ORIGINAL RESEARCH

Exploring sterile processing technology program students' and preceptors' perceptions of the clinical learning environment

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Received: April 22, 2026 **Accepted:** May 21, 2026 **Online Published:** June 22, 2026
DOI: 10.63564/jnep.v16n7p1 **URL:** https://doi.org/10.63564/jnep.v16n7p1

ABSTRACT

Sterile Processing plays a crucial role in healthcare by reprocessing and sterilising instruments and reusable medical devices. Sterile processing technicians must have the expertise and proficiency required to deliver safe, high-quality patient care. Developing such capable and confident professionals depends on rigorous clinical education. A crucial aspect is creating a supportive clinical learning environment, which directly shapes students' acquisition of the skills, knowledge, and attitudes needed for clinical practice. This study explored students' experiences in the Sterile Processing Technology Program (SPTP) and their preceptors' experiences in clinical learning. Method: A phenomenological approach was used, with data gathered through focus group interviews. Participants were purposively selected, and data were analysed using interpretive phenomenological analysis. Findings indicated that structured orientation, preceptor-led competency assessments, preceptorship training, professionalism training, and improved academic clinical coordination are vital for enhancing learning outcomes and student preparedness.

Key Words: Allied health profession, Clinical learning environment, Clinical learning, Perception, Sterile processing, Sterile processing technicians, Students

1. INTRODUCTION

Sterile processing (SP) refers to the procedure of reprocessing and sterilising instruments and other reusable medical devices.[1] This process includes handling, collecting, transporting, sorting, disassembling, cleaning, disinfecting, inspecting, packaging, sterilising, storing, and distributing the reprocessed items to ensure they are safe, functional, and sterile.[2] Inadequate or ineffective sterile processes can result in serious consequences impacting patient safety and well-being.[3] Consequently, SP technicians play a vital role in infection control and patient safety by carefully decontaminating, sterilising, and managing surgical instruments.[4] In response to immense demand in the public and private sectors for qualified, trained central staff technicians, the diploma in Sterile Process Technology was introduced in Oman in 2023 at the Higher Institute of Health Specialities (HIHS). The Sterile Processing Technology Program (SPTP) started with 64 credit hours, including up to 1080 hours of practical experience and 600 hours of theory.

The program was established to address the growing demand for healthcare services in the country and the emergence of new surgical and diagnostic specialities that require sophisticated, highly technical equipment. The current shift in the healthcare system towards more advanced processing technologies and complex instruments suggests that sterile processing technicians require comprehensive training to develop and sustain vital skills.[2] Handling complex in-

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struments and advanced processing technologies demands effective training, along with the acquisition and ongoing retention of these crucial skills.[2]

Literature review

Due to their vital role, SP technicians need both theoretical grasp and practical skills. Consequently, clinical education is vital for shaping capable and confident practitioners.[5] A key part of clinical education that promotes student learning is the Clinical Learning Environment (CLE). It represents a dynamic, complex system of impacts that strongly influences students' clinical learning results.[6, 7] In health professional training, CLE is essential because it provides students with a space to apply theoretical knowledge in real-world settings and enhance their clinical skills. Despite the importance of sterile processing in the health care system and the emphasis on the value of immersive clinical exposure for allied health professionals' education, few studies have examined the learning experiences of SPT students. There is limited research on how SPT students view their clinical learning environments. Therefore, this literature review draws on studies involving nurses and other healthcare professionals to address the research gap in students' perceptions of sterile processing.

The reviewed literature indicates that students across healthcare disciplines, including medicine, radiology, and nursing, regard the CLE as essential to their training and clinical education. It enhances hands-on experience, builds confidence, fosters social interaction, and promotes personal connections. Studies emphasise the importance of a supportive CLE that features experienced clinical instructors, opportunities to develop clinical skills, preparation for real-life situations, and appropriate facilities.[7] Additionally, it delivers numerous benefits, such as increased motivation, active engagement, self-confidence, and student satisfaction. Moreover, it helps students meet their educational needs and improves their clinical skills.[5]

Students' perceptions of their clinical experience and learning vary with the quality of the clinical learning environment, which is influenced by many factors that may enhance or impede students' clinical learning.[7] Numerous studies have explored the factors that improve student learning in clinical settings. These include support from peers and instructors, a well-organised setting with advanced facilities, student preparedness, qualified instructors and preceptors with positive communication skills, and opportunities for independent practice. However, only a few studies have focused on preceptors' perceptions.

