Edhlund and McDougall, 2019). The critical incidents were defined as students' descriptions of their clinical judgment in their performance of physical assessment. KRB and EAB coded the data separately and suggested preliminary subcategories and main categories before deciding on the final main categories. All authors were involved throughout the analysis to ensure a trustworthy process and that the critical incidents were not over-analysed (Butterfield et al., 2005; Hughes, 2007). Table 3 shows the analytical process from excerpts to main areas. Excerpts of empirical data containing critical incidents were organized into nodes and categorized as different articulations that impacted students' clinical judgment. These segments were then sorted according to similarities and merged into subcategories. In the final stage, subcategories were organized into four final categories and then merged into two main areas (Table 3).

Table 3
Analysis process from empiric statement to main area.

Empiric statements	Node	Subcategory	Category	Main area
It is difficult to distinguish between scales of sound. Because, with bowel sounds, you can say it is bubbling, right? You can describe it with more words. With auscultation on the lungs, you have to say where on the scale, how "dull" it is. Is it very dull, just a bit dull, or not dull at all, right?	Percussion is difficult	How to interpret the assessments	The theoretical knowledge embedded in practical performance	Adequate and master patient assessment

Table 4
Characteristics of the sample and use of Basic Physical Assessment Skills (B-PAS).

Background information	Age range*	Health related work experience prior education start (years)	Health-related work experience during education (shifts/week)	Number of B-PAS used in clinical setting (N = 44)	Time used in clinical situation (minutes)	Using checklist under clinical situation	Number of critical incidents articulated during SRI	SRI time (minutes)
Mean	32,7 years	2,6 years	1,3 shifts/week	17,7 B-PAS	27,2 min.	–	37,7	54min
Standard Deviation	9,57 years	2,7 years	1,8 shifts/week	8,99 B-PAS	15,77 min.	–	12,3	20min
Student 1	3	0	0	18	53	yes	38	51
Student 2	2	5	2	15	22	yes	53	57
Student 3	3	0	0	8	20	no	28	37
Student 4	1	6	2,5	20	12	no	32	41
Student 5	1	0	2	20	38	yes	51	101
Student 6	1	6	2,5	32	38	yes	44	65
Student 7	3	0,5	0	30	36	yes	43	57
Student 8	1	0	2,5	2	7	no	13	29
Student 9	2	0	0	18	36	yes	46	60
Student 10	1	2,5	2	14	10	no	29	42

*Age range: 1:23-30 years old, 2:31-40 years old, 3: 41-50 years old.

2.4.2. Analysis of clinical situation

Analysis of the clinical situation were based on descriptive statistics: means and standard deviations (SD) illustrate characteristics of the sample and the number of performed B-PAS, as illustrated in Table 4.

3. Results

3.1. Characteristics of the sample

Ten students with an average age of 33 years (ranging from 23 to 50 years of age) participated. Consistent with the university's general demographics, two participants were male and eight female, and three did not have Norwegian as their native language (Table 4). Half the participants had worked in a health-related context before beginning the nursing programme; six were working as health care providers during their education.

3.2. Use of B-PAS in the patient situation

The students' use of the B-PAS varied, but they typically applied more skills if checklists were used. The reason students gave for using checklists was to enhance their confidence in their appliance when they could have glance at the checklist, and therefore experience better confidence. The students who saw these lists as a distraction in their assessments felt confident that they could remember which skills to perform.

Four main categories were identified from the SRI as factors

Table 5
Factors influencing performance of physical assessment.

Subcategories	Categories	Main area
Skills that I think is difficult to perform Skills that I need more practice on What can I do to become better Skills that I applied	Performance of skills	Adequate mastery of patient assessment.
I am insecure about my own knowledge I am not always sure when it is appropriate to perform B-PAS*	The theoretical knowledge embedded in practical performance	
How I interpret the assessments When I discover something new Knowing my patient well	The patient encounter	Contextual factors that influence the patient meeting and assessment
My cooperation with the patient My communication with the patient What my assessments can result into My role models	How to work with B-PAS* in clinical rotation	

*B-PAS- Basic Physical Assessment Skills.

influencing the students' use of B-PAS. The number of critical incidents the student reflected on influenced the length of the SRI. An overview is shown in Table 5 and will be elaborated on below.

