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## RESEARCH ARTICLE

### EVALUATION OF CLINICAL PRACTICE IN ANESTHESIA TECHNICIAN DEPARTMENTS

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#### ABSTRACT

Vocational schools play a pivotal role in training skilled professionals for specific careers through two-year education programs that offer multiple semesters annually, ultimately granting associate degrees (1). Among these institutions, Health Vocational Schools specialize in diverse health-related disciplines, such as anesthesia, audiology, medical imaging, pharmacy services, and more (2). The focus of this study is the anesthesia program within the Vocational School of Health Services, a critical 2-year program ranked third in university preference for 2022 (3). Anesthesia technicians, educated through this program, are essential personnel responsible for various anesthesia-related tasks. This study aims to establish a standardized framework for evaluating the skills and interventions taught in the two-year anesthesia technician program. It seeks to assess the efficacy of clinical training methods by analyzing the interventions performed by students during their clinical practice training. The study also aims to identify areas where improvements are needed and contribute to the professional development of anesthesia technicians. A cross-sectional evaluation was conducted on interventions performed by second-year students enrolled in the Department of Anesthesia Technician at Health Sciences University Health Vocational School during the 2021-2022 academic year. Ethical approval was obtained, and students underwent clinical practice in various departments. An evaluation form was designed to categorize interventions into anesthesia applications, airway and respiratory procedures, anesthesia device use, and other professional practices. The form tracked variables such as patient evaluation, monitoring, anesthesia application, and more. The study encompassed 65 students, with 47 females and 18 males, aged 18 to 22 years. Analysis of interventions during spring and fall semesters revealed variation in success rates. In both semesters, interventions like drawing arterial blood, orotracheal intubation, and others were assessed. Statistically significant differences were observed in several categories, including patient evaluation, monitoring, anesthesia application, airway maneuvers, and device control. Notably, feedback from instructors and students showed no suggested changes to the evaluation form. The study underscores the significance of integrating theoretical knowledge with practical experience in anesthesia programs. The proposed evaluation form effectively tracks and assesses students' interventions during clinical practice, offering insights into their skills and performance. The findings contribute to improving the education of anesthesia technicians and highlight the importance of standardized evaluation methods for practical training in the field.

## INTRODUCTION

Vocational schools aim to train qualified human resources for specific professions, offering two-year education programs with two or three semesters per year and awarding associate degrees (<https://www.yok.gov.tr/kurumsal/mevzuat>). Among these vocational schools, Health Vocational Schools provide education in various fields related to health, such as anesthesia, first aid, audiology, medical imaging techniques, optometry, oral and dental health, pharmacy services, radiotherapy, medical documentation and secretarial work, health facility management, medical laboratory, emergency and disaster management, biochemistry,

biomedical device technology. provides training in many fields and aims to train qualified personnel in these departments (<https://yokatlas.yok.gov.tr/meslek-onlisans.php?b=30172>).

The anesthesia program is a highly important program in the Vocational School of Health Services in our country. This program focuses on training anesthesia technicians, and it is a 2-year program that has been ranked 3rd among state universities in the university preference ranking for the year 2022 (<https://yokatlas.yok.gov.tr/tercih-sihirbazi-t3-tablo.php?p=tyt>). Upon completion of the program, students are awarded the title of anesthesia technician. Anesthesia education is given in 93 universities according to data from the Higher Education Institution (YÖK) for the year 2022. Among these universities, there are 39 state universities, 48 foundations, and 6 universities in the Turkish Republic of Northern Cyprus. Furthermore, the Ministry of National Defense also trains

