

Instructor Capacity and Professional Development Management in Maritime Vocational Education

(A Study of Human Resource Development for Future Sea Transportation Management)

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Abstract. Maritime vocational high schools are expected to produce graduates whose technical competency matches an increasingly modernized sea transportation industry, yet whether the instructors responsible for delivering that competency are themselves managed as a developing human resource, kept technically current, professionally supported, and strategically incentivized, has received markedly less attention than curriculum content or student outcomes. This study examines how a maritime vocational high school in Jakarta manages instructor technical currency, professional development investment, workload structure, and career-progression incentives, treating instructor capacity as a distinct institutional human resource management function rather than an assumed background condition underlying curriculum and governance reform. A qualitative design was employed, combining semi-structured interviews with 6 school administrators, 10 vocational and technical teachers, and 4 human resource or personnel management staff, supplemented by document review of professional development records and staffing policy spanning three academic years. Thematic analysis, cross-source comparison, and narrative synthesis identified four dominant findings: technical currency maintained predominantly through personal rather than institutional effort, professional development investment structured reactively around accreditation rather than industry or technological change, workload structures that crowd out capacity for technical updating, and an absent formal career-progression pathway linking sustained technical currency to advancement. The findings extend human capital theory and the Job Demands-Resources model into maritime vocational education human resource management and support a restructured, incentive-linked instructor development system as a precondition for sustainable future sea transportation workforce preparation.

Keywords: Career Progression; Human Capital; Instructor Capacity; Maritime Education; Professional Development.

1. INTRODUCTION

A vocational instructor teaching engine-room procedure or navigational technology can only teach what they themselves still know, and what an instructor still knows is a direct function of how recently, and how systematically, their own technical knowledge has been refreshed against a sea transportation industry that does not wait for curriculum committees to catch up. This is an uncomfortable but analytically necessary starting point, because vocational education research, including companion research within this broader research programme, has repeatedly identified curriculum content, institutional governance process, and student experience as the objects of study while treating the instructor supplying that curriculum as a largely fixed, background capacity rather than as a human resource whose development, or lack of it, is itself a management decision with direct downstream consequence for everything built on top of it (Fullan, 2007; Hargreaves, 2000). If a school's curriculum governance is loosely coupled to industry change, as recent governance research within this programme has found, and if instructors themselves have no more systematic mechanism for staying current

than the industry-liaison process governing curriculum documents, then instructor capacity is plausibly not a background condition but the load-bearing constraint the rest of the system depends upon without adequately managing.

Human capital theory supplies the foundational framework for treating this concern with appropriate rigor. Becker's (1993) account of human capital established that an individual's productive capacity is not fixed at the point of initial training but requires ongoing investment, general and firm- or field-specific, to remain economically and functionally current, with organizations bearing direct responsibility for the specific investment component since general investment alone does not guarantee the specialized currency a given operational context requires. Applied to maritime vocational instruction, this theory predicts that an instructor's initial qualification, however rigorous, depreciates over time relative to an evolving sea transportation industry unless the school makes deliberate, ongoing investment in that instructor's technical currency specifically, a prediction with direct bearing on whether Indonesian maritime vocational schools manage this depreciation deliberately or allow it to accumulate by institutional default. Schultz's (1961) complementary formulation of human capital theory further emphasizes that such investment yields returns not only to the individual instructor but to the broader institutional and economic system depending on that instructor's output, framing instructor development explicitly as a sea transportation workforce management concern extending well beyond internal personnel administration.

The occupational demand-resource literature offers a second, complementary theoretical lens directly relevant to understanding why instructor technical currency might lag even where individual instructors are personally motivated to maintain it. The Job Demands-Resources model, established by Demerouti, Bakker, Nachreiner, and Schaufeli (2001) and elaborated by Bakker and Demerouti (2007), holds that occupational strain, and by extension an occupation's capacity to sustain developmental investment beyond core task delivery, results from the balance between job demands, teaching load, administrative duties, student supervision responsibilities, and job resources, time, institutional support, professional development access, made available to meet them. Applied to maritime vocational instructors specifically, this framework predicts that even instructors personally motivated to maintain technical currency will be constrained from doing so if teaching load and administrative demand consume the time such currency-maintenance activity would require, reframing technical-currency lag not necessarily as individual instructor failure to prioritize development, but as a structural demand-resource imbalance the school's workload management practice itself produces or fails to prevent.