3.3. Performance of skills

Most students performed B-PAS based on the patients' diagnosis or current health status (Table 6). However, some students tended to select more skills than required when collecting data, rather than adapting their approach based on the patients' current status. In addition, when new cues emerged during the clinical situation, only some of the students adapted their approach with adequate skills (Table 7). Few students were able to perform relevant assessments that had no clear connection to the peripheral, respiratory and gastrointestinal system (e. g., percussion for kidney tenderness and neurological assessment). However, evaluation of mental status in conversation was prioritized as an integrated part of neurological assessments. Inspection of the patient when talking, walking and moving around, based on former encounter (s) with the patient, was also given priority.

Students emphasized that assessments like the auscultation of heart and lungs, and the percussion of abdomen and thorax, were difficult to perform and interpret correctly. Still, most of the students performed these skills in the clinical situation (Table 6). Students explained that their concerns were related to determining whether their performed assessments were correct and how the anatomical or pathological mechanisms causing specific sounds should be interpreted.

Table 6
Nursing students' use of Basic Physical Assessment Skills (B-PAS) with the patient.

B-PAS curricula	Skills applied by students (N = 10)
Heart and peripheral circulation	
Inspection extremities for skin color/hair growth	9
Palpate distal pulses	8
Palpate for edema	9
Palpate and inspect capillary refill	8
Estimate skin fold	4
Assess pain sensation	8
Evaluate extremities for skin sensation	1
Assess fine motor skills	1
Take blood pressure	7
Auscultate heart sounds	6
Auscultate carotid artery	5
Thorax	
Inspect thorax for shape, breathing effort, respiratory rate	9
Inspect thorax for skin color/scar	6
Palpate thorax wall for thoracic expansion and vocal fremitus	2
Lung percussion	3
Lung auscultation	7
Assess SpO ₂ *	6
Abdomen	
Inspect abdomen	9
Auscultate abdomen for bowel sounds	5
Abdominal palpation	6
Abdominal percussion	1
Percuss for kidney tenderness	3
Neurology	
<i>Mental status</i>	
AVPU, GCS, alternative MMSE***, Delirium Evaluate CN I-XII**	9
II: Optic	2
III: Oculomotor	4
IV og VI: Trochlear, Abducent	2
VIII: Acoustic	3
V: Trigeminal	2
VII: Facial	4
IX: Glossopharyngeal	2
XII: Hypoglossal	3
<i>Evaluate muscle strength, atrophy, tone</i>	
Muscle atrophy	4
Muscle tone	2
Muscle strength in the arms	5
Muscle strength in the legs	6
<i>Evaluate sensation of touch</i>	
Sensation of touch under feet	1
Sensation of position	1
<i>Assess coordination and balance</i>	
Index finger-nose tip test	1
Rapidly alternating movements	1
Heels and knee test	0
Romberg test	0
Walking test	2
<i>Evaluate patella and plantar reflexes</i>	
Plantar reflex	0
Patella reflex	0

*SpO₂- Blood oxygen level.

**CNI-XII- Cranial Nerves Number 1–12.

***AVPU- alert, verbal, pain, unresponsive, GCS- Glasgow Coma Scale, MMSE- Mini-Mental State Examination.

'It is difficult to distinguish between types of sound. With bowel sounds, you can say it is bubbling, right? You can describe it with more words. With auscultation of the lungs, you have to say where on the scale, how 'dull' it is. Is it very dull, just a bit dull, or not dull at all? It is a bit difficult for me to describe it. This is something I realize I have to practise more'. (S4)

The students articulated clear ideas for strategies that could be used to stimulate better skills performance and improve their ability to

interpret sounds. Increased focus on B-PAS related to organ systems during the campus simulation and learning lab was highlighted, as well as improved access to digital learning resources. These strategies were typically connected to the auscultation and percussion of both anatomical and pathological character.

'I did an online course. That was a good one. I could hear mechanical valves, aortic stenosis, and sounds. So, when I auscultated a patient that I knew had a mechanical valve and aortic stenosis, I thought I heard a bit more pronounced sound on lub and not on the dub I have also used YouTube to listen to the different sounds, just to check what I heard was right'. (S2)

Having the opportunity to practise B-PAS in clinical rotation with real patients and real diseases was also highly valued, as was receiving guidance during their practice that confirmed their interpretation of the sounds they heard.