A cross-sectional study by Maalouf and El Zaatari[8] involving 217 undergraduate nursing students in the United Arab Emirates found that peer and instructor support were seen as the main factors promoting a positive learning experience. Similarly, Ergezen et al.[9] report that students viewed the CLE as supportive due to clear instructor guidance, opportunities for active participation, a caring attitude, and meaningful feedback. Bawadi et al.[10] also found that nursing students and clinical instructors shared perceptions about the CLE. Their results aligned with earlier studies by Ergezen et al.[9] and Maalouf and El Zaatari,[8] emphasising the importance of flexible, supportive instructors, positive role models, and hands-on practice. Conversely, Yan[11] observed that physiotherapy and speech therapy students had positive views when supported by preceptors, while medical students expressed negative perceptions due to insufficient supervision and inadequate feedback.

Clinical preceptors and educators have also reported similar facilitators in clinical settings, as noted by Kagawa et al.[12] The clinical educators emphasised key factors in the clinical environment that support effective clinical education, including strong partnerships between academic institutions and clinical settings, well-organised placements, and regular student feedback. This finding was consistent with other studies that examined preceptors' and educators' perceptions of clinical learning environments, such as Koy[13] and D'Souza et al.[14]

While the CLE is widely recognised as vital to healthcare professionals' education and provides considerable benefits and support, it also entails significant barriers for students. These barriers hindered students' learning and clinical placement experiences. These barriers include uncooperative preceptors or staff, very busy units or heavy workloads, limited access to learning resources, insufficient clinical facilities and equipment, and communication.[6]

A common challenge reported by students in nursing, midwifery, and radiologic technology programs was the lack of autonomy. In Singapore, Woo and Li[15] noted that nursing trainees felt demotivated due to passive roles and limited opportunities to make clinical decisions or influence their learning. Similarly, Ergezen et al.[9] reported that nursing students in Turkey experienced the same issues. Radiography students in Zimbabwe faced comparable difficulties, such as financial constraints, insufficient institutional support, poor facilities and supervision, disruptive interpersonal behaviours, and pandemic-related stress, all of which negatively impacted their clinical learning.[16] From the preceptors' perspective, the main challenges were limited training time, heavy workloads, and, at times, inadequate facilities.[17]

Another obstacle is the quality of educators and the level of

supervision. Mbakaya et al.[18] found in their study on nursing and midwifery students' perceptions of their CLE that students viewed insufficient supervision as a major challenge that impeded their clinical training. Similarly, Jacob et al.[19] in Tanzania reported multiple issues, for example, inadequate and infrequent supervision by overburdened instructors.

These findings correspond with those of Ziba et al.[20] in Ghana, indicating that students are less satisfied when supervision is inconsistent. Additionally, Baghdadi et al.[21] found that not only inadequate supervision, but also inconsistent feedback serve as barriers to learning in clinical environments. All the studies underline the key role of instructor-led training and continuous feedback. In this context, preceptors in D'Souza's (2013) study recognised the significance of feedback for effective clinical learning.

The literature review indicates that CLE is an essential part of clinical learning for all healthcare professionals. Its impact on students is determined by the clinical settings' atmosphere and the calibre of instruction provided by instructors or preceptors. Moreover, student and preceptor perceptions vary by environment and profession: medical students valued greater engagement and autonomy, whereas nursing and midwifery students linked their perceptions to patient care and clinical decision-making, and radiology students appreciated more hands-on practice and equipment handling. In general, facilitators of clinical learning identified across studies can be divided into individual factors related to students and preceptors, such as communication, and placement factors, including clinical context, culture, and facilities. Students across all disciplines often reported challenges, including limited hands-on practice, inconsistent instruction, limited resources, and emotional difficulties.

This suggests that we should explore and compare SPTP students' perceptions with those of students in other disciplines. Thus, this proposed study aims to investigate the perceptions of SPTP students and their preceptors regarding the clinical learning environment and to deepen understanding of their lived experiences and the factors that support or hinder their learning. The study will focus on the facilitators and barriers encountered during clinical placements.

2. METHOD

A phenomenological approach was conducted to explore the experiences of SPTP students and their preceptors regarding the clinical learning environment.

2.1 Ethical considerations

The researchers obtained ethical approval from the Higher Institute of Health Specialities Research Ethical Committee and secured informed consent from participants prior to conducting the interviews.

2.2 Participants and setting

Participants were recruited using purposive sampling. The sample included eight SPTP students and eight preceptors from six governmental health organisations, all of whom actively participated in teaching SPTP students in clinical settings. Two focus groups were established. The first group comprised SPTP students currently engaged in clinical education, with enrolment in the Diploma in SPTP at HIHS as the inclusion criterion. The second group consisted of preceptors from various hospitals who are actively involved in clinical teaching, with inclusion criteria requiring participation in clinical education activities.