The broader teacher professional development literature reinforces why this concern deserves systematic rather than incidental institutional attention. Desimone's (2009) influential framework for evaluating professional development impact identified sustained duration, active learning, coherence with existing practice, and collective participation as core features distinguishing effective from ineffective development investment, a framework directly relevant to assessing whether a school's professional development practice, however frequent in raw count, actually possesses the structural features associated with genuine competency change. Darling-Hammond, Hyler, and Gardner's (2017) comprehensive review of effective teacher professional development similarly found that one-off, compliance-driven training sessions, precisely the pattern this study's introduction anticipates finding in a reactive, accreditation-triggered system, produce substantially weaker practice change than sustained, job-embedded development tied to specific, ongoing instructional demands. Guskey's (2002) research on professional development and teacher change further complicates a simplistic input-output assumption, finding that meaningful teacher change often follows, rather than precedes, observed improvement in student outcomes, a sequencing consideration relevant to how this study's findings should be interpreted regarding causality between development investment and instructional quality. Ingersoll and Strong's (2011) critical review of induction and mentoring programs for beginning teachers found that structured, sustained mentoring support measurably improved retention and instructional quality relative to unstructured entry, a parallel directly relevant to this study's concern with whether maritime vocational instructors receive comparably structured, ongoing support for maintaining technical currency specifically, as distinct from general pedagogical competency.

Sea transportation management research provides the substantive backdrop establishing why this concern carries genuine urgency beyond a generic human-resource-management observation applicable to any teaching context. Research on maritime automation and human factors has documented that the maritime industry's technological trajectory is advancing through increasing automation and digital navigation infrastructure at a pace that outstrips the regulatory and organizational structures meant to govern it (Bainbridge, 1983; Endsley, 1995), with maritime-specific empirical research confirming that operators, and by direct extension the instructors preparing future operators, require deliberately maintained, actively practiced familiarity with evolving technology rather than one-time formal training sufficient to establish lasting competency (Man et al., 2015; Wróbel et al., 2017; Relling et al., 2019). Research on Indonesian domestic shipping competency gaps has separately documented that traditional shipping crew rely substantially on informally acquired, experience-based knowledge precisely

because formal training standards have gone largely unrevised for decades relative to advancing vessel technology (Sulistiana et al., 2025), a workforce-level finding whose upstream origin plausibly traces back to exactly the instructor-capacity question this study investigates directly, since a curriculum cannot exceed what its instructors are themselves equipped to teach.

The Indonesian maritime education literature within this broader research programme reinforces this concern from the institutional side. Recent governance research examining curriculum-industry alignment found administrative capacity constraint, rather than curricular design deficiency, as the primary factor limiting governance quality across every domain examined, and found boundary-object coordination artefacts functioning considerably better at the operational periphery of school-industry interaction than at the curriculum-design core. That research, however, examined governance process and document flow specifically; it did not examine whether the instructors ultimately responsible for delivering whatever curriculum that governance process produces possess the technical currency to deliver it credibly, a distinct capacity question the governance research's scope did not reach. Companion research examining vocational identity formation during industry apprenticeship found classroom-workplace gaps concentrated specifically in interpersonal and hierarchical domains rather than technical procedure execution, a finding that, read alongside this study's concern, raises the further possibility that instructors may be maintaining reasonable currency in stable, well-documented technical procedure while lagging further behind in the less codified, faster-evolving domains where technical change is occurring most rapidly.

Despite the clear theoretical grounding human capital theory, the Job Demands-Resources model, and the teacher professional development literature provide, and despite the substantive urgency sea transportation's technological trajectory establishes, no study has examined how an Indonesian maritime vocational high school actually manages instructor human resource development as an institutional function distinct from curriculum governance or student-outcome research. This is a consequential gap because instructor capacity, unlike curriculum content, cannot be revised through a committee decision alone; it requires sustained investment in the individuals who constitute the school's actual teaching capability, and if that investment is managed poorly, however well curriculum documents themselves are written, the gap between documented curriculum and delivered instruction will persist regardless of governance reform targeting documentation and process alone.