3.4. The theoretical knowledge embedded in practical performance

Students expressed uncertainty about trusting their own reasoning regarding human bioscience knowledge in relation to using B-PAS correctly during the clinical situation. Several students stated that it was difficult to select appropriate skills and know how to interpret the data; they worried that this might cause them to forget relevant assessments, use a 'checklist approach', or simply perform skills based on other nurses' preference.

During the simulation on campus, the students learned which assessments are appropriate for each organ system, and how and when to perform these. However, a salient challenge is to transform and integrate theoretical human bioscience knowledge into practice based on reasoning's of why. Those students who were able to articulate why—in relation to their use of knowledge of human bioscience and of B-PAS—appeared to have confidence in their own theoretical knowledge. Students who articulated a specific rationale based on their human bioscience knowledge for why they performed specific assessments were also more confident in their use of other assessments (such as performing Early Warning Score (EWS) assessments).

'I chose not to palpate the abdomen. Because, when I auscultated abdomen, the four quadrants, everything was normal, not too much sound, not too little. If he was a new patient on the ward, or said he had abdominal pain, or hadn't had any faeces or gas air in a long time, then I would have done it. If I had auscultated, and didn't hear anything, or a very high pitch sound, abnormal sounds, then I would have assessed more'. (S7)

The students' ability to integrate their knowledge of human bioscience into their clinical judgment process thus enabled them to perform a specific assessment based on new cues or hypothesis thinking.

3.5. The patient encounter

The students primarily based their clinical judgment on their knowledge about the patient during the clinical situation. They described prior interaction with the patient and knowledge of their specific health situation, diagnosis and pharmacology as facilitating factors in their use of skills.

'I compare every time I meet him with the things I have assessed before. It is always a natural part of my focus when coming to a patient. I shake his hand and I can feel that he has the same strength as before. He walks like he used to, it's all normal. He is alert, awake, remembers me. There are no signs that indicate that I should do a neurological assessment'. (S9)

Personal factors—such as self-confidence, relational competence and communication skills—also influenced students' B-PAS performance.

Table 7
Relationship between patient diagnosis and assessments not performed in clinical situations.

Patient clinical condition	Patient medical diagnosis	Main organ systems not assessed by student
Male 79 years old. Admitted to nursing home due to repeatedly risk of falling in his home.	Atrial fibrillation, Chronic bronchitis, Former bilateral total hip-replacement. No feces in 3 days	Abdominal assessment related to feces output
Female 86 years old. Admitted to nursing home for rehabilitation after Knee prosthetics' operation 3 weeks ago-postoperative pain.	COPD*, Anxiety	Postoperative pain assessment, pulmonary assessment related to COPD
Female 98 years old. Receives home nursing for nutritional follow-up and administration of pharmaceuticals'.	Former breast cancer, non-specific chronic pain.	Pain assessment, abdominal-nutritional assessment related to nutritional status
Male 94 years old. Receives home nursing due to risk of falling in his home, administration of pharmaceuticals' and apply compression stockings.	Kidney failure, FCF** Lung embolism, Cardiovascular disease, Cardiac arrest 4 years ago, Unregularly blood pressure and peripheral pulse, ventricular ulcer, urge incontinence	Neurological assessment related to risk of falling
Female 77 years old. Admitted to nursing home due to failure to thrive and nutritional follow-up.	Atrial fibrillation, COPD*, malnourished, former alcohol problems.	Abdominal- nutritional assessment related to malnourishment
Male 90 years old admitted to nursing home for rehabilitation after FCF operation 2 weeks ago.	Diabetes 1, Polio in childhood- no reflexes in feet	
Male 82 years old. Admitted to nursing home for rehabilitation after FCF sinister- total prosthesis 3 weeks ago.	Prostate cancer cum met, Pacemaker, hypothyroidism. No feces for several days	
Male 85 years old. Receives home nursing due to administration of pharmaceuticals', Diabetes follow-up	Diabetes, Knee arthritis, Abdominal hernia, Pacemaker, Heart failure, Atrial fibrillation	
Female 75 years old. Receives home nursing due to administration of pharmaceuticals', apply compressions stockings, assessment of exacerbation of COPD	COPD*, Hypertension, Depression, Diabetes	
Female 99 years old. Receives home nursing due to age and assistance during morning care.	Pulmonary disease, Hypertension, reduced hearing	

*COPD- Chronic Obstructive Pulmonary Disease.

