The impact of instructional media and cultural intelligence on maritime English literacy: A meta-analysis

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ABSTRACT

This study aims to analyze the influence of learning media and cultural intelligence on maritime English literacy through a quantitative meta-analysis approach. A total of 28 journal articles published between 2012 and 2025 were systematically reviewed based on the PRISMA protocol, involving a combined sample of 3,164 participants from various educational levels and maritime training institutions. Statistical synthesis was conducted using JASP software to obtain pooled effect sizes and assess heterogeneity across studies. The results revealed that both variables had a positive and significant impact on maritime English literacy. Learning media demonstrated a strong effect size of 0.782 (p < 0.001) with high heterogeneity (I^2 = 89.59%), reflecting diverse contexts of media implementation. Cultural intelligence showed a moderate effect size of 0.523 (p < 0.001) with very high heterogeneity (I^2 = 96.99%), indicating contextual variations across studies. These findings affirm that digital and interactive media, as well as cross-cultural competence, play a vital role in enhancing maritime learners' English proficiency and global communication readiness. The study contributes to both theory and practice by providing a comprehensive quantitative synthesis of the determinants of maritime English literacy. The results offer a strong empirical foundation for developing technology-based and culturally responsive teaching strategies, aligned with the Standards of Training, Certification, and Watchkeeping for Seafarers (STCW) and International Maritime Organization (IMO) standards.

INTRODUCTION

The rapid development of the current global shipping industry, supported by technological advances, also requires high-quality human resources who are professional and able to compete in the international arena. One of them is by improving international communication competence, especially mastery of maritime English, which is the main working language on board. Maritime English is part of English for Specific Purposes (ESP), which has a strategic role in ensuring work safety, effective communication, and smooth technical operations in the seafarer's work environment (Dirgeyasa, 2018; Heslop, 2023). Data from the EF English Proficiency Index 2023 indicate that Indonesians' level of proficiency in English falls into the low category. Indonesia ranks 79th out of 113 countries in terms of English language skills, with a score of 469. This figure indicates a category of low proficiency in English. In line with these data, low literacy in English, especially maritime English, is also a significant problem that affects the readiness of shipping graduates to face the international workforce.

This low mastery is not only due to limited learning time, but also to learning methods and media that are not yet fully relevant to the context of the global shipping industry.

Along with the demands to improve English competence, various efforts have been made to enhance the quality of English learning, including by presenting interactive learning media and digital technology in the classroom that will support learning and teaching activities. Digital-based learning media is considered to be able to increase student participation and create a more interesting and contextual learning experience (Agustina et al, 2025). The use of software such as Articulate Storyline and Android-based applications has been shown to support a more visual and practical understanding of the material (Ananda et al., 2023). In addition, the Content-Based Instruction (CBI) approach, which emphasizes the use of authentic materials relevant to the maritime world of work, has been used to bridge the gap between learning materials and field needs (Sulistiono et al. (2024). Nufus and Kasim (2018) emphasized the importance of using authentic video in improving speaking skills, while Limbong et al. (2022) emphasized the effectiveness of Marlins-based synchronous learning in the teaching of maritime English. Therefore, a meta-analytical study is needed to quantitatively measure the influence of learning media on maritime English literacy. However, there has not been a comprehensive systematic review that quantitatively reconstructs these findings to assess the overall impact of learning media on maritime English literacy.

In terms of other research variables, the researchers' attention has also begun to focus on the importance of Cultural Intelligence (CQ) as an important element in the development of language skills, especially in multicultural contexts such as shipping. Alifuddin and Widodo (2022) stated that Cultural Intelligence (CQ) is very important for seafarers working in multicultural and cross-border environments. CQ includes metacognitive, cognitive, motivational, and behavioral abilities in understanding culture (Alifuddin & Widodo, 2022). CQ plays a major role in shaping the cross-cultural communication skills needed on board, whose members come from different cultural backgrounds (Bal, 2022). Wang and Yu (2025) stated that learning a foreign language can improve the CQ of learners, thereby helping them adapt socially and professionally in an international work environment. In the context of shipping education, cultural intelligence not only supports verbal communication, but is also an integral part of seafarers' work readiness to face social and cultural dynamics on ships (Rahayu, 2023; Dewi et al., 2022).

Nevertheless, most previous studies have only highlighted learning media or CQ separately. Studies that combine these two variables in an integrated manner within the framework of maritime English literacy development are still very limited. This fragmented approach makes it difficult to understand the potential synergies between learning technologies and intercultural competencies in support of more comprehensive language skills. In addition, there have not been many studies that compile these findings in the form of quantitative synthesis based on meta-analysis, which should be able to provide a stronger and more objective empirical foundation.

