# ASSESSING THE SATISFACTION LEVEL OF INTEGRATED SEA PRACTICE MONITORING INFORMATION SYSTEMS IN MARITIME EDUCATION AND TRAINING: THE PIECES FRAMEWORK

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***Abstract:*** *Maritime education and training are aimed at producing and enhancing seafarers' competencies. Monitoring training activities is an essential aspect, yet its execution still relies on non-integrated email systems. When monitoring is not integrated and solely relies on email, the monitoring process becomes less effective. This research aims to develop and test an application called OTMON (Online Monitoring) for overseeing maritime education and training (MET). The research method utilizes a research and development (R&D) approach with the ADDIE phases: Analyze, Design, Develop, Implement, and Evaluate. System needs analysis employs the PIECES approach to fulfill monitoring requirements in MET activities. In this study, 67 respondents participated. The findings indicate that users experienced a high level of satisfaction, with a score of 4.08 out of 5 (81.6%), when using the OTMON application. The application was utilized optimally due to the PIECES approach. The implication of this research is that online monitoring applications can serve as an alternative for monitoring maritime education and training.*

***Keywords***: *maritime education and training, PIECES, OTMON, Competency*

***Abstract:*** *Pendidikan dan Pelatihan kepelautan ditujukan untuk menghasilkan dan meningkatkan kompetensi pelaut. Monitoring terhadap kegiatan pelatihan adalah aspek yang esensial, namun dalm pelaksanaannya masih mempergunakan email yang tidak terintegrasi dengan system. Ketika monitoring tidak terintegrasi dan hanya mempergunakan email, maka proses monitoring menjadi kurang efektif Penelitian ini bertujuan untuk mengembangkan dan menguji aplikasi yang bernama OTMON (Online Monitoring) untuk melakukan pengawasan terhadap pendidikan dan pelatihan laut (Prala). Metode penelitian mempergunakan pendekatan research and development (R&D) dengan tahapan ADDIE yaitu Analyze, Design, Develop, Implement, and Evaluate. Analisis kebutuhan system mempergunakan pendekatan PIECES untuk memenuhi monitoring dalam pelaksanaan kegiatan Prala. Sebanyak 67 responden terlibat dalam penelitiian ini. Hasil penelitian menunjukkan bahwa pengguna merasakan tingkat kepuasan yang tinggi, dengan nilai 4,08 dari skala 5 (81,6%) pada saat mempergunakan aplikasi OTMON. Aplikasi tersebut dapat dipergunakan secara optimal karena telah mempergunakan pendekatan PIECES. Implikasi penelitian adalah aplikasi monitoring*

*secara online dapat dijadikan sebagai alternatif untuk monitoring Pendidikan dan latihan kepelautan.*

## INTRODUCTION

In maritime education and training (MET) aboard commercial vessels, Practical Sea Training or PRALA represents a pivotal phase incumbent upon each MET participant. Practical Sea Training entails a sequence of practical work-learning activities conducted aboard commercial vessels for a minimum duration of 12 months. The objective of this endeavor is to equip MET participants, commonly referred to as cadets, with an understanding of the duties and responsibilities aboard ships. Thus, graduates from MET are envisaged to possess competencies and experiences aligned with the exigencies of the job market (Lukita & Sudibjo, 2021). To cultivate participants with robust competencies, vigilant supervision and guidance during sea practice are imperative (Patil et al., 2022). Consequently, the competencies acquired aboard ships should align with the anticipated requisites of the job market (Balaji & Venkadasalam, 2017). However, in practice, the information system employed for supervising the execution of Practical Sea Training aboard vessels by MET still relies predominantly on email communication or other partially developed email-based systems, independently devised by maritime training institutions to cater to their respective needs. Consequently, the lack of data integration among these maritime training institutions hampers the optimal execution of supervision endeavors (Cahyadi & Mirianto, 2023).

An essential requisite for maritime training institutions is an integrated information system. Presently, information systems are inseparable from the concept of integration, as both components complement each other in fostering conducive and well-structured maritime training institutions (Sarifuddin et al., 2022). A interconnected or integrated system facilitates data exchange to prevent manipulation and

generate up-to-date information supportive of decision-making processes for the leadership of maritime training institutions. The implementation of a structured integrated sea practice monitoring information system not only assists system users but also significantly enhances their effectiveness and efficiency.

