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ORIGINAL ARTICLE / ARAŞTIRMA YAZISI

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Evaluation of the Integration of Simulation-Based Training Program into the Anesthesia Technician Curriculum : A Mixed Method Study

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ABSTRACT

Background: The aim of this research is to assess the experiences of graduates from the anesthesia technician program with simulation-based training. By gathering their perspectives as learners who went through the simulation curriculum, the study seeks to identify potential improvements for better integrating simulation into the program.

Method: The research examined the experiences of 68 graduates from the Anesthesia Program at Acibadem Mehmet Ali Aydınlar University's Vocational School of Health Sciences. The focus was on the simulation-based education program that was incorporated into their curriculum during their studies. The study employed a mixed-methods research approach, gathering both quantitative data through surveys and qualitative data through focus group discussions. The data from these different methods were integrated and interpreted using Creswell's Convergent Design

Results: The majority of participants (95.16%) stated that the simulation training significantly contributed to increasing their knowledge and skills,additionally, 93.55% of the participants stated that debriefings and the group discussion environment contributed to their learning processes.Participants who responded to the survey stated that the simulated cases were similar to the cases encountered in the clinic (79.09%), and that the features of the simulators and the environment were realistic (91.94%).However 43.55% of the participants also stated that the time allocated for training was not sufficient. The opinions of the participants in the focus group discussions were also similar.

Conclusion: The simulation-based training program for anesthesia technicians found to be effective. However, based on participant feedback suggesting more time should be devoted to training, it was determined that opportunities for self-directed learning need to be implemented.

Keywords: Medical Simulation, Anaesthesia Training, Curriculum,Development, Mixed Method, Clinical Transfer

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ÖZET

Amaç: Bu araştırmanın amacı, anestezi teknikerliği programı mezunlarının simülasyona dayalı eğitim yöntemi ile ilgili deneyimlerini değerlendirmektir. Öğrencilerin simülasyona dayalı eğitim programı ile ilgili görüş ve deneyimleri üzerinden programın geliştirilmesi hedeflenmiştir.

Yöntem: Acıbadem Mehmet Ali Aydınlar Üniversitesi Sağlık Hizmetleri Meslek Yüksekokulu Anestezi Programı'ndan mezun olan 68 kişinin, öğrencilik dönemlerinde müfredatlarına dahil edilen simülasyona dayalı eğitim programına dair deneyimleri incelendi. Veri toplamada anketler yoluyla nicel veri, odak grup tartışmaları yoluyla nitel veri toplanarak karma yöntem yaklaşımı kullanıldı. Farklı yöntemlerden elde edilen veriler Creswell'in Birleşik DesenTasarımı kullanılarak entegre edildi ve yorumlandı.

Bulgular: Katılımcıların çoğunluğu (%95,16), simülasyon eğitiminin bilgi ve becerilerini artırmada önemli katkı sağladığını belirtmiş; ayrıca %93,55'i geribildirimler ve grup tartışma ortamının öğrenme süreçlerine katkıda bulunduğunu ifade etmiştir. Anketi yanıtlayan katılımcılar, simüle edilmiş vakaların klinikte karşılaşılan vakalara benzediğini (%79,09) ve simülatörlerin özellikleri ile ortamın gerçekçi olduğunu (%91,94) belirtmiştir. Ancak katılımcıların %43,55'i de eğitim için ayrılan sürenin yeterli olmadığını ifade etmişlerdir. Odak grup tartışmalarındaki katılımcıların görüşleri de nicel bulgular ile benzerlik göstermiştir.

Sonuç: Anestezi teknikerleri için simülasyona dayalı eğitim programının etkili olduğu belirlenmiştir. Ancak, katılımcı geri bildirimlerine dayanarak eğitime daha fazla zaman ayrılması gerektiği önerilmiş ve öz yönelimli öğrenme fırsatlarının sağlanması gerektiği belirlenmiştir.

Anahtar Kelimeler: Medikal Simülasyon, Anestezi Eğitimi, Müfredat Geliştirme, Karma Yöntem, Klinik Transfer

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As stated in the standards recommended by the World Health Organization (WHO) for safe anesthesia practices; all anesthesia providers involved in anesthesia care should be trained according to a nationally recognized standard (1). The safe administration of anesthesia requires coordinated team-based care, with the anesthesiologist physician leading the team that includes anesthesia technicians as vital members (2, 3).