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anesthesia technicians at the University of Health Sciences (<https://yokatlas.yok.gov.tr/onlisans-program.php?b=30172>). The anesthesia associate degree program is designed to provide vocational education and practice-oriented training to produce qualified personnel for employment in the business world. This program is categorized as a short-term program under the Bologna Process Higher Education Qualifications Framework, with a code of 72 in the Health area, and a level of 5 in the Turkish Higher Education Qualifications Framework (TYYC). Graduates of this program are equipped with basic knowledge and practical application competencies (<https://gsmyo.sbu.edu.tr/EgitimBilgileri/AnesteziProgramiProgramBilgileri>; <http://www.tyyc.yok.gov.tr/?pid=10>). The roles and responsibilities of anesthesia technicians and technicians can be synthesized as follows: They are tasked with managing all of the equipment and devices involved in anesthesia, ensuring they are adequately prepared for use. Their duties extend to verifying the correct connections of gas sources, including oxygen and nitrous oxide tubes and other connections, as well as preparing drugs and tools required for the anesthesia method to be used (<https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=19696&MevzuatTur=7&MevzuatTertip=5>). They are capable of analyzing malfunctions that may occur during an anesthesia procedure, administering anesthesia agents as required, and notifying the anesthesiology and reanimation specialist concerning the need for supplementary drugs and materials in a timely manner. Moreover, they prepare the patient for anesthesia application and monitor the patient during the process (<https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=19696&MevzuatTur=7&MevzuatTertip=5>). They assist the anesthesiology and reanimation specialist in the safe maintenance, implementation, and termination of anesthesia, document a patient's anesthesia progress, and deliver follow-up information to the specialist. After the anesthesia procedure is completed, they aid in the patient's safe transport to the recovery room. In the event of an emergency or other unusual circumstance, they may intubate the patient and intervene in their care by administering necessary medications and fluids under the direction of a physician (<https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=19696&MevzuatTur=7&MevzuatTertip=5>).

The discipline of anesthesia is one that demands rigorous training and discipline (Başaranoğlu, 2015). Within the anesthesia program, students are subjected to an intensive education lasting only two years. The burden of educating these students within such a brief time frame falls heavily upon those tasked with this responsibility. Therefore, the professional development of anesthesia technicians following the completion of their training is of utmost importance given the critical role they play. The operation of anesthesia devices, along with the necessary management of equipment such as medical gases, flow meters, aspirators, vaporizers, ventilators, monitors, airways, face masks, laryngoscopes, laryngeal mask airways, and endotracheal tubes, requires extensive training and skill ([http://megep.meb.gov.tr/mte\\_program\\_modul/moduller\\_pdf/Anestezi%20Cihaz%C4%B1%20Ve%20Yard%C4%B1mc%C4%B1%20Ekipmanlar.pdf](http://megep.meb.gov.tr/mte_program_modul/moduller_pdf/Anestezi%20Cihaz%C4%B1%20Ve%20Yard%C4%B1mc%C4%B1%20Ekipmanlar.pdf)). As such, the integration of theoretical and clinical instruction is critical in ensuring the continuity and longevity of this training. After conducting a literature review, it has been observed that several studies emphasize the importance of integrating theoretical knowledge with practical experience in anesthesia programs, as well as the significance of practical training and the implementation of a diversified measurement and

evaluation system. However, it has also been determined that there currently exists no standardized clinical evaluation form solely dedicated to the purposes of clinical education evaluation. To address this issue, our department has developed a clinical evaluation form that is designed to guide students during their clinical practices, assist them in self-evaluation, raise their awareness of the practices, and simplify the assessment and evaluation process for their supervisors. This form has been effectively utilized in educating our students. The objective of our study is to establish a standardized framework for evaluating the skills and interventions employed in the education of students enrolled in the two-year anesthesia technician program.

