Original Article

Clinical learning process of surgical technologist students: A grounded theory

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Abstract

Background & Objective: Identifying the learning process of surgical technologist students in the operating room environment can effectively reveal the factors and strategies they use to learn and enhance the quality of their education. This study aimed to elucidate the clinical learning process of surgical technologist students.

Materials & Methods: This qualitative study employed a grounded theory approach at Shahrekord University of Medical Sciences in 2022. Data were gathered through six in-depth individual interviews and three focus groups. Purposeful and theoretical sampling persisted until theoretical saturation was achieved. Data analysis was conducted using MAXQDA10 software.

Results: Thirteen subcategories and four main categories were found. The core variable was self-protection. Students fear making mistakes in the uncertain learning environment and employ flexible strategies, utilizing relationship-oriented approaches to achieve success while avoiding performance that could hinder learning, thereby preventing issues that would protect themselves.

Conclusion: It is essential to enhance students' learning by employing strategies that boost their self-confidence and avoid adhering to the current approach solely for the satisfaction of the training team, thereby preventing numerous negative consequences. Clinical managers are also encouraged to foster an educational atmosphere in the operating room and to cultivate a positive attitude among employees to support student education in these settings. Establishing constructive communication between the clinical environment and the educational system and emphasizing the significance of student education can improve the educational atmosphere in clinical settings.

Keywords: clinical learning, surgical technologist students, self-protection, grounded theory

Introduction

A vital component of many health-related fields is clinical learning, in which students interact with their environment and put newly acquired knowledge into practice [1, 2]. In contrast to classroom instruction, clinical learning occurs in a complicated social setting where clinical educators must concurrently attend to the needs of patients, students, and other medical professionals. Therefore, encouraging clinical learning during practice requires improving the quality of the clinical learning environment [2]. Given this, it is critical to remember that clinical education is a complex process where students apply their scientific knowledge and are impacted by a wide range of circumstances [3].

The results of the studies reveal a gap between the theoretical and clinical training processes. Consequently, the current clinical training needs to equip students with the necessary abilities to attain clinical competence and skills [3, 4]. As surgical technologist students spend most of their learning time at the bedside, it is crucial to understand the extent and manner of various factors influencing their learning process [5]. Meanwhile, nursing students' comprehension of the clinical learning

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environments can significantly impact their understanding of the nature and process of clinical learning [6]. The point of contact between the student and the learning environment is the student's grasp of the clinical learning settings, and this understanding affects their learning in the clinical context [7]. The actual clinical context frequently differs from what students expect from the clinical learning environment. Therefore, when establishing a clinical education program, it is essential to identify effective elements influencing clinical learning from the students' perspective [8, 9]. Analyzing their perceptions and understanding of clinical education can help them identify the advantages and disadvantages of learning in clinical settings, which will improve educational programs and raise educational standards. Students' experiences can be the most essential components of clinical education since they are the primary means of establishing professional attitudes, values, and norms [10–12].

Numerous contributing factors cause students' comprehension of the clinical environment to vary, which is a major difficulty in clinical learning, according to studies. Due to this variation, different clinical education approaches and theories have varying degrees of efficacy in students' clinical learning. In other words, while many factors impacting clinical learning are well-documented, the processes of their influence and interaction in fostering student learning remain ambiguous [14, 13]. Consequently, despite the availability of diverse models and theories in learning and clinical education, substantial gaps persist between theoretical education and its application in clinical settings [8, 15]. Considering the significance and challenges in this domain, it is essential to analyze the learning process from the students' viewpoint to clarify various ambiguous elements, thereby improving and advancing this cohort's clinical education. Many studies have been conducted on the clinical education environment for nursing and medical students and the associated challenges; however, students' clinical learning experiences have been less regarded as a crucial component in the clinical education process [16, 3, 17]. Ekstedt et al. noted in their study that a positive clinical learning environment relies on an educational setting where staff is engaged in supervising students, and there is effective interaction between lecturers and clinical educators [18]. Mbakaya et al. also noted that nursing and midwifery students faced various challenges, including a lack of educational facilities, poor communication with clinical personnel, and insufficient support from clinical educators, all of which negatively impacted their clinical learning experiences [19]. In their study of nursing students' experiences in clinical learning environments, Najafi Kalyani et al. found that students had "identity confusion" due to an inadequate educational setting [20].