This study offers a meta-analytic approach as a strategy to compile and re-evaluate relevant research results related to the influence of learning media and cultural intelligence on maritime English literacy. To address these theoretical and methodological gaps, this study employs a meta-analytic approach to quantitatively synthesize findings on the effects of learning media and cultural intelligence on maritime English literacy. Guided by the PRISMA protocol (Moher et al., 2009), this research offers the first comprehensive quantitative reconstruction in this field, combining technological and intercultural perspectives into a single analytical model.

In addressing these theoretical and methodological gaps, this study employs a meta-analytic approach to quantitatively synthesize previous findings related to instructional media and cultural intelligence in the context of maritime English literacy. Guided by the PRISMA protocol (Moher et al., 2009), this research focuses on systematically examining the magnitude of the effects reported across empirical studies. Accordingly, this study is directed by the

following research questions: (1) To what extent do instructional media influence maritime English literacy based on cumulative empirical evidence? (2) How significant is the effect of cultural intelligence on maritime English literacy across previous studies? (3) Do instructional media and cultural intelligence demonstrate differentiated or complementary impacts on maritime English literacy when evaluated through a meta-analytic model? These research questions provide a clear analytical direction for constructing a comprehensive quantitative synthesis that contributes to the development of more effective, evidence-based maritime English learning strategies.

RESEARCH METHOD

This research was carried out using a quantitative research approach with a meta-analysis method to synthesize the results of previous research statistically. The meta-analysis method was chosen because it allows researchers to integrate independent study results and draw general conclusions with higher statistical power (Borenstein et al., 2021; Lipsey & Wilson, 2001). The article selection followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol (Moher et al., 2009; Page et al., 2021). The inclusion criteria were: (1) studies applying a quantitative design that reported statistical relationships (e.g., correlation r or effect size d) between learning media or cultural intelligence and English literacy; (2) published between 2012–2025; (3) focused on English literacy in general or in maritime contexts; and (4) published in peer-reviewed journals with full-text access. Studies were excluded if they used a purely qualitative approach, lacked statistical data, or did not include literacy as an outcome variable.

Ensuring the credibility and methodological rigor of the included studies, each article was evaluated using the Modified Joanna Briggs Institute (JBI) Critical Appraisal Checklist for quantitative studies. The checklist assessed nine criteria, including clarity of research objectives, appropriateness of sampling, validity of measurement instruments, completeness of statistical reporting, and control of confounding variables. Each criterion was scored 0 (not met) or 1 (met), with a total possible score of 0–9. Studies with a total score of ≥7 were categorized as high quality, 5–6 as moderate quality, and <5 as low quality. Two independent reviewers conducted the quality assessment, and inter-rater reliability was verified using Cohen's Kappa ($\kappa = 0.86$), indicating high agreement.

The coding process followed the procedure proposed by Cooper (2017). For each article, data were recorded on the author's name, year, sample size (n), educational level, variables studied, effect size type (r or d), and methodological quality score. All correlation coefficients (r) were converted into Fisher's Z values for statistical normalization. The overall mean effect size was calculated using both fixed-effect and random-effect models, depending on the level of heterogeneity indicated by the Q statistic and I² index.

Potential publication bias was examined using multiple approaches. In addition to visual inspection via funnel plots, Egger's regression test was conducted to statistically assess asymmetry in the distribution of effect sizes. When bias was detected, the Trim and Fill method (Duval & Tweedie, 2000) was applied to estimate the number of potentially missing studies and adjust the pooled effect size accordingly. Sensitivity analysis was also performed by sequentially removing individual studies to determine the robustness of the overall effect. All statistical analyses were performed using JASP version 0.19.3.0. This software enabled automatic computation of heterogeneity indices (Q, I², τ^2), forest and funnel plots, Egger's regression, and Trim-and-Fill corrections. Confidence intervals (95% CI) and prediction intervals (95% PI) were reported to illustrate both the precision and potential generalizability of the estimated effects.

The integration's analysis of two main variables, namely; learning media and Cultural Intelligence, this study seeks to provide strong scientific evidence related to the determinants of

maritime English literacy. The results of this quantitative synthesis are expected to be an important reference for educators, curriculum designers, and policymakers in formulating technology-based and culturally sensitive maritime English learning strategies. The findings of this study are also expected to be in line with the international communication needs set by STCW, IMO model courses, as well as the demands of global shipping work in the modern era.