In Turkey, students can enroll in a 2-year anesthesia technician program at Vocational Schools of Health Sciences after high school, without prior health education. This program trains students as assistant healthcare personnel in anesthesia and is classified at Level 5 (short cycle) according to the Qualifications Framework for the European Higher Education Area (QF-EHEA), which standardizes higher education qualifications across Europe (4).

There is a disparity among Vocational Schools of Health Sciences some have well-developed infrastructure and provide good training, while others lack proper facilities (5). Beyond having the right infrastructure for skills training, it is crucial to properly structure and integrate those facilities/resources into the curriculum (6).

In recent years, clinical simulation applications have started to be used increasingly in training health professionals for skills training (7, 8). Simulation training provides the opportunity to practice repeatedly in a controlled and safe environment towards specific goals (9, 10).The prominence of patient safety, the need for new educational methodologies for the new generation, and the limitations in providing standardized training and assessment environments necessitate education in simulated settings (10, 11).

As with all educational modalities, the effectiveness of simulation applications varies depending on how, to whom, and for what purpose they are used (12). When creating a program, the target audience and learning needs must be identified, and the planned time, resources, instructor profile, simulation method, and assessment methods must be planned (13).

Since the 2013-2014 academic year, Acibadem Mehmet Ali Aydınlar University's Anesthesia Program has integrated simulation-based learning into its practical courses. Simulation-based education, which is widely used in medical and nursing education (14), has been implemented for the first time in Anesthesia Programs in Turkey at Acibadem University. First-year students engage in skills-focused simulations, while second-year students participate in advanced clinical simulations. This study evaluates graduates' experiences with this training, using a mixed-methods approach, to inform future curriculum enhancements.

Method

The study evaluated the perspectives and experiences of graduates from the Anesthesia Program at Acibadem Mehmet Ali Aydınlar University's Vocational School of Health Sciences. The focus was on the simulation-based education program that was integrated into their curriculum during their studies.A mixed-methods research approach was utilized, combining both quantitative (survey) and qualitative (focus group discussions) data collection methods.The aim was to gain insights from the graduates about their views and first-hand experiences with the simulation-based training they received as part of the anesthesia technician education program. In this study, the mixed-method approach was preferred in order to provide a more holistic perspective when aiming to develop the implemented educational program. The data were integrated and interpreted using Creswell's Convergent Design (15).The flow diagram of the study is shown in Figure 1.

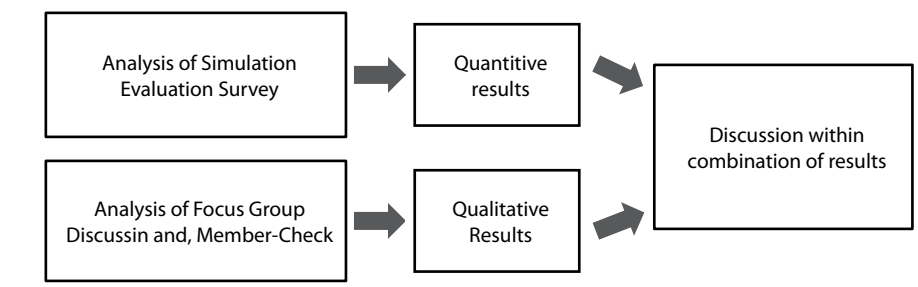

Figure 1: Flow diagram of the study

Participants:

The population of this research consists of students who have completed the Anesthesia Program at Acibadem University Vocational School of Health Services. The sample is 70 graduates who completed the Anesthesia Program in 2019.

Ethical Approval:

Prior to starting the research, ethical approval was obtained from the local ethics committee (decision no. ATADEK-2024-6/240). The content of the study was explained to the graduates, and consent was obtained from those participating in the study.

Data Collection

In this research, a mixed-methods approach was used for data collection. The survey method was employed for quantitative data, while focus group discussions were conducted for qualitative data. Out of 70 graduates, 62 graduates participated in the survey, and 14 graduates volunteered for the focus group discussions.

