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Enhancing Dynamic Positioning Operator Performance through Integrated Training Methods: An Empirical Study in Offshore Maritime Operations

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Abstract

As the Dynamic Positioning (DP) systems of the offshore fleet become increasingly automated and integrated with sensors to enhance safety, Dynamic Positioning operators (DPOs) still play a critical role in accurately positioning vessels as safely and efficiently as possible, even under the harshest conditions. This study is framed in a quantitative context and examines the effects of different types of DPO training on training outcomes. Structured questionnaires were issued to certified operators to collect the data. This study found that this type of training has the greatest effect on training outcomes. Among the training types, the greatest training outcome is attributed to onboard or practical training on DP Vessels, compared with outcomes from simulator and computer training. Of the types of training mandated by the company, and the professional seminars or webinars attended, the majority of the training outcomes were intellectual, and in-the-field operational skills were minimally affected. This study found the remaining types of training on the spectrum of the theoretical portion of the training, practical, and in-the-field training to be balanced. This study provides the foundation for encouraging potential lines of sight for improving the development of training competencies. This study is intended to enhance industry safety.

Keywords:

Dynamic positioning, MET, DPO, Maritime Education & Training.

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1. Introduction

The last few decades have seen many shifts in the global maritime sector due to technological advances. One such development is the Dynamic Positioning (DP) system, which enables ships to maintain specific positions and orientations even in challenging situations (Kvaal et al., 2022). Dynamic Positioning (DP) technology is critical in subsea construction, the extraction of oil and gas, and the installation of wind farms. It notably enhances the range of offshore services while also safeguarding the environment (Masood, 2024).

The DP system relies heavily on automation; however, human input is still valued for safety reasons. Dynamic Positioning Operators (DPOs) monitor system data, analyze external variables, and make decisions in real time under challenging conditions. The stabilization of a ship is highly dependent on the decisions of a DPO. The system is likely to encounter unforeseen circumstances, such as the loss of a system unit, operation of a system unit during severe thunderstorms, or loss of system power (Øvergård et al., 2015).

Despite the risks of DP, human error is the cause of the majority of them, especially in DP risks known as the Loss of Position (LoP) risk. 61.2% of DP LoP cases have a human error component. There is a significant risk due to skill and supervisor-dependence errors. It is critical to efforts to reduce risks associated with the systems that end up improving DPO performance to put risks on the systems in the first place (Chae, 2017).

Many forms of effective training, such as onboard training on DP vessels, simulator exercises, company-mandated training, Computer-Based Training (CBT), and registered seminars or webinars, have been devised, but the effectiveness of each form has not been studied.

The disparity in knowledge may result in wasted training resources and unevenly skilled operators, raising concerns about safety in DP operations (Lundborg, 2014).

2. Research objectives and hypotheses

This research examines the impact of various DP training methods on DPO performance. The central question concerns the effect of the various training types on the improvement of DPOs' operational skills, the quality of their on-the-job decision making, and overall performance regarding safety. In light of this, the hypotheses have been constructed as follows:

- **H1:** DP training has a positive effect on DPO performance.
- **H1.1:** Simulator training significantly improves DPO performance.
- **H1.2:** Onboard training markedly boosts operational competence.
- **H1.3:** Company-required training produces a significant positive influence on performance results.
- **H1.4:** CBT significantly enhances DPO performance.
- **H1.5:** Webinars and seminars considerably improve professional performance.

From a methodological perspective, the research was designed as a quantitative study to collect data through a structured questionnaire administered to maritime-certified DPOs. This approach enabled statistical analysis of the relationship between the various DP training methods (the independent variables) and DPO performance (the dependent variable), thereby providing grounds for assessing training effectiveness and supporting the decision.