The benefits and conveniences offered by such an integrated sea practice monitoring information system serve as indicators that, besides, user satisfaction value represents a benchmark for comparing outcomes or performance with expectations (Chen et al., 2020; Pillai et al., 2021). Evaluating the implemented integrated sea practice monitoring information system to determine if it aligns with the planned objectives necessitates measurement, where several indicators can be utilized. These indicators include Performance, Information, Economy, Security, Efficiency, and Service, commonly known as the PIECES method (Dewi et al., 2023). All identified facts serve as references for enhancing, improving, or designing a better system. This research aims to determine the satisfaction of maritime training users with the integrated sea practice monitoring system. The Evaluation phase represents the fifth stage in the ADDIE model, indicating that in this phase, a model is considered proven and ready for implementation.

## METHOD

The research employed a developmental model in this study, indicating an investigation of field facts through weakness analysis, followed by conceptual development to address them. The developmental steps in this study utilized the ADDIE model approach. This model encompasses five phases: Analyze, Design, Develop, Implement, and Evaluate (Aldoobie, 2015). The first phase focuses on analyzing the phenomenon under study. In this model, it delineates the identification and analysis of the needs required during research. Subsequently, the second phase involves designing the model, wherein an ideal model for monitoring integrated sea practices is determined. The design process is built upon previous

research and analyzes factors supporting the achievement of integrated sea practice monitoring objectives. The third phase entails developing a model based on factual and theoretical models. Here, a model is developed based on previous theories and research and compared with the current factual conditions, ensuring linearity between the developed model and the current factual conditions. The fourth phase involves implementation using integrated technology-based monitoring media. During this phase, data reflecting user satisfaction with the integrated sea practice monitoring information system is obtained, providing a clear picture of the situation based on the acquired data.

Development is carried out with a monitoring system called OTMON (Online Monitoring). OTMON is an application-based system designed to enhance monitoring. The research developed an application called OTMON to replace the previous manual monitoring process, which relied on email. The population and sample data for this research were sourced from users of the integrated sea practice monitoring system at the Maritime Education and Training Institution, Politeknik Ilmu Pelayaran Semarang, comprising 67 respondents selected through purposive sampling. The targeted respondents were provided with questionnaires to express their perceptions as users of the integrated sea practice monitoring information system.

Data collection techniques serve as the initial step in acquiring precise and accurate information. The technique employed in this study was interview-based, involving a one-way question-and-answer process with users who had completed their sea practice period and utilized the integrated sea practice monitoring system onboard (OTMON). This method enabled researchers to obtain information pertaining to user satisfaction levels with the system and to gather evaluative feedback. Interviews were conducted with cadets who had utilized the OTMON system. Questionnaire or survey is a method utilized to obtain data by disseminating questions aimed at respondents. The use of questionnaires in data collection is more efficient as it enables a precise understanding of

the variables used for measurement and aligns with respondents' expectations. Statements and questions within the questionnaire are derived from the PIECES Framework domain. The computation of scores from questionnaire or survey results employs the Likert Scale. The Likert Scale is employed to gauge an individual's perceptions or opinions regarding a specific condition. Each score option is assigned a value or score as follows:

Table 1. Assessment Characteristics

| Response | Criteria | Score |
|---|---|---|
| Strongly Agree | SS | 5 |
| Agree | S | 4 |
| Neutral | N | 3 |
| Disagree | TS | 2 |
| Strongly Disagree | STS | 1 |

Observation is an approach based on direct field observation to gain firsthand insight into field phenomena. Data collection was conducted at the Politeknik Ilmu Pelayaran Semarang, involving Diklat participants who had completed sea practice and utilized the integrated sea practice monitoring system (OTMON). Data obtained from observation activities encompassed the application usage flow, application features, and user ratings. The objective of conducting observations was to acquire authentic information regarding real-world occurrences.

The researcher employed the PIECES Framework method to analyze user satisfaction with the integrated sea practice monitoring information system. The PIECES Framework is a method utilized to measure the effectiveness of variables employed or applied within the integrated sea practice monitoring information system (Yunianto et al., 2021). The framework comprises six variables:

a. Performance: This variable assesses the performance or functionality of the information system utilized.

b. Information: It evaluates the clarity and comprehensiveness of information obtained from the integrated sea practice monitoring information system.

c. Economics: This variable examines whether the quality of the information system justifies the costs and fees incurred.

d. Control and Security: It measures the level of difficulty and security concerns when utilizing the integrated sea practice monitoring information system.

e. Efficiency: This variable determines the efficiency or inefficiency of the system in meeting user needs.

f. Service: This variable assesses the quality of service provided and any issues or disruptions encountered in service delivery.