Quantitative data:

The survey sent online consists of questions whose validity and reliability have been established and it has been previously used in the evaluation of simulation education programs in the university (Appendix 1). The validity of the survey was assessed using exploratory factor analysis. The Kaiser-Meyer-Olkin value was calculated as 0.902. Cronbach's alpha was calculated for reliability, resulting in a value of 0.849. The survey comprises 22 questions regarding the content of the education, the effectiveness of the educational method, the safety of the educational environment, the contribution of the education to teamwork, and the realism of the simulation environment. The evaluation was conducted using a four-point Likert scale (1- Strongly Disagree, 2-Disagree, 3-Agree, 4-Strongly Agree).

Qualitative data:

The survey participants were invited to a focus group discussion to share their experiences regarding the simulation-based education program, which was a part of their educational process.In reporting the focus group discussions conducted to understand the participants' experiences in this research, the criteria in the Consolidated Criteria for Reporting Qualitative Research (COREQ) guideline were taken into consideration (16).

The interviews with volunteer graduate students were conducted in two separate sessions by a simulation educator who had not previously attended their classes, was experienced in simulation education, was familiar with the anesthesia simulation education program, and had prior experience conducting focus group discussions. No prior relationship was established between the interviewer and the participants. However, the participants were familiar with the research team that designed and implemented the educational program.

The focus group discussions were held at the simulation center's dedicated meeting room facilities on a single day, with different groups of participants scheduled at separate times. Proper arrangements were made to ensure a private, controlled environment with only the focus group moderator and student participants in attendance during each session.

In the focus group discussion, participants were asked five questions regarding the simulation education program:

1.What were your expectations from the simulation-based learning education?

2.Were your expectations met?

3.Were you able to transfer your experiences to clinical practice?

4.What are the best and worst aspects of the program?

5.How would you plan it if you were in charge?

These questions were formed based on the reaction evaluation criteria from Kirkpatrick's first level of the program evaluation models (17). Participants were informed prior to the interviews that the discussions would be recorded, and that no information revealing their identities would be included in the research, and their written consent was obtained. The focus group discussions lasted 35 and 40 minutes

Data Analysis:

Audio recordings from the focus group discussions were transcribed into written form by the second researcher involved in the study.

These transcriptions were then cross-verified by the researchers by listening to the recordings again to ensure accuracy and reliability of the transcription process. The coding process involved in analyzing the focus group discussions was performed manually.This manual coding

was done by the second researcher involved in the study. No software tools were used in the coding process.The researcher identified all the main themes, sub-themes, and concepts that emerged during the focus group discussions.The data were organized and grouped according to the coding system established at the end of the discussions, and a thematic analysis was conducted based on the main and sub-themes. The codings were checked by the first researcher. The findings that emerged were compared with the survey results, included in the findings section, and discussed in the conclusion part. As the transcribed interviews underwent the coding and analysis process, participants' opinions were revisited (member-check). The data were returned to the participants to verify the accuracy of their experiences, and they were asked to revise, clarify, and elaborate on their statements using their own words. The additions made by participants during the member-check were included in the data analysis.

Simulation based training program:

Simulation-based practical training has been integrated into the curriculum for both regular and second-shift education, with a total of 280 hours for first-year skills training and an additional 168 hours of clinical simulation training outside of clinical practice hours for the second year. These trainings are conducted by instructors competent in simulation-based education at Center of Advanced Simulation and Education (CASE).

The first-year program focuses on basic skills training; it includes manually measuring vital signs on simulated patients, performing intramuscular and intravenous interventions on skill models, endotracheal intubation and laringeal mask airway placement, drug dosage calculations and applications, basic monitoring, and anesthesia equipment preparation during twenty-eight weeks.

In the second year program focuses on advanced skills training; that includes preoperative patient assessment with simulated patients, preoperative preparation, anesthesia induction, difficult airway management, advanced life support training, intraoperative and postoperative complications with manikin based simulators during twenty-eight weeks.

Results

The 'Simulation Evaluation Survey', which consists of questions whose validity and reliability have been established and has been previously used in the evaluation of simulation education programs, was sent online to students who completed the Anesthesia Program in 2019. The survey included an assessment of the two-year simulation practices. 62 graduates responded to the survey, and the survey results are presented in Table 1.