3. Human factors and competence

Although the DP system is largely automated, human factors remain crucial to maintaining optimal safety and operational efficiency. The DPO examines the overall operation and uses discretion to make critical, often urgent decisions about the operation of the system. The Senior DPO (SDPO) has complete responsibility for maintaining the position of the ship, ensuring navigation safety, and managing the DP activities related tasks (IMCA, 2025a).

A DPO's effectiveness and balance of key components, including technical knowledge and decision-making. Technical knowledge includes system construction, redundancy principles, and procedures for system operation. In contrast, situational awareness includes the flexibility of changing conditions, the behavior of the vessel, and the operational framework. The most proficient decision-making is crucial and provides a DPO with the tools required to contain risks, guide normal to abnormal situations, and manage the varied operational modes (NI, 2026).

To maintain and evaluate efficiency, formal training and certification courses are provided, for the most part, by the Nautical Institute (NI). This includes simulations and practical training, which is manufacturer-specific, continuous professional development (CPD) included, and is all related to the International Convention on the Standards of Training, Certification and Watchkeeping for Seafarers (STCW) (NI, 2026). The DP Offshore Training Scheme offers a structured certification process that combines theoretical education with practical DP sea-time experience to ensure readiness for operations (see Fig.1).

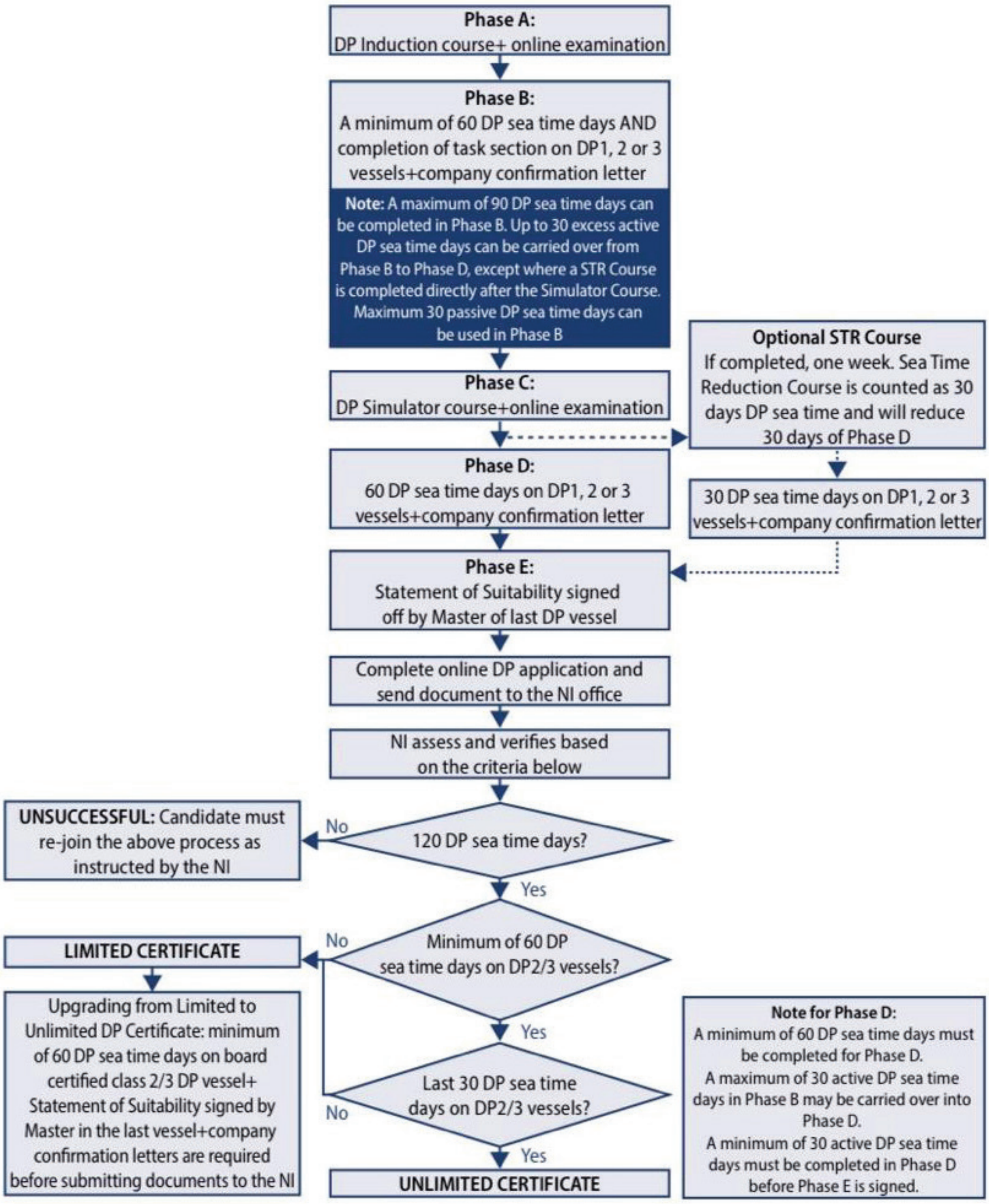

Figure 1: Offshore Limited/Unlimited DP Certificate flowchart (NI, 2026)

4. DP systems and technical framework

The DP system is designed as fluidly integrated hardware and software, allowing a ship to hold a specific position and heading in the absence of anchors while using active thrusters. Each subsystem in the system, position reference sensor, environment sensor, gyrocompasses, and a centralized control system, works in partnership to measure the disruption and establish a compensatory measure using active thrusters. (Duffield, 2024).

Central to DP is the concept of the six degrees of freedom. DP system defines parts of the system's movement in the horizontal direction as surge, sway, and yaw, and the parts of the movement in the vertical direction as heave, pitch, and roll (see Fig.2). DP systems can control horizontal movements, while vertical movements, although affected by various control systems, are largely left to the environment. This necessitates extensive system feedback and corrective measures to maintain stability (Masood, 2024).

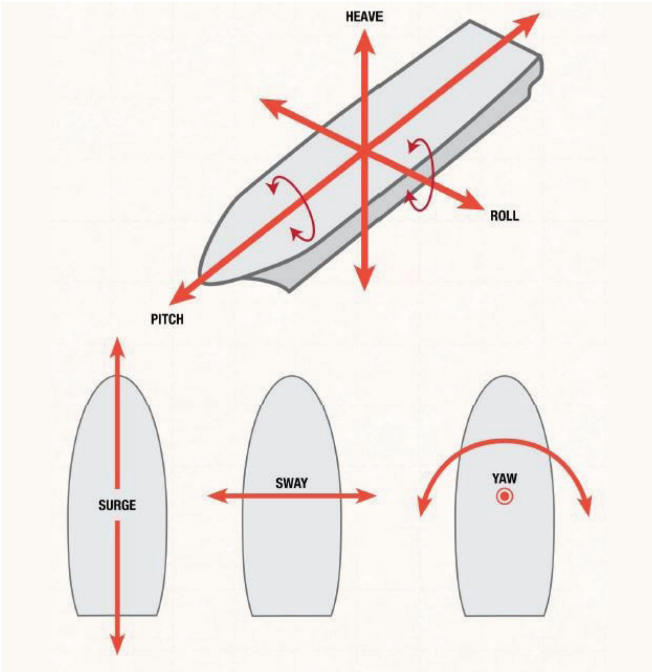

Figure 2: Six degrees of freedom (NI, 2024)

The critical components that integrate successfully to support effective station-keeping include a power supply, thrusters, environmental systems, Position Reference Systems (PRS), DP controllers, and Human-Machine Interfaces (HMIs) (see Fig.3). These components, within a cohesive architecture, enable accurate control and stability of the vessel. The system's reliability is further bolstered by redundant features across different DP classes (Duffield, 2024).