## MATERIALS AND METHODS

Our study is a cross-sectional evaluation of the number of interventions performed by students enrolled in the Department of Anesthesiology Technician during clinical practice training. Ethics committee approval was granted by the local ethics committee at our university on March 14, 2023, with the identification number 46418926. The study included all second-year students in the Department of Anesthesia Technician at Health Sciences University Health Vocational School during the 2021-2022 academic year. Two students were excluded from the study due to excessive absenteeism. Students were placed into clinical practices in a variety of departments, including neurosurgery, general surgery, thoracic surgery, plastic surgery, ophthalmology, obstetrics, urology, pediatric surgery, orthopedics, otolaryngology, interventional-diagnostic radiology, code blue, gastroenterology clinics, and pain clinics. To increase the efficacy of education, an evaluation form was designed to track the number and type of interventions performed by students during clinical practice training (see Appendix). This form was structured according to four main categories: applications for anesthesia, airway and respiratory applications, applications related to anesthesia devices and other equipment, and other professional applications.

A total of 18 variables were identified under these four categories, including the patient evaluation before anesthesia application, monitoring of the patient, establishing vascular access, initiation, maintenance, and termination of general anesthesia, patient preparation for regional anesthesia, aiding intervention during regional blocks, regular monitoring of the patient's vital signs, ECG, and anesthesia forms during anesthesia applications. This information was periodically documented throughout the course of the students' clinical practice training. The students were instructed to utilize these evaluation forms during their clinical practice training and to perform the interventions listed on the form with minimum numbers set separately for each category. The instructors, working within the department, approved the number of attempts made by the students for the various interventions. The monitoring, training, and realization data for each variable were recorded separately for both the spring and fall semesters. The reason for division into semesters is due to discrepancy in the number of training days per week, with practical training being held for 24 hours in 3 days per week in the spring semester and for 16 hours in 2 days per week in the fall semester. The average number of interventions, per student, was determined based on the categories described in the analysis performed on the data obtained from the evaluation

forms filled by the students, and subsequently compared between the spring and fall semesters.

**Statistical Analysis:** The statistical analysis of the data was conducted using the SPSS version 23.0 software package. Data were reported as percentage (%), frequency (n), and mean±standard deviation (minimum-maximum). The analysis utilized the dependent sample t-test, with significance determined at the 0.05 level ( $p < 0.05$ ).

## RESULTS

The study involved a cohort of 65 students, ranging in age from 18 to 22 years. Out of the 65 students, 47 were female and 18 were male. Table 1 provides a summary of the monitoring and implementation data for the interventions during the spring semesters. Table 2 shows the same data for the fall semester. Upon examining the monitoring and implementation values of the initiatives during the spring semester, it can be observed that aside from the ability to draw arterial blood ( $3.5 \pm 5.15$ ), minimum goals were accomplished for all other interventions. The successful implementation average for orotracheal intubation was  $18.7 \pm 9.07$ , while the average for failure was  $3.8 \pm 7.74$ . Similarly, when examining the monitoring and implementation values for the fall semester, it can be observed that the minimum goals were achieved for all interventions, except for the ability to draw arterial blood ( $2.6 \pm 4.93$ ). The successful implementation average for orotracheal intubation was  $12.9 \pm 8.67$ , while the average for failure was  $2.1 \pm 3.06$ . Upon analyzing the comparison of interventions implemented during the spring and fall terms, significant differences were observed in several categories. These categories include evaluating the patient prior to anesthesia application ( $p=0.006$ ), monitoring the patient ( $p=0.003$ ), establishing vascular access ( $p=0.003$ ), starting, maintaining and terminating general anesthesia ( $p=0.039$ ), monitoring the patient's vital functions during anesthesia applications, ECG monitoring and regular recording on anesthesia forms ( $p=0.001$ ), applying airway maneuvers to the patient ( $p=0.005$ ), ventilating the patient with a mask ( $p=0.022$ ), controlling the anesthesia device ( $p=0.001$ ), maintaining and managing patient parts ( $p=0.001$ ), preparing an infusion pump ( $p=0.016$ ), and applying orogastric and nasogastric catheters to the patient ( $p=0.025$ ). No feedback or suggestion was received from either the instructors or students regarding changes in the evaluation form's main headings or subheadings.