Data obtained from distributed and respondent-filled questionnaires were subsequently processed through data analysis using the PIECES method with the formula:

RK = JSK/JK

Where:

RK = Average Satisfaction Rate

JSK = Total Questionnaire Score

JK = Total Questionnaires

Based on the aforementioned formula, the average satisfaction score is generated by dividing the total questionnaire score by the total number of questionnaires for each variable. The following are the characteristics of the PIECES Framework assessment.

## RESULTS

From the basis of the formula above, the average satisfaction score is produced by dividing the total questionnaire scores by the number of questionnaires in each variable. The following are the characteristics of the PIECES Frameworks assessment.

Table 2. Assessment Characteristics

| Scale | Assessment Category |
|---|---|
| 4.92 - 5 | Very satisfied |
| 3.4 - 4.91 | Satisfied |
| 2.6 – 3.39 | Neutral |
| 1.8 – 2.59 | Not satisfied |
| 1.00 – 1.79 | Very Dissatisfied |

In table 2 above it can be explained that the assessment characteristics are based on a Linkert scale with scores ranging from 1 to 5 which come from the assessment framework.

## RESULTS

Digital Guidance and Supervision of Marine Practices (Prala) through integrated monitoring is an urgent and relevant step. Digital transformation under Prala supervision will bring many significant benefits to the entire education and training system for maritime training participants. Digital monitoring will enable maritime authorities and training agencies to monitor cadet activities in real-time.

### Data Analysis Based on the PIECES Framework

As a result of distributing and filling out questionnaires carried out in accordance with the data collection method used, data was obtained from 67 respondents. The data was then processed by conducting data analysis using the PIECES Framework method by calculating 6 variables. The following are the calculation results for each variable from the PIECES Frameworks.

a.    *Performance*

The table below is the result of distributing and filling out respondent questionnaires based on Performance indicators.

Table 3. Performance indicators

| Question No | Respondent | | | | |
|---|---|---|---|---|---|
| | SS | S | N | T.S | STS |
| 1. OTmon easy to access by users | 19 | 34 | 4 | 7 | 3 |
| 2. If OTmon is used simultaneously, 13 system performance is stable | 33 | 15 | 4 | 2 | |
| 3. OTmon can operate a number of orders in a relatively short time without experiencing any obstacles | 11 | 40 | 9 | 7 | 0 |
| 4. OTmon can quickly respond to an cancellation orders or requests | 18 | 33 | 11 | 5 | 0 |
| 5. Menu and navigation provided OTmon can be run easily and interactive | 17 | 41 | 5 | 4 | 0 |
| 6. OTmon has an attractive appearance | 13 | 44 | 8 | 2 | 0 |
| 7. The menus available on OTmon, can instantly display information Which suits your needs | 20 | 40 | 7 | 0 | 0 |
| 8. In OTmon a cancellation action is available easily if needed | 16 | 38 | 10 | 3 | 0 |
| 9 The output produced by OTmon has Display the same (consistent) examples TRB, KKP, E - TRB monthly reports | 18 | 39 | 5 | 5 | 0 |
| 10. OTmon once experienced an error When used | 19 | 31 | 11 | 6 | 0 |
| **Amount** | **164** | **373** | **85** | **43** | **5** |

$$RK = \frac{(164*5)+(373*4)+(85*3)+(43*2)+(5*1)}{164+373+85+43+5}$$

$$RK = \frac{2658}{670}$$

RK = 3.9

Based on the results of calculating the average user satisfaction of the integrated Prala monitoring information system on the Performance variable, the final result was 3.9. and is included in the satisfied category, thus showing a positive indication that the developed integrated maritime practice monitoring information system plays a good role in the field of performance.

b. Information

The table below is the result of distributing and filling out the questionnaire based on information indicators.