FINDINGS AND DISCUSSION

Findings

PRISMA Result and Data Conversion

The results of the meta-analysis of the 28 selected articles showed that both learning media and cultural intelligence had a positive influence on maritime English literacy. The result identified a total of 250 articles were found that were relevant to the topic. Analysis carried out with Screening, which is filtering articles based on relevance to the variables X1 (learning media) and X2 (cultural intelligence), resulting in 48 articles for X1 and 26 articles for X2, both from quantitative and qualitative studies (Figure 1). In the Eligibility stage, a strict selection was carried out to screen articles that included statistical data in the form of N values and correlation coefficients (r) that could be analysed in meta-analysis, resulting in 28 articles. Included got 15 articles related to learning media (X1) indicate that the use of interactive media, digital multimedia, and maritime-based materials consistently improves reading ability and technical English comprehension. Meanwhile, 13 articles related to cultural intelligence (X2) show that aspects such as cross-cultural adaptability, empathy, and intercultural communication contribute to improving English literacy competence, especially in the context of international seafarers. These results confirm that both variables play a significant role in supporting global instructional and communication readiness in the shipping field. The results of the search obtained publication data that met as many as 15 articles for learning media on maritime English Literacy and 13 articles for Cultural Intelligence on maritime English Literacy. The data collected in this study were the Fisher test score (F), student test (t), correlation test (r), and number of research subjects (N). Next, the value of r is converted to the value of z as the value of the new effect size (ES) and the standard error value (SE) is calculated. Thus, the calculation results are according to Table 1 and Table 2.
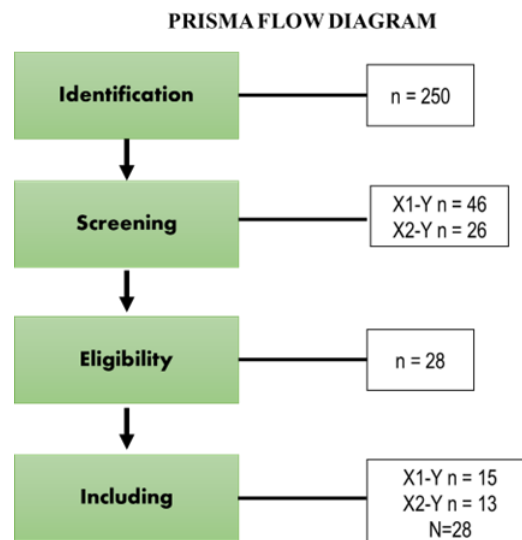

Figure 1. PRISMA Study Selection Flowchart

Table 1. Learning Media to Maritime English Literacy Data Conversion

No.	Author	r	N	Z	Std. Error
1	Sulistiono et al., 2024	0.6	24	0.693147	0.218218
2	Sadha et al., 2022	0.622	70	0.728261	0.122169
3	Safira, 2023	0.842	30	1.228006	0.19245
4	Nufus & Kasim, 2021	0.5	100	0.549306	0.101535
5	Sumarta et al., 2019	0.337	44	0.350704	0.156174
6	Marsitah & Pratolo, 2019	0.7	15	0.867301	0.288675
7	Ratnaningsih, et al., 2024	0.697	24	0.861442	0.218218
8	Heslop, 2023	0.91	130	1.527524	0.088736
9	Jeon et al., 2022	0.48	185	0.522984	0.074125
10	Shi & Fan, 2021	0.8	289	1.098612	0.059131
11	Budiatman et al., 2025	0.34	60	0.354093	0.132453
12	Sari & Sari, 2022	0.75	195	0.972955	0.072169
13	Limbong et al., 2022	0.45	24	0.4847	0.218218
14	Putri, F. A. K. et al., 2023	0.776	25	1.035236	0.213201
15	Aprian, R, 2019	0.407	70	0.43201	0.122169

Table 1 presents the data transformation for research investigating the influence of instructional media on maritime English literacy. The correlation coefficients (r) range from 0.337 to 0.910, revealing consistently positive relationships across the studies. Greater effect sizes are noted in studies that incorporate advanced technological integration, such as those by Heslop (2023) and Safira (2023), indicating that interactive or multimodal digital tools have a more significant impact on literacy outcomes. The transformed Fisher's Z values reinforce this trend, with several studies showing values exceeding 1.0, indicating moderate to large effects. The standard errors differ based on sample size, with smaller samples (e.g., N = 15, 24) exhibiting larger standard errors, which indicates increased variability. In summary, these findings provide substantial empirical evidence for the positive impact of instructional media on enhancing maritime English literacy.