Table 1: Simulation Evaluation Survey Results

Simulation Evaluation Survey	Strongly disagree(%)	Disagree(%)	Agree (%)	Strongly agree(%)
Simulation education contributed to increasing my knowledge and skills.	1,61	3,23	20,97	74,19
The time allocated for the training was sufficient	16,13	27,42	32,26	24,19
The scenario duration and equipment used in the scenario were sufficient for crisis management skills.	0,00	11,29	41,94	46,77
Simulation trainings should be a part of in-service trainings	1,61	1,61	12,90	83,87
Observing other participants during the training contributed to my learning	4,84	6,45	40,32	48,39
Planned practical training under the guidance of an instructor was important for acquiring new skills.	0,00	4,84	24,19	70,97
Watching myself during debriefing increased my awareness and enabled self-evaluation	6,45	8,06	27,42	58,06
Debriefing and group discussion contributed to my learning.	4,84	1,61	41,94	51,61
The instructor's feedback helped me understand the subject better	1,61	1,61	24,19	72,58
Seeing the mistakes in the video recordings contributed to my learning	8,06	4,84	40,32	46,77
Self/peer/team evaluation contributed to my learning	1,61	3,23	35,48	59,68
The simulated cases were similar to the cases I encounter in the clinic.	4,84	16,13	48,39	30,65
I found the features of the simulators realistic	1,61	6,45	33,87	58,06
The realism of the environment was effective in making the scenario more convincin	4,84	3,23	41,94	50,00
I observed that teamwork positively affected clinical outcomes	3,23	11,29	35,48	50,00
I better understood the responsibility that falls on the leader in teamwork	1,61	3,23	33,87	61,29
I saw that equal knowledge and skill levels of individuals in the team affected success.	4,84	4,84	37,10	53,23
I realized how important communication skills are	1,61	1,61	12,90	83,87
The fact that the scenario applications were being recorded caused stress in me	35,48	37,10	12,90	14,52
Being under stress negatively affected my performance	30,65	29,03	25,81	14,52
I had difficulty recalling the information I knew theoretically while under stress	19,35	29,03	32,26	19,35
The deterioration of the simulated case's clinical condition during the simulation training caused me stress	32,26	25,81	20,97	20,97
Mean	**3,85**	**6,72**	**32,53**	**56,90**