**FCF- Fractura Colli Femoris.

The initial conversation with the patient in the clinical situation was highlighted as important. This conversation mainly consisted of history-taking and pain assessment, and students indicated that a lack of self-confidence could be a barrier in certain situations and make them hyper-aware of the patients' body language. Their interpretation of the patients' body language caused several students to exclude specific B-PAS, despite what they thought was appropriate.

'We talked about him not being on the toilet for the last three days. He hasn't had any faeces in the last three–four days and has problems with it. The thing I should have done was to palpate, all four quadrants. But I didn't do that. It was just because he began to be like "that", it seemed to me that he began to feel that it was enough. I guess I would have felt something if I had palpated. And I should have listened to the bowel sounds'. (S1)

Students' low self-confidence in their communication skills also represented a barrier. For example, instructing the patient to change their body position to facilitate a better assessment. Students' low confidence in their use of skills then led to fragmented assessments: instead of instructing patients to change their body position repeatedly, several students chose not to perform a specific assessment.

'Sitting like this, upright on the sofa, when trying to assess the abdomen, you can't reach all quadrants, if I were supposed to palpate. Now I chose not to do that, because I got the impression of him not wanting to do that'. (S5)

The nursing students thus felt that confidence during the patient encounter and good communication skills in clinical situations were a prerequisite for using adequate B-PAS in clinical rotation.

3.6. How to work with B-PAS in clinical rotation

The students were conscious of contextual factors, such as when it is appropriate to perform physical assessment. They explained how this depends on where the patient is—e.g., in a home care setting or in a nursing home—and the patient's health situation, as not all home-dwelling patients need a health assessment. The students emphasized

that patient transitions, e.g., between home care and nursing homes, required detailed information and thorough physical assessment.

Acceptance and expected use of B-PAS were highlighted as very important contextual factors during clinical rotation. Reassurance from preceptors and observing other health care providers perform physical assessment were highly valued. Discussions about and guidance on performance of physical assessment enabled the students to reflect on how they might integrate B-PAS into a systematic approach to clinical assessment. This contributed to increased confidence in their own performance and in their articulation of their clinical judgment.

'When calling the general practitioner, I could give her the assessment I did on a patient with chest pain. I could say, "He has chest pain, with radiation of the pain in his left arm, feeling nauseated, blood pressure 158/100, palpation of the left radial artery is 140 irregularly but symmetric to the right radial artery. Respiratory rate at 35, dyspnoea, he is using an extra set of muscles when breathing. We are taking an ECG. Should we also give him nitro-glycerine?' (S4)

The students highlighted the importance of role models—preceptors, general practitioners and peer-nursing students—in clinical rotation. Performing co-assessments with role models and discussing findings increased students' confidence in their own assessments and stimulated performance of physical assessment in other clinical situations.

4. Discussion

This study reports on nursing students' reflections-in-action and reflections-on-action using B-PAS during clinical rotation. Study findings offer important insight into facilitators of and barriers to students' performance of physical assessment, and how pedagogical approaches must be taken into consideration when designing learning activities in B-PAS, as illustrated in Fig. 1.

4.1. Barriers to inadequate use of B-PAS

Several findings are similar to other studies of students' self-reported use of PAS and perceived barriers in their reflections on the clinical