Table 2. Cultural Intelligence to Maritime English Literacy Data Conversion

No.	Author	r	N	Z	Std. Error
1	Wang & Yu, 2025	0.347	145	0.362029	0.083918
2	Dewi et al., 2022	0.251	28	0.25648	0.2
3	Bal, 2022	0.78	289	1.045371	0.059131
4	Becirović, 2023	0.09	211	0.090244	0.069338
5	Canbay, 2020	0.42	113	0.447692	0.095346
6	Rachmawaty et al., 2018	0.304	120	0.313921	0.09245
7	Karadağ, 2022	0.23	86	0.234189	0.109764
8	Johnsen et al., 2012	0.48	336	0.522984	0.0548
9	Rahayu, 2023	0.5	380	0.549306	0.051503
10	Jiony et al., 2021	0.84	150	1.221174	0.082479
11	Feng et al., 2025	0.213	249	0.216312	0.063758
12	Lin et al., 2012	0.12	295	0.120581	0.058521
13	Rafieyan & Golerazeghi, 2015	0.88	120	1.375768	0.09245

Data translation for research evaluating cultural intelligence (CQ) and its connection to maritime English literacy is shown in Table 2. Compared to educational media, the effect sizes are more variable, ranging from extremely minor (r = 0.09) to very significant (r = 0.88). Large sample size studies typically indicate moderate benefits (e.g., Rahayu, 2023; Johnsen et al., 2012), indicating consistent contributions of CQ to language literacy. High impact sizes found in Rafieyan and Golerazeghi (2015) and Bal (2022) suggest that CQ greatly improves learners' linguistic competency and adaptation in multicultural settings. Smaller effects, on the other hand, might be a sign of cultural exposure or contextual variations. The diversity emphasizes

how crucial it is to combine findings through meta-analysis in order to provide a more accurate assessment of the impact of CQ.

Meta-Analysis Result of Learning Media

The results of the meta-analysis of 15 articles that discussed the influence of learning media (X1) on maritime English literacy (Y) were obtained with a measure of the combined effect and a significant degree of heterogeneity.

Table 3. Residual Heterogeneity Test Variable X1 to Y

Residual Heterogeneity Test		
Q_e	df	p
151.891	14	< .001

Based on Table 3, the residual heterogeneity test reveals a Q-value of 151.891 with p <.001, showing significant heterogeneity among the included studies. This implies that there is a wide range in the effect sizes of instructional media on maritime English literacy, which may be impacted by moderating factors such media type, technical sophistication, instructional design, or student characteristics. Thus, it seems sense to use a random-effects model for the ensuing pooled effect analysis. The results of the residual heterogeneity test (Q_e) showed a value of Q = 151.891 with a degree of freedom df = 14, and a p value < 0.001, which means that there was significant heterogeneity among the studies analysed. This suggests that although all studies showed the same (positive) direction of effect, there was a marked variation in the magnitude of the effects between studies. This variation can be caused by differences in the context of media implementation, student characteristics, and research design in each study.

Table 4. Pooled Effect Size Test Variable X1 to Y

Pooled Effect Size Test			
Estimate	Standard Error	z	p
0.782	0.095	8.224	< .001

The results of the meta-analysis based on Table 4 Pooled Effect Size of the influence of learning media (X1) on maritime English literacy (Y) based on data from 15 articles showed significant and consistent findings. The pooled effect size test yielded an estimate of r = 0.782 with a standard error of 0.095, and a z-value = 8.224. This value is statistically significant with a p < 0.001, which indicates that overall, learning media has a strong positive influence on maritime English literacy.
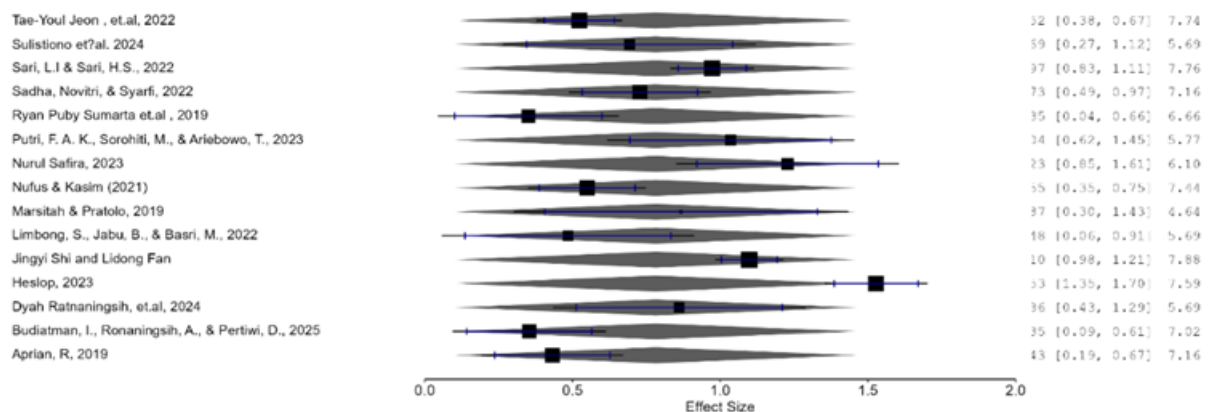