## DISCUSSION

Based on our findings, the evaluation form we developed to standardize the assessment of clinical practice training in two-year anesthesia technician departments was deemed effective. No additional modifications were suggested by trainers for the 18 variables detailed in the four main headings of the evaluation form. In all categories of monitoring and application, except for supervised arterial blood collection, the minimum numbers were surpassed for both the spring and fall terms. Practicing clinical training for 3 days a week, as opposed to two days, resulted in significant differences for 11 out of the 18 variables. Individuals who successfully complete an anesthesia program are qualified to work as anesthesia technicians at both private and public healthcare institutions, wherever an anesthesiologist is present.

These professionals may be employed in a variety of settings, including the operating room waiting unit (pre-op unit), the operating room, the operating room recovery unit (post-op unit), the intensive care unit, the anesthesia device and equipment control record and warehouse, patient transfer, pain units, non-operating room anesthesia applications (such as Electroconvulsive therapy, Radiofrequency ablation, bronchoscopy, endoscopy fields, interventional and/or diagnostic radiology, neuro-radiology), the emergency department, code blue program, dental units, and animal and research laboratories (10-12). Upon completion of the program, students are presented with the opportunity to pursue careers in Nursing, Social Work, Health Management, Emergency Aid, and Disaster Management departments, depending on their performance in the YÖK vertical transfer exam (13).

In Turkey, there is no uniformly developed education model that integrates both education and practice in Vocational Schools of Health Services. It has been observed that inconsistency amongst individuals with the same job title, but with varying levels of education, knowledge, and skill sets impedes the overall quality of the healthcare industry (14). Therefore, education should prioritize developing skills that add value to organizations, enable them to reach their goals, and provide sustainable competitive advantages. In order to achieve this, theoretical knowledge must be complemented by practical applications (15). One of the most significant issues in Vocational Schools is that inadequate practice results in students not acquiring the requisite level of skills (16). Hence, vocational school programs should increase their application opportunities significantly to ensure that students acquire requisite professional knowledge, skills, and competencies (17). The emphasis in education should be on developing students' practical skills and providing them with the essential professional knowledge necessary (18). It is critical to remember that even the slightest error in anesthesia can result in undesirable and dangerous consequences (8).

For our study, we created an evaluation form to assess the interventional procedures performed during clinical practice by sophomore students in the Department of Anesthesiology at the Health Professions School of Health Sciences during the 2021-2022 academic year. By analyzing the data from these evaluation forms, we established the average number of interventions performed per student and determined the number of days required for practical training by comparing the spring and fall semesters. With the exception of arterial blood collection skills, the monitoring and application values of the students in both semesters met our minimum requirements. The evaluation of student behavior, which involves the application of their profession in real-life conditions, is considered the highest level of the competence pyramid developed by Miller. In clinical practice training, students can learn through experiences in a genuine environment, thereby integrating theoretical knowledge and practical skills. It is imperative that practical applications be mandatory for students to prepare them for their professional careers.

There is a growing need for establishing standards for the adequacy and use of performance in education. Pre-planning skill training practices, proper organization, and timely communication of changes can improve trainers and students' compliance with training (23).