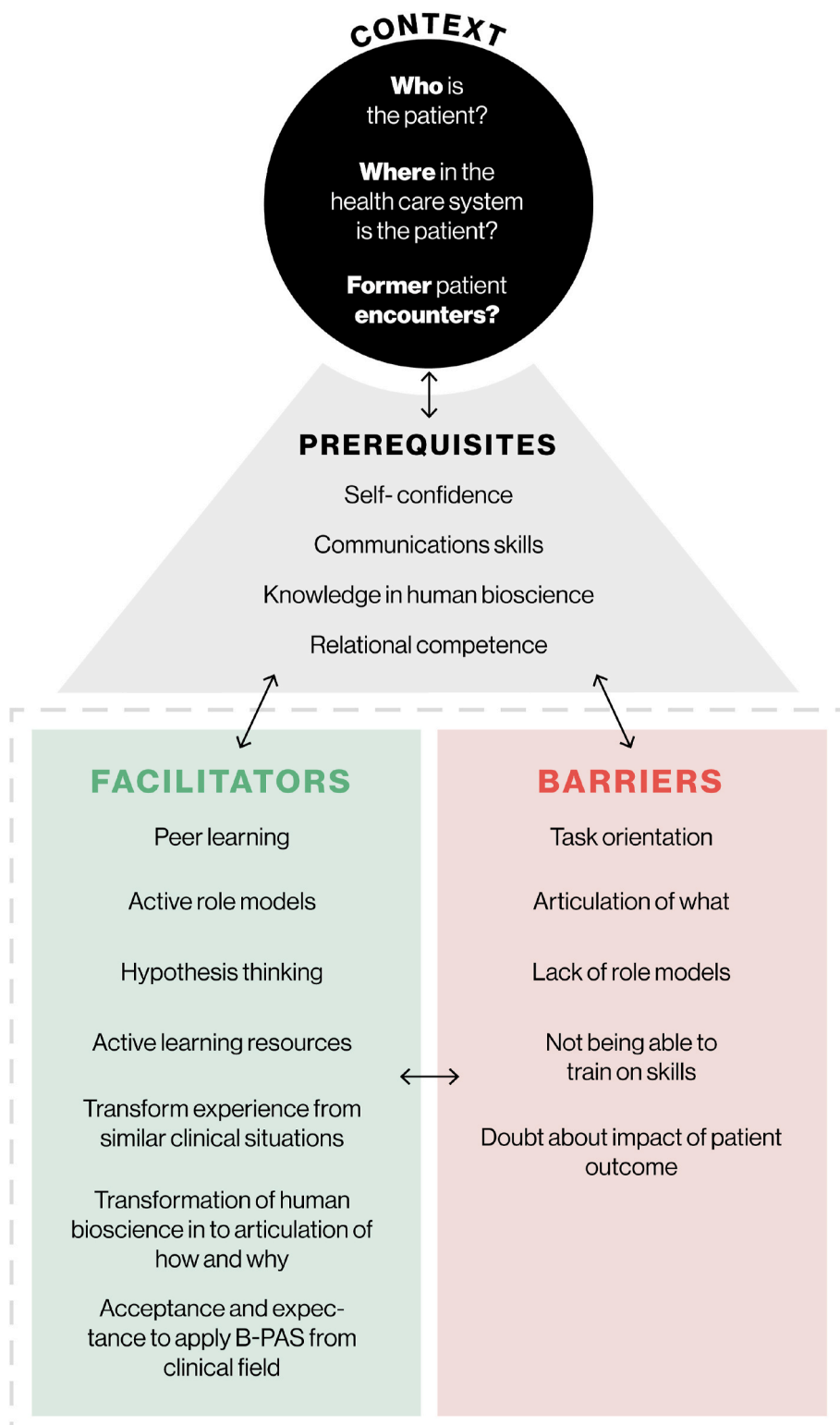


Fig. 1. Facilitators and barriers in Basic Physical Assessment Skills (B-PAS) utilization. NOTE: Utilization of B-PAS are influenced by prerequisites', and the context of the patient encounter. Facilitators and barriers can be both influence the students' prerequisites', and vice versa. When facilitating factors are dominating, the barriers are the weakened, and vice versa.

situation—these include low self-confidence, doubt about the utility of B-PAS, and lack of role models (Douglas et al., 2015). In their reflections on their actions, students were aware of their own competence and confidence as barriers. They performed less assessments based on signals from the patient or the clinical rotation placement site, even when they believed they should have done an assessment. Students'

communication skills and relational competence in the patient encounter also affected the skills and assessments applied—and the integration of these competencies with knowledge in human bioscience was seen as necessary for successful use of B-PAS. As other studies have found, this can be challenging for students practising B-PAS who are novices in transforming theoretical knowledge into practical use.