Figure 2. Forest Plot X1 to Y

The forest plot summarizing the effect sizes from the 15 previous research examining the impact of instructional media on maritime English literacy is shown in Figure 2. The majority of studies demonstrate moderate to large beneficial effects and cluster above zero. There is consistent evidence that instructional media improves literacy results since the confidence intervals of several research do not cross the null line. The robustness of the aggregated effect obtained from the random-effects model is supported by this visualization.
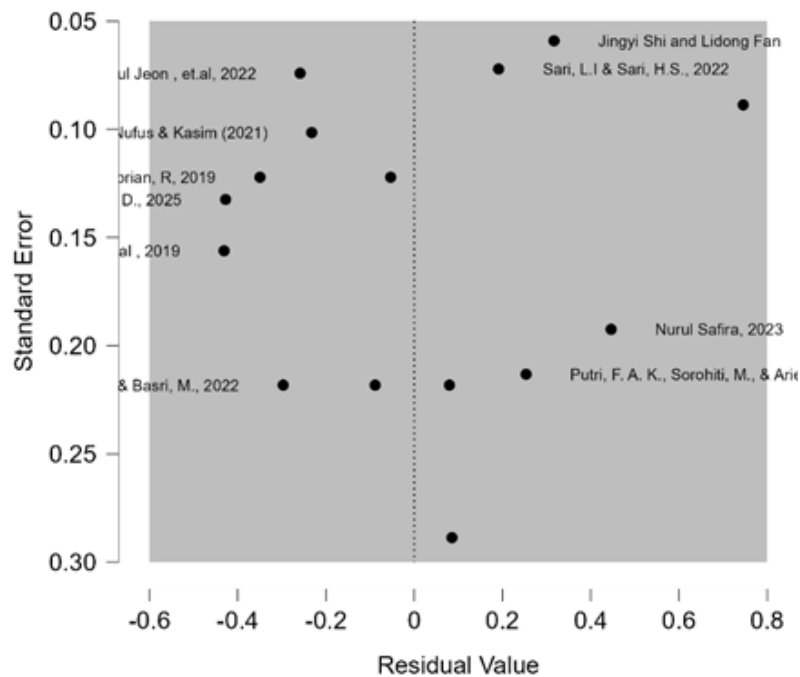

Figure 3. Residual Funnel Plot X1 to Y

The residual funnel plot, which evaluates publication bias and effect distribution symmetry, is shown in Figure 3. The general trend is still well balanced despite the small asymmetry, indicating no significant publication bias. The observed spread, which shows variation among studies without systematic bias that would jeopardize the validity of the pooled effect, mirrors the heterogeneity already found in the statistical tests.

The first hypothesis, "Instructional media has a considerable favourable influence on maritime English literacy," is statistically and factually supported by Figure 2 and Figure 3. According to Cohen (1988) conventions, the pooled effect size of 0.782 indicates that instructional media, including digital, interactive, and contextual tools, significantly improves students' comprehension, reading skills, and technical linguistic competency in maritime contexts.

Based on these results, Figure 2 and Figure 3, it can be concluded that the first hypothesis in this study, namely "learning media has a significant positive influence on maritime English literacy", is proven and statistically accepted. An effectiveness value of 0.782 falls into the category of large effects according to Cohen's interpretation (Putri, M. S. et al., 2021), providing strong support that the use of learning media whether digital, interactive, or contextual is visibly able to improve students' comprehension, reading skills, and technical linguistic abilities in the context of shipping. These findings not only strengthen the theoretical argument about the importance of the role of technology and media in English learning for specific purposes (ESP), but also provide an empirical basis for the development of maritime education policies that are responsive to global communication demands.