The analysis of the studies above indicates that the learning experiences of nursing students in the clinical environment are significant, and its various dimensions still require further investigation. Grounded theory studies conducted on nursing students have illustrated how they learn in clinical settings; however, it is important to recognize that different learning contexts play a crucial role in shaping students' learning experiences. In this regard, it is noteworthy that surgical technologist students, like nurses, undergo clinical training in hospital environments and para-clinical departments, resulting in a similar clinical learning environment. Nevertheless, it must be emphasized that, despite these similarities, the operating room environment presents distinct contextual differences and levels of care compared to other hospital departments. Consequently, given that the learning process of this group of students has yet to be adequately addressed in previous studies, this research will elucidate how surgical technologist students learn and the nature of their learning process.

Materials & Methods

Design and setting(s)

The present qualitative study was conducted at Sharekord University of Medical Sciences in 2022. The research setting was the Borujen Faculty of Medical Sciences. Given that learning is fundamentally a process, this study aims to explore how the clinical learning process affects surgical technologist students, mainly since this group's clinical learning process is often overlooked within the Iranian educational system. Consequently, a grounded theory technique was used to analyze the study question.

Participants and sampling

Participants in this study included surgical technologist students who underwent clinical learning experiences in the operating room. They were carefully chosen based on specific characteristics, such as their ability to communicate their experiences and previous exposure to the operating room atmosphere. The sampling process occurred concurrently with the research stages, which

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involved gathering information, analyzing it, classifying concepts, and identifying themes. The researcher selected samples as the theory developed. Sampling and data collection continued until data saturation and theoretical saturation were achieved. To guarantee maximum variety in sampling, volunteers of various ages, genders, and academic semesters were chosen. The schedule and venue of the face-to-face interviews were decided based on the students' preferences and agreement. In this study, the researchers served as interviewers, carrying out the research and assessing the data.

Data collection methods

Data for this study were collected through face-to-face individual interviews and focus groups. The interviews were conducted by the first author (a male with a PhD in nursing). Initially, two interviews were conducted as a prototype, resulting in the creation of an interview guide. The first interview was with an eighth-semester student from the operating room program. Data collection began with in-depth semi-structured interviews, followed by structured interviews that asked increasingly sophisticated and specialized questions on the area of interest. The interview began with open-ended questions such as, "Please describe how you learn in a clinical environment during a day of training" and "How do you learn as a student in an operating room environment?" More specific questions were posed based on the responses provided by participants. To clarify the participants' comments, probing questions such as "Please explain further" and "What does this mean?" were used. As the study progressed, the interviews were led by the created theory, with the researcher asking questions based on the prominent and relevant themes uncovered. The interviews' length varied according to the interview procedure and the participants' desire and ability to participate. Following each interview, participants were asked for permission to do follow-up interviews in person or over the phone.

Additionally, focus groups were used in this investigation. The participants were already familiar with the study's goal before participating in group interviews. The interviewer asked questions, and the participants gave their comments. The presence of other participants prompted them to complement one another's ideas and expound on their responses. They often agreed with each other's points of view, although they also disagreed at times. The researcher followed the processes provided and incorporated the acquired data while reading the interview text several times to understand its substance thoroughly. The semantic units of the interview text were then identified, and coding was conducted. During the coding process, participants' phrases and expressions were evaluated, and different individuals investigated the meanings of these expressions in various circumstances. The codes were compared and categorized according to their similarities, differences, and content. Due to a lack of data, sampling was initially purposeful. However, after assessing the initial interviews, the theoretical sampling procedure proceeded to complete and integrate the study concepts in accordance with the desired theory. The theoretical sampling process also persisted in integrating subcategories for the formation and saturation of categories until theoretical saturation was reached; at this point, the categories and their dimensions and characteristics were integrated into the core variable. Interviews continued until data saturation was achieved. Furthermore, the analysis of the initial interviews served as a guide for ongoing sampling in the direction of theoretical sampling, which continued until theoretical saturation was accomplished. Throughout all data interpretation and coding stages, memos were utilized to aid in forming categories and theory. A digital audio recorder was employed to capture the interviews.