Students often applied more assessment than required based on predetermined rules, rather than adapting their approach based on the patients' current status. Their clinical judgment process during the SRI was more concerned with descriptions of the skills they had used, rather than giving rationales of *why* they used them. This in turn could impact their awareness of new cues that may arise during a clinical situation—cues that would remain unassessed due to the students' task-oriented focus—and thus can be considered a barrier to adequate skills performance (Burbach and Thompson, 2014; Itano, 1989).

4.2. Facilitators of adequate use of B-PAS

The students found it difficult not only to recall facts, but also to synthesize and use their own knowledge in the clinical situation. Clinical situations are sometimes complex and critical, requiring that students master a broad spectrum of skills and translate relevant human bioscience knowledge to identify cues of clinical deterioration (Levett-Jones et al., 2010). Cue identification is influenced by what nurses bring into the situation (Tanner, 2006), and students brought with them expectations based on their knowledge about the patient, their theoretical knowledge, and the patient's patterns of responses.

The students' process of becoming patient- and context-centred was evident when they were selective in their data and cue collection, and in their ability to articulate the *why*—i.e. integrating human bioscience into their clinical judgment process (Levett-Jones et al., 2009; Jensen et al., 2018; Craft et al., 2016). This is in line with students' rationale for and articulation of their scope of practice (Jensen et al., 2018; Craft et al., 2016).

Students' familiarity with a situation, as well as knowledge developed through prior experience, are antecedents for cue recognition (Messmer et al., 2004). This underscores the need for educational programmes to facilitate students' reflection on human bioscience as it relates to specific clinical settings and cues. The combination of different teaching methods, such as practical skills appliance, clinical simulation and digital simulation, enable students to break down what is happening in a clinical situation. They also prompt further reflection-on-action and facilitate declarative knowledge—a conscious awareness and understanding of the specific subject (Tanner, 2006; Ashley and Stamp, 2014).

4.3. Educators' facilitating role in adequate use of B-PAS in clinical practice

The cognitive processes of clinical judgment in the performance of physical assessment must be addressed to fully understand how to successfully implement physical assessment in nursing education. A point that needs to be raised is how educators can facilitate students' ability to trigger reasoning patterns in their development in the clinical judgment process (Levett-Jones et al., 2009; Tanner, 2006). Noticing patterns requires the performance of adequate physical assessment in the face of complex elements that must be integrated in a patient encounter; this requires combining communication skills, relational competence, human bioscience knowledge and practical skills (Levett-Jones et al., 2009; Zambas et al., 2016).

Based on the complex nature of the knowledge students need to perform adequate assessments, and as we found the presence of limiting contextual factors and low confidence in students' own knowledge, is it important that faculty collaborate closely with students (Burbach and Thompson, 2014; Zambas et al., 2016; Gillespie and Paterson, 2009). This is especially important during their theoretical coursework, to facilitate practical learning activities that a) give a deeper understanding of human bioscience, and b) show how to articulate and transform theoretical knowledge into hypothesis thinking and practical use and interpretation. Digital simulation with virtual patients constitutes a learning activity in a non-clinical course that prepares students to 1) take an active approach to understanding what is happening with the patient; 2) act upon their interpretation; and 3) perform nursing

interventions (Padilha et al., 2019; Price et al., 2017; Douglas et al., 2015). Perspectives relevant to the nursing curriculum, such as relational competence and communication, can be integrated into these learning activities. Moreover, the preceptors and faculty members whom the students meet in their clinical rotation represent important role models: they can support the students, communicate clear expectations that B-PAS are an integral part of nursing practice, and emphasize students' use of bioscience knowledge when performing assessments. This can help reduce the barriers identified in this study.

5. Strengths and limitations

Data were obtained from students who had an interest in B-PAS, which represents a possible limitation of the study. Moreover, including only pre-defined clinical rotation sites may have affected the preceptorship of students. However, including two different community health care contexts in the study should be considered a strength. The researcher was an experienced faculty member with expert knowledge in physical assessment and clinical competence—hence; she could notice important actions during observation and follow these up during the SRI.