Table 5. Meta-Analytic Estimates of X1 to Y

		95% CI		95% PI	
Meta-Analytic Estimates					
	Estimate	**Lower**	**Upper**	**Lower**	**Upper**
Effect Size	0.782	0.595	0.968	0.102	1.461
τ	0.333	0.220	0.530		
τ^2	0.111	0.048	0.281		
I^2	89.586	78.914	95.601		
H^2	9.602	4.742	22.730		

The results of meta-analytical based on Table 5, the estimation showed that learning media had a large and significant influence on maritime English literacy, with an effect value of 0.782 (95% CI: 0.595–0.968; $p < 0.001$). Despite the high heterogeneity between studies (I^2 = 89.586%; τ = 0.333), all results still showed a positive direction of effect. The prediction range (95% PI: 0.102–1.461) indicates that these effects tend to remain positive even when applied in different contexts. The H^2 value of 9,602 and Q = 151,891 ($p < 0.001$) confirm the existence of real variability that needs to be considered, but in general these results reinforce that the use of learning media, especially contextual and digital ones, consistently improves the technical English literacy skills of seafarers.

Meta-Analysis Result of Cultural Intelligence

The results of the meta-analysis of 13 articles that discussed the influence of cultural intelligence (X2) on maritime English literacy (Y) were confirmed that CQ is an important factor in English language learning in a multicultural and global shipping environment.

Table 6. Residual Heterogeneity test Variable X2 to Y

Residual Heterogeneity Test		
Q_e	**df**	**p**
362.513	12	< .001

The residual heterogeneity test (Q_e) based on Table 6 yielded a value of Q = 362.513 with df = 12 and $p < 0.001$, indicating a very high heterogeneity between studies. The residual heterogeneity test demonstrates very high heterogeneity (Q = 362.513, $p < .001$), indicating that the magnitude of CQ's influence varies widely across studies. This variability suggests the presence of contextual or demographic moderators that shape the relationship between CQ and literacy.

Table 7. Pooled Effect Size Test Variable X2 to Y

Pooled Effect Size Test			
Estimate	**Standard Error**	**z**	**p**
0.523	0.118	4.419	< .001

According to Table 7, the results of the meta-analysis method of 13 studies showed that Cultural Intelligence (CQ) had a significant influence on maritime English literacy, with an effectiveness value of 0.523 (SE = 0.118; z = 4.419; $p < 0.001$). This effect is moderate, but still statistically and practically significant. This means that although all studies show a positive effect direction, there is significant variation in the magnitude of the influence of CQ on maritime English literacy ability, likely influenced by differences in cultural backgrounds, educational contexts, and cross-cultural competency levels of learners. Overall, these results confirm that CQ is an important factor in English language learning in a multicultural and global shipping environment.
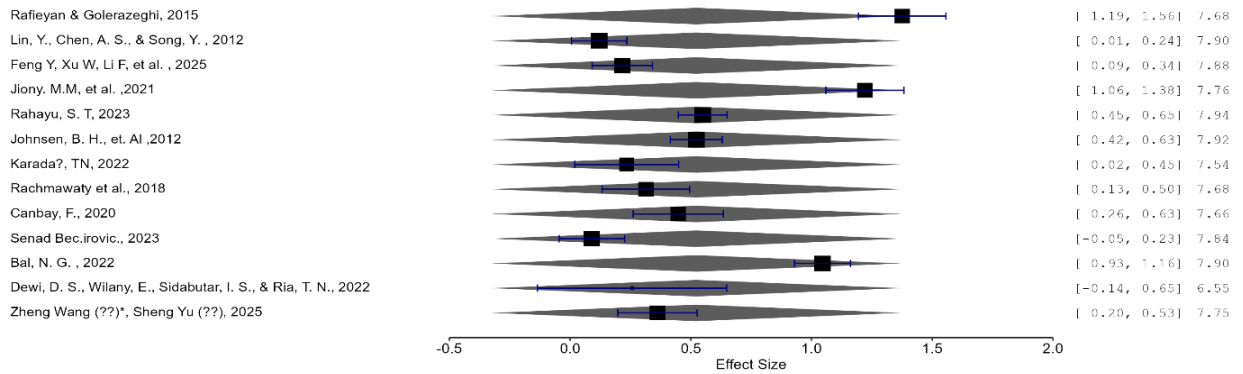
Figure 4. Forest Plot X2 to Y