Data analysis

The interviews were analyzed concurrently with the data collection process. The Strauss and Corbin (2015) method was employed for data analysis [22]. These steps include open coding, identifying concepts and developing concepts in terms of their properties and dimensions, analyzing data for context, incorporating processes into the analysis, and integrating categories. MAXQDA 10 software was utilized to manage qualitative data.

Rigor

To evaluate the accuracy and scientific validity of the findings, the criteria established by Lincoln and Guba were employed [23]. To enhance the credibility of the findings, long-term engagement with the research topic and validation were conducted with the research participants. In this study, the researcher was deeply involved with the research topic and data over an extended period. Furthermore, the text of the interview and the resulting open codes were shared with the available participants, and the degree of alignment of the ideas extracted from the data was compared with the

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participants' opinions. Any corrections they suggested were taken into account. Peer review was also utilized as a means to bolster the credibility of the data. For this purpose, the complete text of the conducted interviews and the relevant codes, concepts, and emerging categories were sent to referees and colleagues for their review and critique of the coding and analysis process. Throughout the research, the codes, concepts, and emerging categories were repeatedly shared with experts familiar with qualitative research to solicit their feedback, leading to criticism and content revisions. Participants were selected to ensure maximum diversity in demographic characteristics. Accurate documentation of research steps and processes was also prioritized to enhance the validity of the results. In this study, all stages of data collection, coding, data analysis, and presentation of findings were articulated in detail and depth whenever possible. Additionally, all interviews were recorded, transcribed, and analyzed. The meticulous and step-by-step documentation of the research process facilitated auditing and follow-up of the research activities. **Table 1** shows the process of forming a category from the participants' statements.

Results

The interview process lasted 6 months, with an average duration of 40 minutes. Nine face-to-face interviews (6 individual interviews and three focus groups) were conducted with 16 participants. The characteristics of the participants are detailed in **Table 2**.

Table 1. An example of the process of formation of category from the participants' statements

Category	Subcategories	Initial code	Statements
Learning distress	Disappointment	Feelings of failure followed by avoidance of facing the fear	I did not participate in the surgery due to the fear of facing the doctor and therefore I feel like a failure
	Remaining concern	The possibility of not achieving learning goals in the future	My biggest fear is that I won't know anything after graduation, and this worries me
	Hidden fear	Pretending to be successful in learning	When my teacher asked me to go for a caesarean section, I told him to go for another one and I know... After a while, I panicked because it wasn't really like that.

Table 2. Characteristics of study participants

Interview	Participant	Age	Sex	Academic semester	Marriage
1	1	22	Male	4	Married
	2	23	Female	6	Single
	3	22	Female	4	Single
	4	28	Female	8	Married
2	5	21	Female	4	Single
	6	26	Female	8	Single
	7	24	Female	6	Single
3	8	28	Female	7	Single
	9	25	Female	5	Single
	10	24	Female	3	Married
4	11	22	Male	6	Single
5	12	21	Male	5	Single
6	13	23	Male	6	Single
7	14	21	Female	7	Single
8	15	29	Female	7	Married
9	16	21	Female	5	Single

1- Open coding and identifying concepts and developing concepts in terms of their properties and dimensions

The analysis of raw data resulted in the identification of 112 primary codes. After merging similar codes, 80 codes were included in the analysis process. This classification of primary codes led to the development of 13 subcategories and ultimately 4 categories (**Table 3**). By the end of this stage, the main concern was identified. The most significant concern, which was the fear of making mistakes, was expressed by students regarding their learning in the operating room environment. They indicated that they were very apprehensive about being harmed by the system while learning clinical procedures. This urgent issue requires immediate attention and action.