Table 4. Information Indicator

| Question No | Respondent | | | | |
|---|---|---|---|---|---|
| | SS | S | N | T.S | STS |
| 1. The information presented by OTmon has | 18 | 38 | 8 | 3 | 0 |

high precision

| Question | SS | S | N | T.S | STS |
|---|---|---|---|---|---|
| 2. The information presented by OTmon is appropriate | 18 | 43 | 4 | 2 | 0 |
| 3. The information presented by OTmon is easy to be studied and understood without experiencing obstacles | 19 | 40 | 6 | 2 | 0 |
| 4. Data on OTmon is easy to access or used as needed | 19 | 40 | 4 | 4 | 0 |
| **Amount** | **74** | **161** | **22** | **11** | **0** |

RK = $\dfrac{(74*5)+(161*4)+(22*3)+(11*2)+(0*1)}{74+161+22+11}$

RK = $\dfrac{1102}{268}$

RK = 4.1

The results of calculating the average satisfaction of users of the integrated prala monitoring information system on the Information variable obtained a final result of 4.1is included in the SATISFIED category, so it can be concluded that the developed marine practice monitoring application can provide the information needed by users.

c. Economics
The table below is the result of distributing and filling out respondent questionnaires based on Economic indicators

Table 5. Economic indicators

| Question No | Respondent | | | | |
|---|---|---|---|---|---|
| | SS | S | N | T.S | STS |
| 1. Install OTmon is free | 39 | 26 | 1 | 1 | 0 |
| 2. OTmon can speed up completion user interests | 20 | 35 | 9 | 3 | 0 |
| **Amount** | **59** | **61** | **10** | **4** | **0** |

RK = $\dfrac{(59*5)+(61*4)+(10*3)+(4*2)+(0*1)}{59+61+10+4}$

RK = $\dfrac{577}{134}$

RK = 4.3

The results of calculating the average satisfaction of users of the integrated marine practice monitoring information system on the Economics variable obtained a final result of 4.3 is included in the SATISFIED category, so it can be concluded that the integrated maritime

practice monitoring information system developed is free of charge and can speed up the completion of user tasks while carrying out maritime practice.

d. Control and Security
In the table below are the results of distributing and filling out respondent questionnaires based on the Control and Security indicators.

Table 6. Control and Security Indicators

| Question No | Respondent | | | | |
| --- | --- | --- | --- | --- | --- |
| | SS | S | N | T.S | STS |
| 1.  OTmon has limited access rights different between admin, supervisor, cadet, instructors and assessors | 22 | 38 | 7 | 0 | 0 |
| 2.  The data on OTmon is guaranteed its confidentiality | 25 | 32 | 8 | 2 | 0 |
| **Amount** | **47** | **70** | **15** | **2** | **0** |

$$RK = \frac{(47*5)+(70*4)+(15*3)+(2*2)+(0*1)}{47+70+15+2}$$

$$RK = \frac{564}{134}$$

$$RK = 4.2$$

The results of calculating the average satisfaction of users of the Prala integrated surveillance information system on the Control and Security variable obtained a final result of 4.2in the SATISFIED category, so it can be concluded that the integrated marine practice monitoring information system developed has a guarantee of confidentiality for documents sent by users.

e. efficiency
The table below is the result of distributing and filling out respondent questionnaires based on the Efficiency indicator.

Table 7.Efficiency Indicator

| Question No | Respondent | | | | |
| --- | --- | --- | --- | --- | --- |
| | SS | S | N | T.S | STS |
| 1.  OTmongive profit for user | 21 | 30 | 10 | 5 | 1 |
| 2.  OTmoncan be used all over prala report process | 21 | 35 | 5 | 5 | 1 |
| 3.  OTmon saves operational costs or paper less | 22 | 32 | 11 | 1 | 1 |
| 4.  With OTmon every task becomes easier to solve | 18 | 37 | 9 | 3 | 0 |
| **Amount** | **82** | **134** | **35** | **14** | **3** |

$$RK = \frac{(82*5)+(134*4)+(35*3)+(14*2)+(3*1)}{82+134+35+14+3}$$

$$RK = \frac{1082}{268}$$

$$RK = 4.0$$

The results of calculating the average satisfaction of users of the integrated prala monitoring information system on the Efficiency variable obtained a final result of 4.0 is included in the SATISFIED category, so it can be concluded that the integrated marine practices monitoring information system developed is efficient in completing user tasks and saves operational costs incurred by users in carrying out marine practices in the use of paper.

f. Service

The table below is the result of distributing questionnaires to respondents based on Service indicators.