Although the magnitude varies significantly, Figure 4 demonstrates that the majority of research find positive effect sizes. The pattern of significant heterogeneity is reinforced by the fact that some research shows very tiny impacts while others show strong positive effects. However, the influence is still primarily in a good direction.
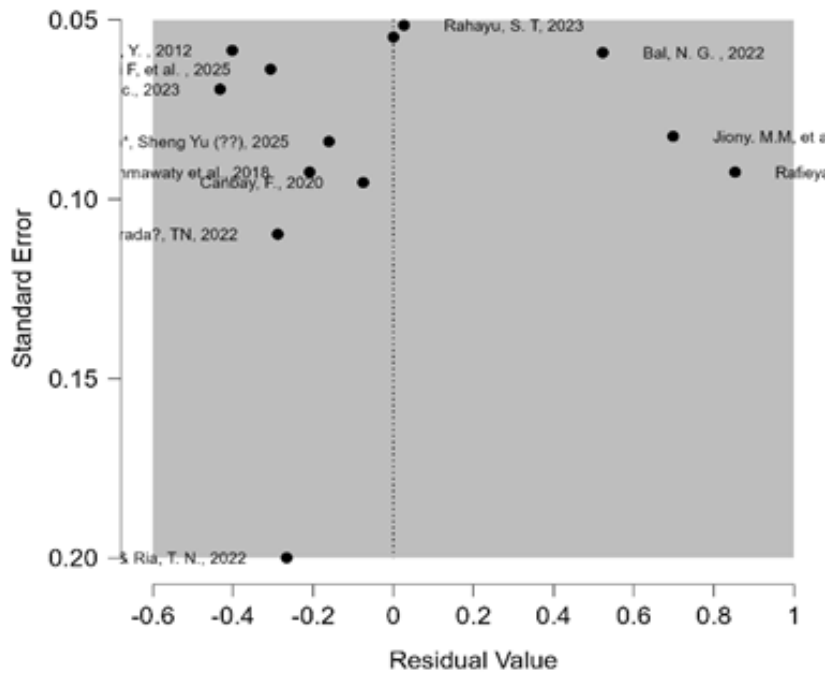

Figure 5. Residual Funnel Plot X2 to Y

The residual funnel plot in Figure 5 shows a moderate degree of asymmetry, which raises the possibility of methodological variations or publishing bias. The broad conclusion that Cultural Intelligence improves maritime English literacy is nevertheless supported by the positive clustering pattern.

The second hypothesis, "Cultural Intelligence has a considerable favorable influence on maritime English literacy," is validated and approved based on Figure 4 and Figure 5. Higher cultural intelligence typically results in better English literacy in marine settings, notwithstanding the significant variation.

According to Table 8, CQ makes a substantial contribution to maritime English literacy (ES = 0.523, CI 95% = 0.291–0.754). The broad prediction interval (PI = -0.326 to 1.371),

however, indicates that impacts may differ significantly based on learners' prior cross-cultural exposure, institutional preparedness, and cultural environment.

Table 8. Meta-Analytic Estimates of X2 to Y

		95% CI		95% PI	
Meta-Analytic Estimates	Estimate	Lower	Upper	Lower	Upper
Effect Size	0.523	0.291	0.754	-0.326	1.371
τ	0.416	0.292	0.695		
τ^2	0.173	0.085	0.483		
I^2	96.999	94.074	98.901		
H^2	33.327	16.875	91.024		

It is confirmed by the heterogeneity values (I^2 = 96.999%, τ^2 = 0.173) that actual differences rather than sampling error dominate variability. Therefore, while CQ typically improves literacy, its efficacy is highly dependent on instructional, cultural, and contextual factors.

The results of Table 8 about meta-analytical estimation table showed that the influence of Cultural Intelligence (CQ) on maritime English literacy had an effectiveness value of 0.523, with a confidence interval (CI 95%) between 0.291 and 0.754, which signifies a stable and significant positive effect. Nevertheless, the prediction interval (PI 95%) ranges from -0.326 to 1.371, suggesting the possibility of considerable contextual variability in the influence of CQ, even allowing negative effects under certain conditions. The heterogeneity between studies was also very high, reflected in the I^2 value of 96.999%, which means that almost all of the variation in effects came from real differences between studies, rather than from random errors. The values τ^2 = 0.173 and τ = 0.416 confirm the high true effect variance, while H^2 = 33.327 has shown that the variability of the outcome far exceeds the homogeneous assumption. These findings indicate that although CQ generally contributes positively to English literacy in the context of shipping, its effect is strongly influenced by factors such as participants' cultural backgrounds, instructional design, and institutional readiness to integrate cross-cultural learning across the board.