Participant number 7, a 24-year-old female in her 6th semester, said: "*When I'm in the dressing room and my*

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shift is about to start, I'm afraid that if I don't do something, I'll have a problem... "

Participant number 11, a 22-year-old male in her 6th semester, said: "*I once made a set non-sterilized... and then I'm afraid that if I make a mistake again, it will cause me problems*."

2- Analyzing data for context

The results at this stage revealed that the uncertain learning environment is a source of students' fear of making mistakes. In other words, operating room students are afraid of getting hurt in this unpredictable learning setting. The uncertain learning environment is also affected by factors such as the disparity between theory and practice and the non-educational context, which contributes to students' fear of making errors.

Participant number 6, a 26-year-old female in her 8th semester, said: *"During a surgery, one of the personnel made a mistake, and they blamed the mistake on me. Isn't this educational, and we have to have the opportunity to make mistakes to learn? This makes me afraid of making mistakes."*

Participant number 13, a 23-year-old male in her 6th semester, said: *"Once I was washing hands with a staff member... I saw he was doing something very different from what they told us in the classroom. I was afraid that I was doing something wrong.*

Table 3: Categories and subcategories of clinical learning process of surgical technologist students

Categories	Subcategories
Uncertain learning environment	The difference between theory and practice
	Ambiguous learning environment
	Fear of making a mistake
	Doctor's opinion preferred
Trust building	Avoiding performance leading to learning to prevent problems
	Relationship-oriented strategy to achieve success
Educational progress	Imagination
	Strive for optimal learning
	Effective educational infrastructure
	Being flexible
Learning distress	Disappointment
	Remaining concern
	Hidden fear

3- Bringing process in to the analysis

Examining the data of the study revealed that in the face of the fear of mistakes, the operating room students used strategies such as being flexible, using relationship-oriented strategy to achieve success, and avoiding performance, leading to learning to prevent problems. These strategies were facilitated by a suitable educational infrastructure and confounded by the doctor's opinion referral. Students' use of these strategies resulted in learning distress in them.

3-1- Students' learning strategies

Due to their fear of mistakes, students use strategies to avoid harm. In this regard, students use the three strategies of being flexible and relationship-oriented to achieve success and avoid performance, leading to learning to prevent problems. The strategy of being flexible helps them to adapt to existing unfavorable conditions. Using the relationship-oriented strategy to achieve success, students try to overcome their fears by creating positive and good relationships with others and influential people. Using the strategy of avoiding performance leading to learning to prevent problems, students try to avoid situations that they think will create problems for them and, in other words, do nothing.

Participant number 2, a 23-year-old female in her 6th semester, said:*"Ever since I made a mistake during the surgery, I have become very cautious, and I try to be gentle in every operation... This is good for me."*

Participant number 10, a 24-year-old female in her 3th semester, said: "*Ever since I made a mistake during the surgery, I have become very cautious, and I try to be gentle in every operation... This is good for me. I didn't say anything to one of the staff who insulted me and I didn't answer him.... "*

3-2- Facilitating and confounding factors affecting the process: Appropriate educational infrastructure, doctor's opinion preferred.

Students use strategies to prevent harm to themselves. Factors such as suitable educational infrastructure can facilitate these strategies, and the doctor's opinion infrastructure in this educational system confounds them. The existence of suitable educational infrastructure,

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including the appropriate teacher and environment, and the educational behavior of the care team can facilitate students' use of these strategies. On the other hand, the doctor's opinion preference in the clinical education system can distort these strategies.

Participant number 15, a 24-year-old female in her 7th semester, said: "*One of the personnel, who was also our trainer, supported me when we were in surgery with the doctor and the doctor complained about me, and in this way, the relationship between the doctor and me improved*."

Participant number 9, a 25-year-old female in her 5th semester, said: "*During an operation, the surgeon made a mistake... he did not reach the staff, he stuck with me... This process caused my relationship with that staff and doctor to become bad, and I became soft with them during the operation*..."