2.3 Data collection

In-depth interviews were audio-recorded using a semi-structured interview guide developed based on existing literature. The focus group questions were piloted with a small sample of students and preceptors similar to the study population. Institutional experts also reviewed the questions, which clarified the wording and intent. Both students and preceptors indicated that the questions were simple, straightforward, and easy to understand. As a result, no major modifications were made to the interview guide.

2.4 Data analysis

Data were analysed using interpretive phenomenological analysis to provide detailed examinations of participants' lived experiences.

2.5 Methodological rigor

Multiple strategies were adopted to ensure rigor within phenomenological focus groups. Reflexivity and bracketing were maintained through the use of a reflexive log, which enabled the recognition and suspension of researchers' beliefs and assumptions. Participants were selected based on direct experience with the phenomenon, and small, closely matched groups were used to enable deeper investigation.

Focus group discussions were structured to elicit shared understanding and core experiences through guided dialogue. Audio recordings ensured accurate capture of verbal interactions. Data analysis was conducted transparently to identify themes from participants' descriptions. Credibility was enhanced through peer review and verification. Ethical considerations were addressed by establishing clear ground rules for focus group interviews to minimise conformity influences common in group settings.

3. RESULTS

The first focus group explored the students' perceptions of the clinical learning environment. The final analysis revealed eight themes:

Lack of proper orientation
Students reported that the initial orientation provided during clinical placements is insufficient and leads to confusion, particularly regarding roles and responsibilities.

"We don't receive much detailed orientation; everything is quite different, and we will be confused about what we are supposed to do and what our duties are."

Role clarity
Students experienced ambiguity in their duties during clinical placement, leading to disorganisation and wasted learning opportunities. They recommended a structured orientation and clearly defined roles and responsibilities to enhance learning outcomes.

"Tasks and assignments aren't always explained to us clearly, good planned orientation program will be more suitable to ensure that we do what we are supposed to do, and do not miss any chances to learn."

Assessments & competency tracking
The students explained that the assessment does not align with clinical and theoretical evaluations. Also, competency checklists are seldom signed by preceptors, which limits the reliable tracking of student progress.

"Tests are repetitive and do not match what we learn at the institute."
"Preceptors rarely sign our competency checklists; this makes them unable to follow our progress in the clinical areas."

Student-preceptors relationships & peer interaction
Some students stated that the negative attitudes and behaviours displayed by certain peers create a poor impression, which influences how preceptors perceive subsequent groups of students. Conducting pre-placement meetings between students and preceptors can help students adjust earlier.

"Some students give a bad impression about others; this affects how preceptors see the new batch of students."

"Meeting preceptors before starting clinical placement will allow us to adapt faster."

Supervision & feedback
Students stated that ongoing supervision and prompt feedback are crucial. Having a dedicated preceptor at each hospital provides improved guidance, consistent feedback and learning opportunities.

"We need proper supervision by assigning each student a consistent preceptor to ensure stable support and advice and to allow us to receive timely, regular feedback"

Clinical placement structure
Students favoured continuous placement blocks of 2–3 weeks to help maintain focus and minimise fragmentation.

"Offering full two or three-week blocks could improve our ability to focus and learn more effectively."

Communication & coordination
Students stressed that improving communication between the institute and hospitals is essential to ensure that students receive consistent instructions and meet the expectations of the clinical placement.

"Meetings between the institute and preceptors should happen to share even information about our objectives, competencies, and what is expected from the preceptors."

Preceptors' motivation
Students highlighted that some preceptors are hesitant to train them, and they stressed that choosing motivated preceptors who are willing to teach them is needed to s improve their skills.

"Some preceptors demonstrate reluctance to teach us, and we need those who are truly interested in teaching us, as they can add more to our clinical experience".

The second focus group explored the preceptors' perceptions of the Clinical Learning Environment. The final analysis revealed several themes:

Theory and practice gap
Preceptors noted that students demonstrated understanding of concepts and terminology but had difficulty applying this knowledge in practice.

"They know the names of instruments and some related information, but when they come to practice, they cannot demonstrate."

Several participants highlighted that students remained preoccupied with examinations during clinical rotations, limiting their engagement in practical learning.

"Most of the time, they come with their books. They are thinking about exams, not practice. Their mind is busy with theory while they are in clinical."

Professionalism and behaviour
Preceptors expressed concerns related to professionalism; they described issues related to punctuality, communication, and professional etiquette.