6. Conclusion

This paper provides new knowledge about how nursing students perform B-PAS and how they describe their process of clinical judgment, and proposes strategies for systematic and confident use of B-PAS. Implementing pedagogical strategies and learning activities that facilitate reflection-in-action and reflection-on-action may enable students to collect and adequately act upon cues, such as clinical and digital simulation that emphasize reflection-on-action in the debriefing phase. Activities of this nature will teach students to remember former experiences and transform these into performance in their assessments. Research is needed to explore how and which learning activities in human bioscience might influence nursing students' development around the adequate use of PAS. Additionally, further exploration is needed on how reflection-in-action and reflection-on-action regarding physical assessment while in clinical rotation could be made a compulsory learning activity. Moreover, how to integrate relational competence, communication skills and nursing in general as perspectives when implementing physical assessment learning activities.

CRedit authorship contribution statement

Kirsten Røland Byrmoen: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Resources, Writing - original draft, Writing - review & editing, Visualization, Project administration, Funding acquisition. **Espen Andreas Brembo:** Methodology, Formal analysis, Validation, Supervision, Writing - review & editing. **H. Ösp Egilsdottir:** Conceptualization, Validation, Writing - review & editing, Funding acquisition. **Lena Günterberg Heyn:** Validation, Writing - review & editing, Supervision. **Anne Moen:** Conceptualization, Validation, Supervision, Methodology, Writing - review & editing, Funding acquisition. **Hilde Eide:** Conceptualization, Methodology, Validation, Writing - review & editing, Supervision, Funding acquisition.

Declaration of competing interest

Not applicable.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.nepr.2020.102913>.

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Ethical approval

The Norwegian Centre for Research Data (NSD) (Project No. 196758) approved the study.