Table 2: Focus Group Data Analysis

Themes	Subthemes	Participants Comments
1.Expectations from simulation-based learning education"	1.1.Practical experience	*"My expectation was to acquire practical hands- on experience "(K-5)*
	1.2.Contribution to theoretical education	*"I thought that practical applications would contribute to my theoretical knowledge."(K-7)*
	1.3.No expectations	*"I had no expectations when coming here, because I did not research the school. I did not come and see this place beforehand, I just happened to end up here. I did not know that such programs existed here."(K-4)*
2.Meeting Expectations	2.1.Structured content	*"(...) For example, we cover a topic in theoretical classes for a week or during that week, and then we come here and practice it. Since we are adding practical knowledge on top of the theoretical knowledge, it becomes more memorable. What we practice here completely complements and overlaps with the theoretical knowledge, our practical applications here reinforce it." (K-1)*
	2.2.Gaining experience	*"Perhaps we may not encounter such complicated cases throughout our lives, but here we do. So, we at least get to experience them. If such a case were to come our way, we would have some idea about it. We would be able to handle the crisis situation, at the very least." (K-5)*
		"In the practical courses here, I learned things like 'what I should do when touching a patient, how I should behave, how my communication should be during an operation, etc.' I didn't know any of these things before coming here. And after coming here, I was taught what I need to do when I go out into the field. So when I went out there, at least I didn't freeze up or get flustered. In this way, it was extremely beneficial for me."(K-4)
		" I gained the most self-confidence here(…) I learned what I need to do during crisis situations." (K-6)
	2.3.Instant Feedback	*"With every practical application I did, I received feedback from my instructors regarding my errors, and this situation led to an increase in my theoretical knowledge as well." (K-7)*
3.Clinical transfer	3.1. Transfer of knowledge and skills	*"Let me put it this way, from the very beginning, I personally practiced everything there, from how we should behave with a patient, to medications, monitoring, and what to do in difficult situations. I even assisted the instructors. When I was asked questions like 'Do you know how to draw up this medication? How many units per dose? How many will we give this patient?' and I could answer those kinds of questions, that's when I realized the value of this place." (K-4)*
	3.2. Confidence	*"When we see the same scenario in a real setting that we've seen here, it feels very ordinary now. I can think logically, remember the steps I need to follow, and I get less anxious." (K-8)*
		"Previously, because I didn't know about it, I used to blow the difficult airway situation out of proportion in my mind. But here, through the scenarios, I learned and practiced what I needed to do, and after doing those things, I realized that it's not something to be so afraid of" (K-8)
	3.3. Teamwork	*"We saw teamwork in action. I thought that everything would be expected from me and that I would have to do it all alone, but in the scenarios here, I saw that tasks are carried out through teamwork."(K-9)*
4.The good and bad aspects of the program	4.1. Time	*"Time is limited. That's the biggest problem." (K-1)*
	4.2. Stress	*"The manikins were very realistic. The advanced life support and intubation training was so realistic that I became stressed." (K-10)*
		"More than anything, it's making mistakes that causes stress. The sense of responsibility weighs heavily. If you don't do it (properly), the patient (simulator) dies" (K-2)
		"The limited time and being observed put me under stress." (K-6)
	4.3. Realism of the environment	*"The facilities were good, they accurately reflected the real environment. This situation facilitated our ability to practice."(K-14)*
		"When I look at it as a whole, I really think that the things here (the manikins) added a lot to me. The fact that they are realistic, the videos we recorded, and then watching the camera recordings here, noticing our mistakes - all of these were more beneficial." (K-3)
		"I enjoyed selecting the most appropriate anesthesia medications for each patient and administering the correct dosage, while monitoring their effects on the monitors. We were able to observe what happens when we don't administer the proper dosage of medication " (K-11)
	4.4. Taking Responsibility	*"The situations I enjoyed the most were when I had to be alone, think quickly, and make rapid decisions. When I was left alone at the patient's bedside, I learned what to do and how to ask for help. I had not experienced this at the clinic since I was never given sole responsibility. " (K-8)*
		"Although we caused to death of our simulators here, we learned that human life is more important than anything else in real life, and how seriously we need to be in such a situation. We learned that here." (K-3)
5. Suggestions for planning	5.1. Time	*"I would form groups based on each person's areas of deficiency, and provide them with the opportunity to practice independently through an appointment system" (K-7)*
		"We come once a month. We should come 3-4 times." (K-13)
	5.2. Content	*"The preparation of the room should be learned in the first year. Before going to the hospital for the summer internship, (...) the room preparation should be done in the first year. It needs to be added to a course that is close to the summer internship"(K-12)*
		"There was nothing that needed to be removed, but there were things that needed to be added. Everyone needs to learn the awakening stage as well. We did the preparation, induction, monitoring, and postop, but we didn't do the awakening and extubation, and I think that was the most important deficiency. The awakening process is very different for some patient groups, and it would have been great if we could have experienced that too." (K-8)
		"It was quite good, it was sufficient. There was nothing that needed to be removed." (K-13)

The analysis of the responses from the 14 participants who volunteered and were invited to the focus group discussion is presented in Table 2.

During the coding and analysis process of the interviews, participants' views were re-obtained (member-check). The data was returned to the participants to verify the accuracy of their experiences. Participants were asked to rephrase their own words, clarify, and provide more details in their narratives. Two of the participants who started the study stated that they wanted to make additions regarding the details they wanted to elaborate on. The other participants indicated that they did not have any data they wanted to change or remove at this stage (Table 3).

Table 3: Comments after Member-Check

Content suggestions for planning after member-check	*"At the end of our conversation, apart from the infusion pump, I thought it would be beneficial to demonstrate procedures such as PCA devices, cerebral and BIS monitoring applications, and arterial line flushing in the simulations. This way, when a student goes into the field and sees these devices, they will at least have some idea about them." (K-3)*
	"Thanks to the knowledge and experience gained from the practical courses, I had full confidence and self-assurance when starting the job. Since you showed me everything from monitoring the patient to induction and post-op follow-up, I am very comfortable in my professional life right now." (K-6)

The additions made by the participants during the member-check were included in the data analysis.

Discussion

In this study, it was aimed to evaluate the views and experiences of the graduates from the Anesthesia Program at Acibadem Mehmet Ali Aydınlar University concerning the simulation-based educational program incorporated into their curriculum, utilizing a mixed-methods approach. Additionally, it aimed to enhance the educational program within this context. The graduates' perspectives were examined quantitatively via a survey and qualitatively through focus group discussions.