"Some students come late, leave early, and sometimes go

without permission."

"In our culture, when you enter the department, you say salam, good morning. Some students just enter without saying anything."

Student motivation and engagement

Participants noticed significant differences in student motivation. Some students were praised for their enthusiasm and eagerness to learn, whereas less engaged students seemed to have a greater negative impact on the group's learning environment than others. Additionally, participants associated the expectation of secure employment after graduation with reduced urgency and effort among certain students.

Most students are highly motivated and eager to learn, putting in their best effort during clinical practice.

Nevertheless, just one or two disengaged students can impact the motivation of the entire group.

Some students do not feel pressured to work harder or improve their performance because they are confident of securing a job after graduation.

Clinical assessment

The preceptors emphasised that although they are currently not involved in students' clinical assessment, they believe they should assess and grade a specific component of the overall clinical placement. Participants felt this approach would improve student accountability, motivation, and engagement during clinical practice. A specific percentage of the marks for clinical evaluation should be determined and directly assessed by the preceptors overseeing the students.

Students who understand that their clinical performance impacts their final grade tend to be more diligent and committed during training.

Preceptor preparation and support

Although preceptors expressed strong commitment to student learning, many felt inadequately prepared for the teaching role. There was a clear request for short, targeted training sessions focusing on teaching strategies and managing student behaviour.

Our teaching relies solely on our experience, as we did not receive formal training as preceptors.

"Even a brief workshop on handling students can have a significant impact."

Clinical placement structure

Preceptors emphasised that large student cohorts pose a major obstacle to effective clinical learning. They recommended using smaller groups and implementing block clinical rotations without simultaneous theory exams.

"When the number is large, students have limited opportunities to practice." "Clinical time should be reserved for practical activities only, avoiding interruptions for theoretical exams.

Communication and feedback

Preceptors noted that informal communication with academic staff was usually positive. However, they pointed out the absence of structured and consistent feedback systems. Participants strongly recommended establishing regular joint meetings involving preceptors, academic staff, and students to evaluate progress, resolve issues, and enhance coordination between the clinical and academic environments.

We communicate with faculty as necessary, but there is no established or consistent system for providing structured feedback.

"Regular scheduled meetings would help us discuss student progress, identify problems early, and find solutions together."

"Having even one hour per week for joint discussion between students, preceptors, and faculty would make a big difference."

Generational and cultural challenges

Participants frequently referred to challenges related to students' maturity and readiness for professional responsibility.

"This generation is not mature enough. They don't take responsibility seriously."

4. DISCUSSION

This study examines both student and clinical preceptor perspectives on the clinical learning environment. Combining these viewpoints provides a comprehensive understanding of clinical learning processes and identifies shared priorities for educational improvement.

Students highlighted the importance of a structured orientation and clear role expectations at the start of clinical placements. Many reported uncertainties about their responsibilities and confusion due to inconsistent information from various sources.

This lack of clarity reduced students' confidence, preparedness, and initial engagement in clinical practice. Recent studies confirm that clear orientation, defined roles, and consistent guidance significantly improve students' confidence, satisfaction, and integration into clinical teams.[22,23]

Additionally, structured orientation programs have been found to enhance clinical learning outcomes and lower student anxiety during early clinical experiences.[24] These findings support the need for structured orientation programmes

that clearly define roles, responsibilities, and clinical expectations to ease students' transition into practice.

Both groups highlighted the importance of regular supervision and constructive feedback. Students preferred having a single dedicated preceptor, as this improved consistency, fostered trust, and enabled more personalised feedback. While preceptors acknowledged their teaching responsibilities, they reported insufficient training and limited institutional support. Evidence from recent studies indicates that structured preceptor training programs significantly enhance teaching competencies, student satisfaction, and clinical learning outcomes.[25,26] Preceptor motivation was also identified as a key factor in teaching engagement, further underscoring the value of structured development programmes, as demonstrated by Gholizadeh et al.[27]

Students and preceptors voiced concerns about the lack of a structured, preceptor-led clinical assessment. Students noted inconsistent evaluation practices and a weak connection between academic objectives and clinical assessments. Preceptors highlighted that their limited role in formal grading decreased student accountability and engagement. Both groups concurred that preceptors should be integral to evaluating and grading clinical skills through standardised checklists. This approach would improve tracking skill progress and provide clearer performance feedback. Modern research strongly supports the use of workplace-based assessment (WBA) tools such as direct observation, structured feedback forms, and competency checklists to enhance learner engagement, responsibility, and skill development.[28,29] Incorporating graded competency assessments into the academic framework alongside structured clinical input ensures evaluations are aligned with curriculum objectives, standardised, and equitable. Evidence indicates that integrating summative clinical performance assessments into formal grading systems significantly boosts student motivation, encourages professional behaviour, and improves the development of clinical competence.[30–32]