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References

- Ashley, J., Stamp, K. Learning to think like a nurse: the development of clinical judgment in nursing students. *J. Nurs. Educ.*, 53, 519–525.
- Birks, M., Cant, R., James, A., Chung, C., Davis, J., 2013. The use of physical assessment skills by registered nurses in Australia: issues for nursing education. *Collegian: Journal of the Royal College of Nursing, Australia* 20, 27–33.
- Burbach, B.E., Thompson, S.A., 2014. Cue recognition by undergraduate nursing students: an integrative review. *J. Nurs. Educ.* 53, S73–S81.
- Butterfield, L.D., Borgen, W.A., Amundson, N.E., 2005. Fifty years of the critical incident technique: 1954–2004 and beyond. *Qual. Res.* 5, 475–497.
- Cicolini, G., Tomietto, M., Simonetti, V., Comparcini, D., Flacco, M., Carvello, M., Manzoli, L., 2015. Physical assessment techniques performed by Italian registered nurses: a quantitative survey. *J. Clin. Nurs.* 24, 3700–3706.
- Corbin, J., Morse, J.M., 2003. The unstructured interview: issues of reciprocity and risks when dealing with sensitive topics. *Qual. Inq.* 9, 335–354.
- Craft, J., Hudson, P., Plenderleith, M., Gordon, C.J., 2016. Registered nurses' reflections on bioscience courses during the undergraduate nursing program: an exploratory study. *J. Clin. Nurs.* 26, 1669–1680.
- Craft, J., Hudson, P., Plenderleith, M., Wirihana, L., Gordon, C.J., 2013. Commencing nursing students' perceptions and anxiety of bioscience. *Nurse Educ. Today* 33, 1399–1405.
- Creswell, J., Poth, C., 2018. *Qualitative Inquiry and Research Design. Choosing Among Five Traditions*. SAGE Publications, London.
- Dempsey, N., 2010. Stimulated recall interviews in ethnography. *Qual. Sociol.* 349–367.
- Douglas, C., Windsor, C., Lewis, P., 2015. Too much knowledge for a nurse? Use of physical assessment by final-semester nursing students. *Nurs. Health Sci.* 17, 492–499.
- Edhlund, B., McDougall, A., 2019. NVivo 12 Essentials. Your Guide to the Leading Qualitative Data Analysis Software. Form og Kunskap AB, Stockholm.
- Egilsdottir, H.Ö., Byermoen, K.R., Moen, A., Eide, H., 2019. Revitalizing physical assessment in undergraduate nursing education - what skills are important to learn, and how are these skills applied during clinical rotation? A cohort study. *BMC Nurs.* 18.
- Gerry, S., Birks, J., Bonnici, T., Watkinson, P., Kirtley, S., Collins, G., 2017. Early warning scores for detecting deterioration in adult hospital patients: a systematic review protocol. *Br. Med. J.* 7.
- Gillespie, M., Paterson, B., 2009. Helping novice nurses make effective clinical decisions: the situated clinical decision-making framework. *Nurs. Educ. Perspect.* 30, 164–170.
- Guillemin, M., Heggen, K., 2008. Rapport and respect: negotiating ethical relations between researcher and participant. *Med. Healthc. Philos.* 12, 291–299.
- Hoffmann, K., Aitken, L., Duffield, C., 2009. A comparison of novice and expert nurses' cue collection during clinical decision-making: verbal protocol analysis. *Int. J. Nurs. Stud.* 46, 1335–1344.
- Hughes, H.E., 2007. Critical incident technique. In: Lipu, S., Williamson, K., Lloyd, A. (Eds.), *Exploring Methods in Information Literacy Research*. Centre for Information Studies, Charles Sturt University, Wagga Wagga.
- Itano, J.K., 1989. A comparison of the clinical judgment process in experienced registered nurses and student nurses. *J. Nurs. Educ.* 28, 120–126.
- Jensen, K.T., Knutstad, U., Fawcett, T.N., 2018. The challenge of the biosciences in nurse education: a literature review. *J. Clin. Nurs.* 27, 1793–1802.
- Kain, D., 2004. Owning significance: the critical incident technique in research. In: Demarrais, K., Lapan, S.D. (Eds.), *Foundations for Research: Methods of Inquiry in Education and the Social Sciences*. Lawrence Erlbaum, Mahwah.
- Karnieli-Miller, O., Copiously, R., Pessach, L., 2009. Power relations in qualitative research. *Qual. Health Res.* 19, 279–289.
- Laurant, M., van der Biezen, M., Wijers, N., Watananirun, K., Kontopantelis, E., Van Vught, A.J.A.H., 2018. Nurses as substitutes for doctors in primary care. *Cochrane Database Syst. Rev.* (7), CD001271
- Levett-Jones, T., Hoffmann, K., Dempsey, J., Jong, S.Y.-S., Noble, D., Norton, C.A., Roche, J., Hickey, N., 2010. The "five rights" of clinical reasoning: an educational model to enhance nursing students' ability to identify and manage clinically "at risk" patients. *Nurse Educ. Today* 6, 515–520.
- Levett-Jones, T., Lathlean, J., Higgins, I., McMillan, M., 2009. Staff-student relationships and their impact on nursing students' belongingness and learning. *J. Adv. Nurs.* 65, 316–324.
- Messmer, P., Gracia Jones, S., Taylor, B.A., 2004. Enhancing knowledge and self-confidence of novice nurses: the "SHADOW-A-NURSE" ICU Program. *Nurs. Educ. Perspect.* 25, 131–136.
- Odell, M., Victor, C., Oliver, D., 2009. Nurses' role in detecting deterioration in ward patients: systematic literature review. *J. Adv. Nurs.* 65, 1992–2006.
- Osborne, S., Douglas, C., Reid, C., Jones, L., Gardner, G., 2015. The primacy of vital signs- Acute care nurses' and midwives' use of physical assessment skills: a cross sectional study. *Int. J. Nurs. Stud.* 52, 951–962.
- Padilha, M.J., Machado, P.P., Ribeiro, A., Ramos, J., Costa, P., 2019. Clinical virtual simulation in nursing education: randomized controlled trial. *J. Med. Internet Res.* 21, 1–9.
- Price, A., Zulkosky, K., White, K., Pretz, J., 2017. Accuracy of intuition in clinical decision-making among novice clinicians. *J. Adv. Nurs.* 73, 1147–1157.
- Schutler, J., Seaton, P., Chaboyer, W., 2008. Critical incident technique: a user's guide for nurse researchers. *J. Adv. Nurs.* 61, 107–114.
- Shubert, C., Meredith, D., 2015. Stimulated recall interviews for describing pragmatic epistemology. *Phys. Rev. Phys. Educ. Res.* 11.
- Tanner, C., 2006. Thinking like a nurse: a research-based model of clinical judgment in nursing. *J. Nurs. Educ.* 45, 204–211.
- Zambas, S., Smythe, E., Koziol-McLaine, J., 2016. The consequences of using advanced physical assessment skills in medical and surgical nursing: a hermeneutic pragmatic study. *Int. J. Qual. Stud. Health Well-Being* 11.