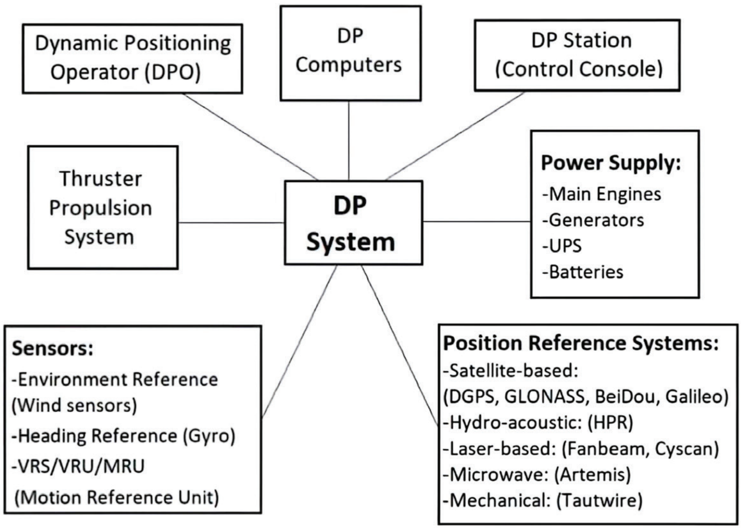

Figure 3: Components of a DP system (Duffield, 2024)

There are three types of DP Vessels, denoted as DP1, DP2, and DP3, and they are categorized based on their failure tolerance. Such analyses, such as failure mode and effects analysis (FMEA) and worst-case failure (WCF) analyses, delineate the failure that results in LoP for DP vessels. DP classes at a higher tier are preferable for high-risk offshore operations (IMO 2017), as they provide greater redundancy and fault tolerance.

From this perspective, operational planning dimensioned with the redundancy protocol and systems of defenses facilitates the protection offered. The frameworks for operational planning are dimensioned with the redundancy protocol and systems of defenses, Critical Activity Mode (CAM), and Task Appropriate Mode (TAM), as well as risk-specific Activity Specific Operating Guidelines (ASOG), which provide operational

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balance and the setting of redundancies. Prevention and response scheduling of maintenance activities and Hazard Identification (HAZID) activities sustain system integrity by addressing anticipated failures and ensuring that all system-perceived redundancies are available and operational (IMCA 2025b).

The complete crystallization of DP systems design is a robust, integrative approach to automation, redundancy, and operational structures. It ensures the safety of the vessel's systems and crew under harsh operational conditions.

5. Safety management in DP operations

There are three types of risk associated with DP operations: equipment failures, environmental risks, and human behavior risks. Because of the evident risk that human behavior poses to DP operations, continuing education, robust communication systems, and a cohesive safety culture are imperative for organizational success. From the IMCA (2023) publication, communication provides the basis for safety, and because people are a part of a system that should ensure safety, they should form the channels that combine controlled communication and regulated safety.

In addition, the safe management of DP operations, safety management systems such as the International Safety Management (ISM) Code, the International Maritime Organization (IMO), and the International Marine Contractors Association (IMCA) provide the foundation for safe practices, maintenance, and operational competency of the crew. The safety of operations that encourage constant improvements should also embrace blame-free reporting. This safety culture enables organizations to identify incidents and take measures to prevent them from recurring (IMO, 2017).

In conclusion, safety systems for DP operations should rely on people and technological systems that focus on risk management. Safety and effective operation of their radical system rely on the technological system, yet also on the capacity to operate the system, well-integrated supervisory systems, and holistic safety systems.

6. Research methodology

This research focuses on why people use different training methods. To collect data, a cohort of DPOs was sent a structured questionnaire in a bucket survey rather than a signpost survey to gain DPOs in offshore maritime jobs. The survey questions were mixed across both training and performance, and asked survey respondents to rate their responses to statements on a Likert scale.