3-3- Outcome: learning distress

To overcome their fear of mistakes, students used strategies that protect them from harm. However, these strategies caused learning distress in them. In other words, the strategies they used could not remove the fear of mistakes in them, and despite using these strategies, they experienced distress and suffering in learning.

Participant number 1, a 22-year-old male in her 4th semester, said: *"Although I didn't go to the surgery due to the fear of getting into trouble with the doctor, I feel that I missed a proper procedure, which makes me sad."*

Participant number 14, a 21-year-old female in her 7th semester, said: *"Even though I improved my relationship with the operating room supervisor and he likes me, that day he told me that if you don't listen, I won't give you a grade. A person becomes conflicted about who is good and who is bad..."*

Participant number 12, a 21-year-old male in her 5th semester, said: *"In order to let me go to surgery, I improved my relationship with the orthopedic doctor, but when he became busy, he seemed to forget our relationship and treated me inappropriately, which made me really disappointed."*

4- Integrating categories

Determining the core variable: Examining the interviews as well as analyzing the results and memos, revealed that students, in the face of the fear of harm as their primary concern, use the strategies of being a flexible and relationship-oriented strategy to achieve success and avoiding performance and leading to learning to prevent problems. Which results in learning distress for them. A comparative and continuous study of the strategies used by students showed that to reduce their anxiety; students act according to the stated strategies to protect themselves; in other words, in an uncertain learning environment, they act only to protect themselves from the situation. Self-protection is at the top of their learning process, so self-protection is considered at the highest level of these strategies.

Participant number 6, a 26-year-old female in her 8th semester, said: *"At the beginning of the operation, I was in scrubs, and the staff was explaining something wrong. Even though I knew it was wrong, I confirmed his relationship with me so that the person wouldn't feel bad about me, and he liked it, too. I did something wrong, but I just wanted to protect myself and the other students."*

Participant number 8, a 28-year-old female in her 7th semester, said:

"In the neurology operating room, the scrub nurse made a mistake and blamed it on the student... the doctor also insulted us... I kept silent so that my relationship with the others would not be damaged and they would let me go to the operation..."

Because the concept of self-protection is at the highest level of each of the strategies, the storyline can be formulated as follows: In an uncertain learning environment, students are afraid of being harmed, so they use three strategies: being flexible, using relationship-oriented strategy to achieve success and avoiding performance leading to learning to prevent problems. These strategies are all developed by students to protect them from harm. These strategies are facilitated by suitable educational infrastructure and distorted by doctor's opinion referral. Using these guides causes learning distress in students. In other words, their strategies aim to reduce the fear of harm; however, given a lack of proper learning, it follows them with distress and suffering. Finally, according to the position of each of the strategies used in relation to the concept of self-protection and their relationship with each other, self-protection was chosen as the core variable, and other variables were integrated around it. Then, the theory of self-protection in the learning environment was developed as a clinical learning process for surgical technologist students. The components of the theory are shown in **Figure 1.**