Discussion

The meta-analysis of 28 eligible studies revealed that both learning media and cultural intelligence significantly influence maritime English literacy. Learning media demonstrated a large overall effect size (r = 0.782; p < 0.001), while cultural intelligence produced a moderate yet significant influence (r = 0.523; p < 0.001). These findings suggest that improving maritime English proficiency requires not only technological innovation in instruction but also the strengthening of intercultural competence among learners.

From a theoretical perspective, the findings confirm that digital and context-based instructional media enhance comprehension, vocabulary acquisition, and communicative fluency in English for Specific Purposes (ESP), particularly within maritime settings. Similarly, high levels of cultural intelligence enable cadets to interpret messages more accurately, collaborate effectively in multicultural teams, and respond appropriately to cross-cultural communication challenges on board. Together, these two factors shape a comprehensive model of maritime English learning that is both cognitively engaging and culturally adaptive.

The practical implications of these results are particularly relevant for maritime academies and training institutions seeking to align their curricula with global standards such as STCW and IMO Model Courses. First, technology-enhanced learning (TEL) should be integrated systematically into maritime English instruction. This can include the use of simulation-based training, interactive e-learning modules, and contextual video scenarios that replicate shipboard

communication and emergency situations. For example, software such as *Articulate Storyline*, *Marlins e-learning*, and *virtual bridge simulators* can provide cadets with authentic linguistic exposure that mirrors real-life maritime operations. Second, task-based and content-based instruction (CBI) should be employed to bridge the gap between classroom learning and shipboard communication demands. Teachers can design modules where students practice English while completing tasks such as radio communication, safety reporting, or cargo handling discussions all grounded in actual maritime procedures. Third, the development of Cultural Intelligence (CQ) must be integrated explicitly into the curriculum. Maritime schools can incorporate cross-cultural workshops, role-playing exercises, and international exchange programs to foster empathy, adaptability, and awareness of diverse communication styles. This can be further strengthened by embedding SMCP (Standard Marine Communication Phrases) practice with intercultural reflection sessions, helping cadets understand not only what to say, but how cultural context affects meaning and tone. Finally, teacher training should emphasize the dual role of instructors as language facilitators and intercultural mentors. By combining digital literacy with cross-cultural pedagogy, instructors can design learning environments that simulate global maritime realities, bridging technological fluency and human understanding.

While both variables contribute meaningfully to maritime English literacy, their interaction opens an avenue for future exploration. The results imply that digital media and cultural intelligence may have synergistic effects, where technology facilitates exposure to diverse cultural content, and CQ enables learners to interpret that content effectively. Future studies can investigate this interaction through moderated or multilevel meta-analysis to better understand contextual variations such as nationality, learning environment, and instructional design. In summary, the findings highlight the urgent need for maritime institutions to adopt technology-based and culturally responsive learning frameworks. This integration will not only improve students' linguistic competence but also prepare them for the interpersonal and intercultural challenges of a global maritime workforce.

CONCLUSION

This study concludes that both learning media and cultural intelligence have a positive and significant influence on maritime English literacy. The results of the meta-analysis of 28 articles show that learning media make a major contribution to improving technical understanding of the English language, especially through the use of digital, interactive, and contextual media based on the maritime world. Meanwhile, cultural intelligence plays an important role in supporting the cross-cultural communication competencies that are essential for seafarers in the international work environment.

These findings show that improving maritime English literacy depends not only on innovative teaching methods, but also on students' readiness to understand and adapt to cultural diversity. Thus, the results of this study contribute to the development of the theory of learning English for Special Purposes (ESP) and support maritime education policies that are globally oriented and responsive to the demands of international communication in the shipping industry. These findings affirm that maritime English competence requires a balance between technological engagement and intercultural understanding to meet global communication demands in the maritime industry.

In practical terms, maritime academies and policymakers should move beyond general adoption of digital tools toward structured curriculum integration of maritime-based media and cultural intelligence training. Curriculum design should embed simulation-based modules, authentic communication scenarios, and SMCP-oriented tasks that reflect real maritime operations. Equally important, lecturer training programs must strengthen educators' skills in digital pedagogy and intercultural facilitation, enabling them to design contextualized learning

experiences. The development of locally relevant maritime media through collaboration between language experts, technologists, and maritime practitioners will further ensure that learning remains authentic, adaptive, and aligned with STCW and IMO standards.

Conflict of Interests

The authors declare that they have no conflict of interest to disclose.

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