The study population consisted of approximately 2,000 certified Dynamic Positioning Operators (DPOs) working in the offshore maritime sector (NI,2025). A sample of 100 certified DPOs was selected from this population. The majority of the participants were employed on supply ships, followed by diving support vessels and subsea construction vessels.

Statistical evaluation was obtained via the analysis. Descriptive statistics were used to summarize the retrieved evidence, while the relationship between training and performance variables was assessed using correlation analysis. This was also the case for regression analysis, which assessed the nature and degree of these variables.

This is a result of the best practices of research. Evidence found from a study that is both trustworthy and useful in answering the question of what the difference in training methods means for operational performance.

7. Results and Analysis

Analyzing the data illustrates the impact of various training methods, including simulator training, onboard training, company-required training, CBT, and webinars/seminars, on an operator's performance. It was apparent that the training conducted on-site and incorporated multiple training methods, like onboard training on DP vessels and Active Learning Principles, was the most beneficial for positive performance changes.

Conversely, simulation training allows operators to rehearse various scenarios, some of which may be rare in daily operations, as well as different emergency protocols. The use of CBT to consolidate operators' new knowledge and practice procedures and policies by using resources to guide them to the pertinent information was beneficial.

In addition to the use of different training methods, the facilitation of training in the form of one or two directed online courses is mandated more for policy compliance and procedural practice and is less beneficial to participants than the engaged learning of Facilitated training, Webinars, or Scheduled Professional Seminars in terms of the improvement of operational capability. The data illustrate that the most effective training of an operator, in terms of overall positive performance, centers on practical, active learning, rather than the less engaged type of training, which is more knowledge-centered.

8. Discussion

This research demonstrates the importance of integrated training systems for the maritime sector. Offshore activities often require operators to manage complicated technical systems and respond to rapidly changing environmental conditions. Therefore, effective training programs should address the requisite theoretical and practical components.

For that reason, the best training practices for an organization using DP systems integrate learning management systems, simulation training, and practical exercises on the vessels. Simulations allow learners to practice operating in and responding to difficult and dangerous operational environments. Practicing exercises on the vessel reinforces classroom concepts and hands-on training.

This research reinforces experiential learning theories that support learning through engagement with real-life activities. Actual engagement helps operators develop a better understanding of operational systems and, ultimately, better judgment through participation in real operational environments.

To conclude, maritime training programs that include an adequate amount of practical learning components as well as a strong theoretical component will best allow operators to cope with the inherent difficulties of offshore operations.

9. Conclusion

This research examines the influence of various training methods on DPOs' performance. The research study indicates that training is a core factor in improving the operational and safety skills of personnel involved in services in the maritime offshore environment. Among the evaluated training methods, Practical or onboard training has the most significant positive effect on operators' performance. This is followed by training using a simulator and training using a computer, in that order.

Contrary to the methods of training discussed in the previous paragraph, company-mandated safety training and participation in workshops, while they aid in the acquisition of knowledge, have a considerably smaller and indirect effect on enhancing operational skills. Based on the research, there is a need for comprehensive training programs for Operators that combine practical, simulation, and online training.

10. Recommendations

The present research offers several recommendations. Initially, it has been noted that maritime training involves much more theory than practice. Given the nature of the training, it is acceptable to conduct one or more training sessions at a company's training boards.

The second recommendation is much more focused on the Operators, and in fact, concerns the development and incorporation of more sophisticated training fitters into the training system.

The third, intricately connected to the development of simulators that will allow complex offshore situations to be worked on, is the development of Integrated Bridge System Simulators, which will be of significant importance.

The fourth recommendation is more directly aimed at the DPOs and their performance and concerns the development of standardized training frameworks. The last recommendation, of course, concerns the leap/leap of distance, as the introduction of distance learning systems contributes to training that is more than standard in the areas of further training, as noted. The improvement in offshore maritime activities can be conveniently monitored.

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