**Table 1. Monitoring and Implementation Values of Initiatives Spring Term**

Spring Semester	Mon/App	Min-Max	Mean	Std. Deviation
Evaluate the patient before administering anesthesia	Mon	0-126	29.13	26.97
	App	9-170	73.63	37.67
Monitoring the patient	Mon	0-90	16.81	19.12
	App	17-185	86.36	36.88
Vascular access	Mon	0-101	37.00	23.17
	App	0-140	52.29	30.60
General anesthesia initiation, maintenance, termination	Mon	0-109	34.10	26.40
	App	0-123	43.60	24.90
Patient preparation for regional anesthesia	Mon	0-70	11.66	15.28
	App	0-95	16.98	20.14
Assisting the intervention during regional blocks	Mon	0-79	12.40	18.32
	App	0-62	11.50	13.61
Monitoring of the patient's vital functions, ECG and regular recording of anesthesia forms during anesthesia applications	Mon	0-115	19.90	25.58
	App	15-170	80.49	37.03
Follow-up and monitoring of complications that may develop during and after anesthesia	Mon	0-145	33.26	31.86
	App	0-159	50.83	33.25
Evaluate the patient's airway	Mon	0-92	33.72	25.32
	App	0-123	37.21	24.95
Airway application to the patient	Mon	0-93	30.90	23.24
	App	0-86	31.46	18.33
Implementation of basic airway maneuvers	Mon	0-118	31.98	23.74
	App	0-120	32.76	22.81
patient ventilation with mask	Mon	0-81	31.60	20.48
	App	0-102	35.21	21.72
Implementation of alternative airway tools	Mon	0-65	14.38	14.97
	App	0-42	12.40	9.22
Successful orotracheal intubation to the patient	Mon	0-70	32.87	19.74
	App	0-44	18.76	9.07
Failed to apply orotracheal intubation to the patient	Mon	0-60	3.81	7.74
	App	0-106	15.23	20.28
Checking the anesthesia device and maintaining its parts	Mon	5-166	46.98	34.38
	App	0-91	15.53	20.31
Preparing the infusion pump	Mon	0-88	32.63	21.60
	App	0-90	16.21	18.75
Orogastric and nasogastric catheter application	Mon	0-85	14.63	17.47
	App	0-86	11.78	16.19
Arterial blood collection monitoring	Mon	0-22	3.59	5.15
	App			

Mon: Monitoring; App: Application; Min:Minimum; Max:Maximum; Std: Standard

**Table 2. Monitoring and Implementation Values of Initiatives Spring and Fall Term**

Fall Semester	Mon/App	Min-Max	Mean	Std. Deviation
Evaluate the patient before administering anesthesia	Mon	0-95	29.30	25.42
	App	10-165	59.53	28.59
Monitoring the patient	Mon	0-92	16.86	21.20
	App	20-129	71.87	24.40
Vascular access	Mon	0-93	36.49	20.18
	App	2-125	39.74	24.61
General anesthesia initiation, maintenance, termination	Mon	0-90	31.38	21.01
	App	0-82	37.64	19.27
Patient preparation for regional anesthesia	Mon	0-49	11.31	11.27
	App	0-62	14.53	13.45
Assisting the intervention during regional blocks	Mon	0-78	13.52	15.30
	App	0-51	11.61	12.94
Monitoring of the patient's vital functions, ECG and regular recording of anesthesia forms during anesthesia applications	Mon	0-76	19.87	20.43
	App	20-152	63.76	28.62
Follow-up and monitoring of complications that may develop during and after anesthesia	Mon	0-90	29.87	23.98
	App	0-126	43.29	25.62
Evaluate the patient's airway	Mon	0-90.00	31.98	20.54
	App	0-95	32.80	19.65
Airway application to the patient	Mon	0-76	29.52	17.88
	App	5-75	26.80	17.01
Implementation of basic airway maneuvers	Mon	0-75	31.27	18.26
	App	0-86	24.83	15.54
Perform basic airway maneuvers on the patient	Mon	0-80	32.78	18.01
	App	0-82	28.66	18.15
Implementation of alternative airway tools	Mon	0-70	14.36	13.11
	App	0-63	10.47	10.40
Implementation of alternative airway tools (LMA Fastrach etc.)	Mon	0-65	29.36	15.62
	App	0-38	12.95	8.67
Successful orotracheal intubation to the patient	Mon	0-15	2.16	3.06
	App	0-65	13.18	15.78
Successful application of orotracheal intubation to the patient	Mon	0-92	34.64	22.67
	App	0-64	14.86	16.70
Failed to apply orotracheal intubation to the patient	Mon	0-86	26.60	18.02
	App	0-81	14.78	18.41
Checking the anesthesia device and maintaining its parts	Mon	0-67	11.12	13.89
	App	0-60	9.47	12.40
Checking the anesthesia device and maintaining its parts	Mon	0-60	9.47	12.40
	App	0-30	2.61	4.93
Preparing the infusion pump	Mon			
	App			
Preparing the infusion pump	Mon			
	App			
Orogastric and nasogastric catheter application	Mon			
	App			
Applying orogastric and nasogastric catheters to the patient	Mon			
	App			
Arterial blood collection monitoring	Mon			
	App			
Do not take arterial blood	Mon			
	App			