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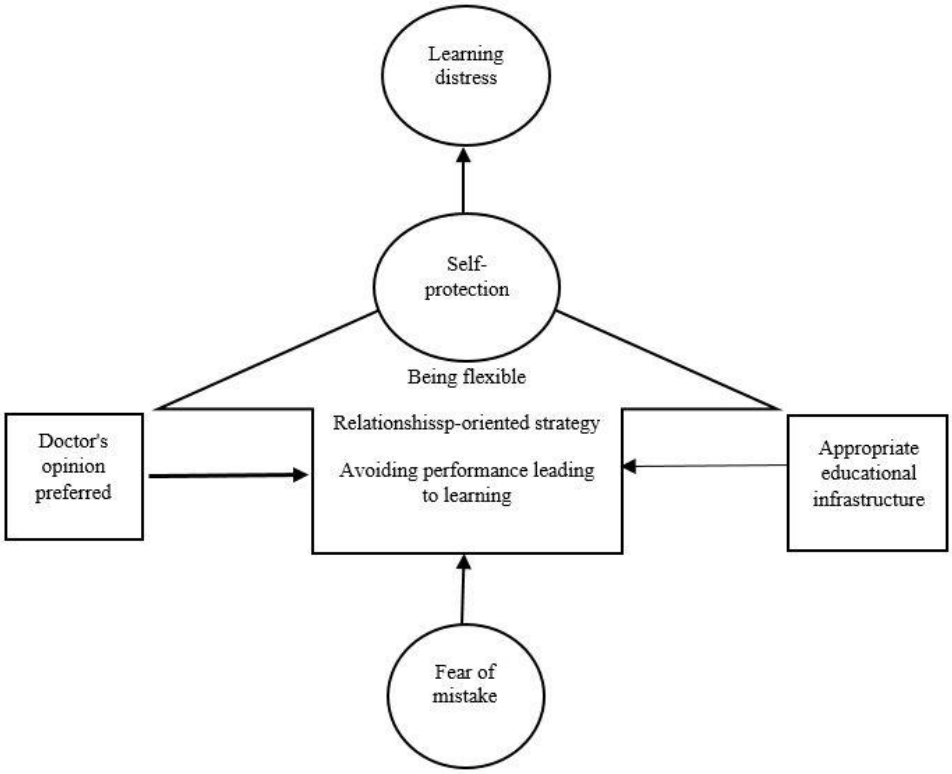

Figure 1: The contextual model of clinical learning process of surgical technologist students

Discussion

The current study sought to understand the clinical learning process of surgical technologist students. The findings suggested that students are concerned about potential injury in an unclear learning environment. To solve this issue, they used techniques such as flexibility, relationship-based approaches to success, and avoiding performance demands, which resulted in learning that would safeguard them. However, these strategies did not yield the desired outcomes and caused their learning distress. Mirzaei et al., in their investigation of nursing students' understanding of the clinical learning setting, noted that various stimuli influence nursing students' comprehension of this environment through a four-step process. These stages included experiencing and processing initial expectations, engaging with the planned environment, navigating the clinical learning setting, and feeling the development of personal and professional skills and qualifications [16]. Najafi Kalyani et al., in their study examining nursing students' experiences in the clinical learning setting, revealed that students faced identity confusion due to an inadequate learning environment, which they identified as their primary concern. In response to this concern, they employed specific strategies, some of which kept them from entering uncomfortable situations. Unfortunately, these solutions did not resolve their issues and hindered their acceptance of professional roles and responsibilities. Conversely, other strategies facilitated their professional development and enabled them to embrace their roles within the clinical setting [20].

In analyzing these studies, it should be noted that students' understanding of the clinical environment, which often differs from the existing challenging environment, frequently confuses them and leads to varying consequences based on the strategies they employ to cope. Given the stressful setting for their learning, the process of evaluating the current conditions by operating room students should guide them toward positive strategies with the support of the educational system to mitigate negative outcomes such as learning distress. Ekstedt et al. conducted a comparative cross-sectional study in Sweden to investigate nursing students' impressions of the clinical learning environment and supervision in two alternative supervision models. The data revealed that both approaches provided pupils with a favorable learning environment. An effective learning setting for students in clinical contexts relies on a clear structure for integrating students and an educational atmosphere where staff are committed to supervising students and are readily accessible, fostering effective

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interaction and collaboration between instructors and students. Clinical trainers for nurses should be present [18]. Chan et al. assert that repetitive topics in the clinical environment lead to negative experiences for students. Students enter clinics with inadequate preparation and preconceived notions about clinics and nursing. When confronted with an unsupportive atmosphere, negative behaviors and attitudes from nurses, etc., they encounter conflicts between their expectations, learned subjects, and the reality in clinics [15].

In the analysis of this study, it should be said that the use of support models in which students have enough interaction with professors and staff can play an effective role in students' satisfaction and choosing positive learning strategies. However, in the present study, due to the distorted communication between the students and the care team, the strategies used by the students were inappropriate and aimed at protecting themselves.