Acquiring Knowledge and Skills

The participants' expectations from the simulation-based learning training were to contribute to their theoretical knowledge and gain practical experience. They stated that their expectations were met due to the well-structured content, the opportunity to gain experience through individual and team work, and receiving feedback on their performance. The majority of participants (95.16%) stated that the simulation training significantly contributed to increasing their knowledge and skills. The focus group interviews also supported the responses given in the survey.:

> *".When I was left alone at the patient's bedside, I learned what to do and how to ask for help. I had not experienced this at the clinic since I was never given sole responsibility. This was the aspect I enjoyed the most about the training here." (K-8)*

According to this, it has been observed that the simulation-based training method applied in a safe environment before clinical practices in anesthesia technician education allows participants to gain experience (18, 19).

The proportion of participants who think that the process of self-monitoring and receiving feedback during debriefing contributes to learning is high (85.48%). Additionally, 93.55% of the participants stated that debriefings and the group discussion environment contributed to their learning processes.

> *"I received feedback from my instructors about my mistakes in every performance I did, and this situation led to an increase in my theoretical knowledge as well." (K-7)*

Receiving immediate feedback on performance during simulation-based training highly contributes to learning (20).

Additionally, the realism of the learning environment also increases the effectiveness of the simulation-based learning method. Participants who responded to the survey stated that the simulated cases were similar to the cases encountered in the clinic (79.09%), and that the features of the simulators and the environment were realistic (91.94%).

> *"Here we see the same scenario, but when we see it in the real environment, it seems very ordinary now. I can think logically and remember the steps I need to follow, and I get less excited." (K-8)*

"The manikins were very realistic. The advanced life support and intubation training was very realistic, I got stressed." (K-10)

The opportunity to engage in teamwork in a simulation-based learning environment has increased participants' awareness of this subject. The responses given in the survey showed that participants had a high level of awareness, especially regarding communication and teamwork (96.77%).

"We saw teamwork. I thought everything would be expected from me and I would have to do it alone, but in the scenarios here, I saw that things work with teamwork"(K-9)

With this study, the importance of communication skills and the positive effect of teamwork on clinical outcomes have been emphasized in line with the literature (21, 22).

The study results also showed that the duration of the scenarios applied in education and the equipment used in the scenario are considered sufficient for crisis management skills (88.71%), and the rate of those who agree that simulation trainings should be a part of in-service trainings (96.97%) is high.The opinions expressed by the participants in the focus group discussions support this situation.

" I learned what to do during crisis situations. I learned to make decisions quickly." (K-6)

"We may not encounter such complicated cases throughout our lives, but here we do. So, we are at least trying. If such a case comes our way, we will have some idea. We will be able to experience the crisis moment according to that situation, at least." (K-5)

Simulation-based training is effective, especially in gaining experience regarding crisis management and rare cases that are not frequently encountered (23).

Ultimately, the various characteristics of the simulation-based training program appear to make it easier to apply the learned skills and knowledge in actual clinical settings (24, 25).

Course time

According to the survey results, 43.55% of the participants stated that the time allocated for training was not sufficient. The opinions of the participants in the focus group discussions are also similar:

"We come once a month. We should come 3-4 times." (K-13)

These results indicate that the training duration needs to be increased. However, considering the increased workload for trainers and resource constraints that come with extending the training duration, increasing self-learning activities of the participants could be an effective solution to this problem (26).

Stress Factor

Some of the participants stated that being under stress did not negatively affect their performance (59.68%), while others indicated that being under stress negatively impacted their performance and they had difficulty recalling theoretical knowledge under stress (51.61%).

"It's more that making mistakes causes stress. The responsibility piles up. If you don't do it (the procedure), the simulator-patient " (K-2)

"Being observed and having limited time put me under " (K-6)

During the simulation-based training method, being observed during performance, deterioration of the patient's condition, and time pressure put the participants under stress(30).

Conclusion

The simulation-based training program for anesthesia technicians proved to be effective. However, based on participant feedback suggesting more time should be devoted to training, it was determined that opportunities for self-directed learning need to be implemented. Further research is required to mitigate the stress participants experience from being observed during their performance evaluations.

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Data Availability

The data sets generated during or analyzed during this study are available from the corresponding author on request.

Authors' Contributions

DK was responsible for study conceptualization, methodology, writing, reviewing and editing the manuscript.

TU was responsible for recruitment of the participants, data collection, data analyses methodology, writing, reviewing and editing the manuscript.

Disclosure

The authors did not use generative AI to write any portion of the manuscript.

Conflicts of Interest

None declared.

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