Mon: Monitoring; App: Application; Min:Minimum; Max:Maximum; Std: Standard

To achieve this, checklists should be created, which are valuable tools for evaluating critical, specific behaviors and abilities concerning performance (20). By developing a measurement and evaluation system (24), checklists can be diversified and allow for self-evaluation(20). The use of checklists is recommended for patient safety in the operating room(25). It is important to ensure patient safety as exposure to errors increases if safety is not guaranteed (26). Most potential mistakes can be eliminated through comprehensive planning (27). The advancements in medicine have led to an increased necessity for allied health worker training (28), particularly in the anesthesia program where technical knowledge is crucial and mistakes can lead to serious consequences (29). Our study found that the only intervention for which we did not reach the minimum target number was arterial blood collection skills. A possible justification for this outcome could be related to the fact that arterial blood collection is not always necessary in every surgical procedure. As such, we suggest revising the minimum target number of arterial blood collection skills to 2. The evaluation form used in our department was first created in 2019 and has been actively in use since its inception. Nonetheless, the data collected prior to the study was not intended for research purposes, and therefore not available. Obtaining data for the study was also a lengthy process, which involved feedback from the students. They reported that the evaluation forms could be useful as a reference when applying for jobs after graduation, and graduates who have used them mentioned that it made them more appealing to employers.

## CONCLUSION

The utilization of the form designed for the assessment of applications submitted during the education of anesthesia technician department students represents a reliable, worthwhile, and effective tool for both trainees and instructors. Furthermore, it plays a crucial role in enhancing the quality of education, thereby contributing to the overall improvement of the field. Upon completion of the program, this form can also serve as a valuable point of reference for job applications.

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**Informed Consent:** This was a retrospective study.

## Authorship Contributions

**Concept:** IS

**Design:** IS,

**Data Collection or Processing:** RE,

**Analysis or Interpretation:** IS,CÖ,

**Literature Search:** IS,

**RE Writing:** CÖ, IS, RE.

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## Appendix

	Application Name	Minimum number	Monitoring the Initiative	With the help of an educator
Applications for anesthesia	Evaluation of the patient before applying anesthesia	20		
	Monitoring the patient	20		
	Vascular access	20		
	General anesthesia initiation, maintenance, termination	10		
	Patient preparation for regional anesthesia	5		
	Assisting intervention during regional blocks	5		
	During the anesthesia applications, the patient's vital functions, ECG monitoring and regular recording of the anesthesia forms	20		
	To follow up complications that may develop during and after anesthesia	20		
Airline and respiratory applications	Evaluation of the patient's airway	20		
	Airway application to the patient	20		
	Performing basic airway maneuvers to the patient	10		
	Ventilation of the patient with a mask	20		
	Implementation of alternative airway tools (LMA Fastrach etc.)	5		
	Performing orotracheal intubation on the patient is SUCCESSFUL	10		
Applications with anesthesia device and other equipment	Failed to apply orotracheal intubation to the patient	0		
	Control of the anesthesia device, maintenance of its parts	20		
Other professional applications	Preparing the infusion pump	20		
	Application of orogastric and nasogastric catheters to the patient	5		
	Arterial blood collection from patient	5		

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