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# *Research on the Status and Training Insights of Junior-to-Intermediate Promotion Training for Engineering Technicians—A Case Study of Engineering Technology Promotion Training*

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***Abstract:*** This paper sorts out the current status and existing problems of the junior-to-intermediate promotion training for engineering technicians, analyzes the causes of these problems, and finally derives insights for improving the promotion training. This provides a reference for subsequent promotion training for junior-to-intermediate engineering technicians.

## 1. Introduction

Engineering technicians at the corporal rank, after several years of work experience, will undergo the professional skill level 4 training required by the microelectronic training program. Upon completing the junior-to-intermediate promotion training and achieving the level 4 training standard, they can be promoted to the rank of second-class sergeant and may serve as the leader of the diesel engine section in the microelectronic department. The assessment for professional skill level 4 includes two types: one conducted by the unit in conjunction with the retention assessment, and the other following the junior-to-intermediate promotion training at the academy, followed by a retention examination[1-2].

The requirements for professional skill level 4 include proficient operation and troubleshooting of common faults. Technicians must be familiar with the working principles and actual performance of the equipment under their responsibility, proficient in its operation, use, and management, capable of analyzing and troubleshooting common faults, memorizing the duties of deputy personnel, mastering the operation of deputy-held equipment, and able to perform deputy duties during watch keeping. They must also be able to skillfully organize class and battle station training and guide level 5 technical soldiers in training[3-5].

To better understand the training needs of subtechnicians, analyze factors affecting their job competence development, and propose countermeasures, providing a reference for the reform of practical teaching in subtechnician promotion training, a survey was conducted among 126 graduates of the junior-to-intermediate promotion training in engineering technology and 18

microelectronic officers. The details are as follows.

## 2. Current Status of Junior-to-Intermediate Promotion Training

The survey revealed that all trainees believe the promotion training is necessary, with high political awareness and learning enthusiasm. 96.8% of trainees believe that the promotion training basically met their learning expectations, 28.1% believe the practical effects of the training are significant, and 68.7% believe it has some effect. The top three areas of knowledge that trainees believe are most needed in promotion training are equipment maintenance skills, professional knowledge expansion, and management methods. Trainees generally suggest that hands-on practical sessions should be increased, involving actual parts disassembly and repair, collaborative response to emergencies with other specialties, and practical teaching in job positions to cultivate training and management capabilities and rapid troubleshooting skills. Theoretical lectures should cover equipment's basic parameters, structure, composition, principles, common fault phenomena, causes, and troubleshooting methods. Case videos should be watched to guide discussions among trainees. Emergency response plans, watch keeping precautions, foreign military characteristics, domestic and foreign equipment comparisons, and professional development prospects should also be included. Additionally, visits to manufacturers and research institutions are recommended.

Their mastery of job-related professional knowledge is shown in Table 1:

Table 1: Mastery of Job-Related Professional Knowledge (%)

| Content | Very Good | Good | Average | Poor |
|---|---|---|---|---|
| Equipment Functions, Layout, Main Parameters, and Expected Status | 28.1 | 59.4 | 12.5 | 0 |
| Equipment Use and Maintenance Rules | 28.1 | 46.9 | 25 | 0 |
| Common Fault Phenomena, Causes, and Troubleshooting Methods | 15.6 | 62.5 | 25 | 0 |
| Use and Maintenance Methods of Special Tools | 25 | 59.4 | 15.6 | 0 |
| Knowledge of New Equipment and Equipment Trends | 12.5 | 56.3 | 31.3 | 0 |

As shown in Table 1, the mastery of basic job-related knowledge among trainees follows a normal distribution, with nearly 65% of trainees performing well and 35% performing averagely.

Their mastery of equipment operation and usage is shown in Table 2:

Table 2: Mastery of Equipment Operation and Usage (%)

| Content | Very Good | Good | Average | Poor |
|---|---|---|---|---|
| Preparation Before Starting Equipment | 50 | 37.5 | 12.5 | 0 |
| Starting Operation of Equipment | 53.1 | 34.4 | 12.5 | 0 |
| Management During Equipment Operation | 50 | 34.4 | 15.6 | 0 |
| Stopping Operation of Equipment | 50 | 37.5 | 12.5 | 0 |

Table 2 shows that over 80% of trainees in the junior-to-intermediate training program have achieved a "very good" or "good" level in equipment operation and usage, while a minority considers their operation and management skills average. Compared to job-related knowledge and professional knowledge, trainees are more confident in their operational abilities.

Their mastery of management and training capabilities is shown in Table 3.

Table 3: Mastery of Management and Training Capabilities (%)

| Content | Very Good | Good | Average | Poor |
|---|---|---|---|---|
| Plan Formulation | 12.5 | 59.4 | 28.1 | 0 |
| Use of Computers and Common Office Software | 12.5 | 37.5 | 40.6 | 9.4 |
| Lesson Plan Writing | 9.4 | 40.6 | 31.3 | 18.8 |
| Multimedia Courseware Creation | 6.3 | 37.5 | 37.5 | 18.8 |
| Teaching Methods and Organization | 6.3 | 40.6 | 34.4 | 18.8 |
| Daily Management Capabilities | 12.5 | 50 | 31.3 | 6.3 |

Table 3 indicates that trainees management and training capabilities are generally weak, with only a few considering themselves very good in these areas. Most trainees lack confidence in their ability to execute management and training tasks, especially in lesson plan writing, multimedia courseware creation, teaching methods, and organization.