Karimi Monaghi et al., in a qualitative study aimed at the clinical learning experience of medical students, found 11 themes that indicated the clinical experiences of medical students. These subjects include the nature of clinical learning, not belonging to the medical group, worry and anxiety caused by the program, the relationship between the learner and the teacher, the different platforms and sources of clinical learning, turning potential abilities into actual ones, finding oneself in the clinical setting, Attractive aspects of clinical experience, conflict between work and learning, dependence and lack of clinical learning. Furthermore, the results of this study showed that clinical learning leads students to become professionals in medicine [24]. Mbakaya et al. (2020) investigated nursing and midwifery students' experiences and perceptions of the clinical learning setting in Malawi in a mixed-methods study. The results showed that nursing and midwifery students encountered multifaceted challenges, including lack of resources, poor communication with staff, and lack of support from clinical teachers, which hurt their clinical learning experiences [19]. In a study, Sayadi et al. investigated nursing students' views about the clinical learning environment and the factors affecting it. The results of this study indicate that the highest average score obtained related to the areas of satisfaction and interpersonal relationships, as well as the areas of participation and personalization of the clinical learning environment, had weaknesses [25]. Some of the themes presented in this study are similar to the categories of the present study and show the conflict between theory and practice. Also, the student's concern about whether this learning process in the clinical environment can actualize their talents and achieve competent learning for the future of their careers is worth mentioning, which is in line with the outcome of the present study.

Among the limitations of the present study, it can be pointed out that since the professors conducted the interview, perhaps the students needed to be more comfortable expressing their experiences. In this regard, at the beginning of the interview, it was emphasized to the students that these experiences and their statements would not affect the process and attitude of the professor towards the students, and an environment was tried to provide the students with comfort during the interview.

Conclusion

This study was concerned with explaining the clinical learning process of surgical technologist students. The results suggested that students fear mistakes in the uncertain learning environment and use self-protection strategies, which cause distress in their learning. Students' learning process should be improved by using appropriate educational plans and improving the operating room's educational atmosphere. Frequent monitoring of clinical environments and identification of problems and challenges in the operating room environment by educational managers through interviews and observations by educational officials will enable appropriate planning. Actions such as using appropriate training models from employees can improve the gaps in the need for faculty trainers. Identifying students' fear and anxiety during the learning process will also help to eliminate them and prevent negative consequences. Because the strategies used by the students in dealing with their fear of not learning and making mistakes are not suitable and because the students cannot deal with the existing conditions and problems, it is more in line with protecting themselves and getting grades and satisfaction the environment, it cannot compensate for their learning gap.

Therefore, it is necessary to improve students' learning by using strategies such as increasing students' self-confidence and not following the existing approach to gain the satisfaction of the training team and avoid many negative consequences. It is also recommended that clinical managers expand the educational atmosphere in the operating room environment and create a positive attitude among the employees to help educate students in these environments and have healthy and educational communication with the educational system. Constructive communication between the clinical

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environment and the educational system and emphasizing the importance of student education can help improve the educational atmosphere in clinical environments.

Ethical considerations

This study was approved by the Shahrekord University of Medical Sciences (IR.SKUMS.REC.1400.136). The ethical principles of consent, independence, and confidentiality were observed for the participants. Written informed consent was obtained from all participants, and their participation in the study was voluntary. They were also assured of the confidentiality of their information. Before conducting the interview, the participants were informed about the purpose and method of the study, and written consent was also obtained from them for audio recording and note-taking during the interview.

Artificial intelligence utilization for article writing

Grammarly is used in this paper.

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Conflict of interest statement

The authors declare that they have no conflict of interest.

Author contributions

M.R. conceptualized and designed the study and collected the data, M.S. designed the study and analyzed the data, A.T. analyzed the data, and S.M. and F.M. wrote the main manuscript text. The authors met the criteria for authorship and played a role in preparing the manuscript. Moreover, the authors approved the final manuscript.

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Data availability statement

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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