Both groups expressed concerns regarding professionalism, communication, punctuality, and engagement. Students reported that negative peer behaviours influenced staff attitudes, while preceptors observed a decrease in professional etiquette. Recent research suggests that cultivating a professional identity primarily depends on early role models, well-defined expectations, and a supportive learning environment.[24,33] Clinical environments that encourage psychological safety, mutual respect, and supportive supervision tend to lead to higher student satisfaction, engagement, and career commitment.[34]

Both students and preceptors highly favoured continuous block placements over fragmented schedules. Research shows that longer placement periods enhance experiential learning and clinical reasoning and boost professional confidence.[24,35] Moreover, large student groups were seen as obstacles to hands-on experience. Studies reveal that lower student-to-preceptor ratios greatly enhance the quality of feedback, clinical involvement, and learner satisfaction.[36]

All stakeholder groups highlighted deficiencies in structured communication between academic institutions and clinical sites. Although informal interactions existed, the absence of standardised feedback systems and joint evaluation meetings impeded early identification of learning issues. Strong academic clinical partnerships are often associated with improved learning outcomes, enhanced professional integration, and increased institutional accountability.[37,38] Joint review meetings, shared evaluation forms, and coordinated placement planning are evidence-based strategies that enhance educational coherence and promote continuous improvement.

Several limitations should be acknowledged when interpreting these findings. This study was conducted within a single institutional context, and the findings reflect the experiences and perceptions of students and preceptors at one clinical training site. As such, transferability to other healthcare education settings (particularly those with different resource levels, regulatory frameworks, or cultural norms surrounding clinical supervision) cannot be assumed. The institutional context of this study, including its specific organisational structures, staffing models, and curriculum design, may differ substantially from other settings, and readers should exercise caution in applying these findings beyond comparable contexts. Future multi-site research would strengthen the generalisability of these conclusions.

4.1 Clinical implications

This study emphasises the importance of structured orientation programs, clearly defined roles, and centralised guidance to enhance students' readiness for clinical placements. The results highlight the need for consistent supervision by trained and motivated preceptors, supported by formal development initiatives. Additionally, workplace assessments should incorporate preceptor grading into the overall academic evaluation to promote accountability, monitor competency, and ensure alignment with learning objectives. The preference for continuous block placements suggests that re-evaluating clinical schedules might improve deeper learning, enhance skill retention, and facilitate better professional integration. Developing stronger academic clinical partnerships through regular communication, joint evaluation approaches, and coordinated placement planning is essential to improve the quality and consistency of clinical education.

4.2 Strengths and limitations

A key strength of this study is its incorporation of both students' and preceptors' perspectives, offering a well-rounded view of the clinical learning environment. The qualitative phenomenological method allowed for an in-depth examination of lived experiences, leading to rich contextual insights. Nevertheless, the qualitative approach and the sample size could restrict the generalizability of the findings. Additionally, group discussions may have affected individual responses, so the results should be viewed as context-specific rather than universally applicable.

4.3 Future research

Future research should incorporate mixed-methods and longitudinal designs to assess how structured orientation and preceptor training influence outcomes. Conducting multisite and cross-institutional studies is essential for broader relevance and comparative analysis. Additionally, future investigations should explore preceptor workload, motivation, institutional support, and the long-term impact of clinical learning environments on graduate preparedness and their integration into the workforce.

ACKNOWLEDGEMENTS

The authors would like to express their sincere appreciation to everyone who supported and contributed to this study. We are grateful to all individuals who participated and provided valuable assistance during the research process. Their contributions and cooperation were greatly appreciated.

AUTHORS CONTRIBUTIONS

Muna Bait Saad, Raya Al Habsi, and Sharafudeen Cheriyamakantakath contributed equally to this study. All authors were responsible for writing the research proposal, collecting data, analyzing data, and preparing the final report. All authors reviewed, revised, and approved the final manuscript.

FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

CONFLICTS OF INTEREST DISCLOSURE

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

INFORMED CONSENT

Obtained.

ETHICS APPROVAL

The Publication Ethics Committee of the Association for Health Sciences and Education. The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

PROVENANCE AND PEER REVIEW

Not commissioned; externally double-blind peer reviewed.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

DATA SHARING STATEMENT

No additional data are available.

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