Table 8. Service Indicators

| Question No | Respondent | | | | |
|---|---|---|---|---|---|
| | SS | S | N | T.S | STS |
| 1.   Use of filter features in search data on OTmon produces results appropriate. | 13 | 46 | 8 | 0 | 0 |
| 2.   The services provided by OTmon are appropriate      with what is desired | 11 | 44 | 10 | 2 | 0 |
| 3.   The information generated by OTmon can dependable or trustworthy | 16 | 43 | 7 | 1 | 0 |
| 4. OTmoncan be used easily | 17 | 40 | 6 | 3 | 1 |
| 5. Information on OTmon can be accessed Easily | 17 | 40 | 6 | 4 | 0 |
| **Amount** | **74** | **213** | **37** | **10** | **1** |

$$RK = \frac{(74*5)+(213*4)+(37*3)+(10*2)+(1*1)}{74+213+37+10+1}$$

$$RK = \frac{1354}{335}$$

$$RK = 4.0$$

The results of calculating the average satisfaction of users of the integrated prala monitoring information system on the Service variable obtained a final result of 4.0is included in the SATISFIED category, so it can be concluded that the integrated maritime practice monitoring

information system developed has features that suit user needs and the existing information is trustworthy and reliable.

**Results of Customer Satisfaction Analysis PIECES Framework Method**
The recapitulation of the results from calculating the PIECES variables are all in the SATISFIED category, which means that the integrated prala supervision information system developed by researchers plays a very good role in improving the quality of prala supervision services, thereby providing a sense of satisfaction and efficiency as well as a positive response from users of the integrated prala supervision information system .

Table 9. Recapitulation of Overall PIECES Variables

| Variable | Average Satisfaction | Category |
|---|---|---|
| Performance | 3.9 | Satisfied |
| Information | 4.1 | Satisfied |
| Economics | 4.3 | Satisfied |
| Control & Security | 4.2 | Satisfied |
| Efficiency | 4.0 | Satisfied |
| Service | 4.0 | Satisfied |

From the table aboveIt was found that the average user satisfaction score for the integrated maritime monitoring information system was 4.08, so it can be said that users of the integrated maritime monitoring application were categorized as SATISFIED with the services developed.

**DISCUSSION**

The use of the PIECES (Performance, Information, Economy, Control, Efficiency, and Service) framework in system needs analysis has proven to be a valuable approach in ensuring that educational applications meet various dimensions of performance (Richards, 2017). This framework, which stands for Performance, Information, Economy, Control, Efficiency, and Service, provides a comprehensive and cohesive platform for evaluating the effectiveness of educational technology solutions.(Antonenko et al., 2016)

One of the key benefits of the PIECES framework is its ability to improve efficiency and user satisfaction in the education sector. By considering the various dimensions of system performance, it ensures that

the application not only meets the educational objectives but also optimizes the user experience (Kustandi et al., 2021). The framework's emphasis on information, control, and service aspects is particularly crucial in the context of educational technologies, where the effective dissemination of information, the ability to monitor and analyze student performance, and the quality of the overall service experience are paramount.(Anatolyevna-Stepanova et al., 2018; Contreras, 2019)

Moreover, the PIECES framework aligns well with the principles of constructivist learning environments, as described in the literature.(Haartsen-Geven & Sandberg, 2007) By addressing the needs, abilities, and affordances of both educators and students, the framework can inform the design, implementation, and evaluation of educational technologies, ultimately leading to more effective and engaging learning experiences.(Antonenko et al., 2016). The use of the PIECES framework in system needs analysis can also be enhanced by incorporating elements from other relevant frameworks, such as the Mechanics, Dynamics, and Aesthetics (MDA) framework for the design and analysis of educational games

**CONCLUSION**

The utilization of the PIECES Framework in data calculation and analysis proves highly effective, as it assesses the system per variable, enabling a thorough evaluation. Based on the data analysis results, all variables within the PIECES Framework fall under the satisfied category, indicating that the integrated sea practice monitoring information system effectively enhances sea practice supervision services and provides satisfactory outcomes for users. Despite achieving satisfaction across all variables, some respondents expressed dissatisfaction with the system. Therefore, it is hoped that future developments will be more detailed to accommodate and evaluate system functionalities, ensuring optimal outcomes. Developers or researchers should engage in frequent communication with

users to better understand their needs and preferences, which can serve as evaluation criteria for assessing satisfaction with the integrated sea practice monitoring information system.

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