## 3. Existing Problems

1) 34.3% of trainees believe the teaching content is outdated, lacking diversity and relevance, and not tailored to different subtypes. Over 30% of trainees have insufficient knowledge of new equipment and its trends.

2) 68.7% of trainees believe the teaching conditions are limited, with aging equipment that does not match actual equipment, allowing only general maintenance skills to be learned.

3) 37.5% of trainees believe there is a gap between the teaching and actual combat situations, with insufficient relevance to military operations.

4) 50% of trainees have weak management and training capabilities.

## 4. Cause Analysis

### 4.1. Teaching Content

Prior to initiating each junior-to-intermediate training session, the teaching and research section conducts thorough consultations with trainees to identify their unique learning needs and propose suitable learning content. Despite these efforts, the constraint of limited class hours remains a significant challenge. Due to this limitation, it is impractical to provide comprehensive coverage of every subtype and its intricate systems. Consequently, the training content may not fully cater to the specific needs of every trainee, potentially leading to gaps in their knowledge and skills.

### 4.2. Teaching Conditions

Over the past decade, the teaching and research section has persistently advocated for the allocation of actual equipment to enhance the practicality and relevance of the training. However,

due to budget constraints, procurement delays, and other logistical issues, the necessary equipment has yet to be procured. Furthermore, the current facilities and equipment available to the section are inadequate to support the diverse training needs of the trainees. This limitation prevents every trainee from participating in all training subjects, thereby hindering their overall development.

### 4.3. Teaching Practicality

The teaching and research section faces difficulties in immediately implementing practical teaching content suggested by trainees. This is primarily due to the limited conditions, including inadequate facilities, equipment, and resources. As a result, trainees may find it challenging to apply theoretical knowledge in practical scenarios, which can affect their learning outcomes and preparedness for real-world situations.

### 4.4. Training Capabilities

The section lacks a dedicated course on training methods and strategies, relying solely on guidance provided during related professional courses. While this approach may suffice for trainees who have undergone military technician vocational education, it may not be adequate for those with different backgrounds and learning styles. A dedicated course on training methods would provide trainees with a comprehensive understanding of effective learning strategies, enabling them to maximize their learning potential.

## 5. Training Insights

### 5.1. Teaching Content

To address the issues with teaching content, outdated materials should be discarded and replaced with updated knowledge and information. The emphasis should be on fostering independent exploration and judgment abilities among trainees, enabling them to navigate complex and ever-changing situations. Teaching methods and tools should be innovative and engaging, stimulating trainees' learning initiative and potential. A focus on enhancing maintenance skills training is crucial, as these skills are essential for the safe and effective operation of submarines.

### 5.2. Teaching Conditions

To foster a comprehensive understanding and proficiency in diesel engine technology among students, it is imperative to enhance the teaching conditions by introducing a broader spectrum of diesel engine equipment for hands-on training and maintenance practices. This involves investing in a diverse range of diesel engine models, encompassing both vintage and contemporary designs, to ensure that learners gain exposure to the full spectrum of diesel engine technologies currently in use. Efforts should be directed towards acquiring engines from different manufacturers and with varying specifications, as this will enable students to develop a deeper understanding of the nuances and idiosyncrasies associated with each type.

In addition to physical equipment, virtual and augmented reality (VR/AR) technologies can be leveraged to create interactive simulations of diesel engine operations and maintenance tasks. These digital tools can offer immersive learning experiences that complement traditional hands-on training, making it easier for students to grasp complex concepts and procedures.

### 5.3. Teaching with Practical Combat Scenarios

The incorporation of practical combat scenarios into teaching methodologies is vital for preparing students to face real-world challenges effectively. To achieve this, it is essential to gather an extensive collection of examples and case studies from military units, which reflect the diverse range of combat situations and emergency responses encountered in operational environments. These real-world instances should be meticulously analyzed and integrated into subject design, ensuring that the curriculum aligns closely with the practical demands of the field.

Creating an immersive combat atmosphere within the training environment is crucial for enhancing the effectiveness of scenario-based learning. This can be achieved by utilizing specialized training facilities that replicate the conditions and stresses of actual combat scenarios. Role-playing exercises, live-fire drills, and simulations of emergency responses should be conducted regularly to build students' confidence and competence in handling high-pressure situations.

### 5.4. Training Organization Capability

To further enhance the training organization capabilities: Specialized courses should be established to improve the teaching and organizational skills of instructors. These courses should focus on modern educational techniques, curriculum design, and effective methods for managing and motivating trainees.

Regular workshops and seminars should be conducted to keep instructors updated on the latest trends and best practices in training and education. A system for evaluating and providing feedback on instructors' performance should be implemented to ensure continuous improvement in their teaching and organizational skills.

By addressing these areas, the teaching and research section can significantly enhance its training organization capabilities, leading to more effective and efficient training programs that better meet the needs of trainees and the military organization.

## 6. Conclusions

The study on the status of graduating cadets and its implications for training has provided invaluable experience for the promotion training of machinery technology professionals. Going forward, we will seize this opportunity to continually deepen teaching reforms. Based on the characteristics and needs of trainees, we will formulate more precise training plans to deliver better educational services to our students.

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