This study addresses this gap by examining how a maritime vocational high school in Jakarta manages instructor technical currency, professional development investment, and the workload and career-progression structures shaping instructor capacity for industry-aligned, future-oriented sea transportation instruction. Four questions follow directly. First, through what mechanisms, institutional or personal, do instructors maintain technical currency relative to evolving sea transportation practice and technology? Second, how is professional development investment structured and triggered, and does this structure track industry and technological change or external accreditation requirement? Third, how do instructor workload and demand structures shape the time and capacity available for technical-currency maintenance, examined through the Job Demands-Resources framework? Fourth, does a formal career-progression pathway exist that rewards and incentivizes sustained technical currency, or does career advancement operate independently of this dimension of instructor capacity? The rationale for this study is threefold. Theoretically, it extends human capital theory, the Job Demands-Resources model, and the teacher professional development literature, developed substantially outside vocational-instructor and outside Indonesian contexts, into Indonesian maritime vocational education specifically (Becker, 1993; Demerouti et al., 2001; Desimone, 2009). Empirically, it addresses the instructor-capacity question this programme's curriculum governance and vocational identity research each identified as consequential but did not examine directly. Practically, it offers maritime vocational schools and Indonesian sea transportation workforce policy makers an evidence base for treating instructor human resource development as a distinct, deliberately managed function, with direct relevance to the long-term sustainability of Indonesia's future sea transportation workforce pipeline. The remainder of this paper reviews the relevant theoretical and empirical literature, sets out the study's method, presents and discusses the findings, and concludes with their implications for maritime vocational human resource development policy.

2. LITERATURE REVIEW

Instructor human capital, as used in this study, denotes the technical knowledge, updated professional experience, and instructional capability a vocational teacher brings to and sustains within their teaching role, distinguished specifically from initial formal qualification, representing a fixed stock acquired prior to or at hiring, and ongoing technical currency, representing a flow requiring continuous investment to prevent depreciation relative to an evolving field (Becker, 1993). This distinction is conceptually central to this study because it reframes instructor capacity as a variable subject to institutional management decision, investment, workload allocation, career incentive structure, rather than a fixed attribute established once at hiring and assumed to persist unchanged thereafter.

Three theoretical perspectives structure this study's analytical framework. Becker's (1993) human capital theory distinguishes general human capital, transferable skill applicable across employers and contexts, from specific human capital, knowledge valuable primarily within a particular field or technological context. Applied to maritime vocational instruction, general pedagogical capability constitutes general human capital, while current, field-specific technical knowledge, familiarity with contemporary vessel automation, current safety management practice, evolving regulatory standards, constitutes specific human capital requiring targeted, ongoing investment the general education system does not automatically supply. Becker's framework further predicts that organizations bear primary responsibility for specific human capital investment precisely because individual instructors have weaker independent incentive to invest in knowledge whose value is concentrated within a particular institutional and industry context rather than portable across employment settings generally, a prediction directly relevant to this study's second research question. Schultz's (1961) complementary account reinforces that such investment generates returns extending beyond the individual instructor to the broader system, positioning instructor development explicitly as a sea transportation human resource management concern rather than merely an internal school personnel matter.

The Job Demands-Resources model, following Demerouti, Bakker, Nachreiner, and Schaufeli (2001) and Bakker and Demerouti (2007), supplies this study's second theoretical anchor, directly relevant to its third research question. The model holds that occupational demands and occupational resources jointly determine an occupation's capacity for activity beyond core task delivery, with resource scarcity relative to demand producing strain that crowds out discretionary, developmental activity even among motivated individuals. Applied to maritime vocational instructors, this framework predicts that technical-currency maintenance, itself a discretionary, developmental activity from the instructor's immediate task perspective, will be systematically crowded out under high teaching load and administrative demand unless the school deliberately allocates resources, protected time, funded external training access, specifically to protect this activity from displacement.

The teacher professional development literature supplies a third, complementary perspective directly relevant to this study's first and second research questions. Desimone's (2009) framework identifies sustained duration, active learning, content focus, coherence, and collective participation as the core structural features distinguishing effective professional development from ineffective, one-off compliance activity, a framework this study applies to assess not merely whether development activity occurs but whether it possesses the features

associated with genuine competency change. Darling-Hammond, Hyler, and Gardner (2017) extended this framework through comprehensive review, finding that job-embedded, sustained development tied to specific instructional demands produces substantially stronger practice change than the isolated, compliance-triggered training sessions common in under-resourced institutional settings. Guskey (2002) complicated the assumed causal sequence between development investment and teacher change, finding that meaningful belief and practice change frequently follows, rather than precedes, observed improvement in outcomes, a consideration this study's discussion returns to when interpreting the direction of influence between development investment and instructional confidence. Ingersoll and Strong's (2011) research on induction and mentoring for beginning teachers found structured, sustained mentoring support measurably improving both retention and instructional quality, a parallel relevant to this study's concern with structured versus unstructured support for technical-currency maintenance specifically. The OECD's (2019) Teaching and Learning International Survey found, across a broad international sample, that teacher-reported access to professional development remained substantially uneven across institutional contexts and was frequently structured around externally mandated requirements rather than teacher-identified or field-identified need, a pattern this study's Indonesian maritime-specific findings are positioned to test directly.

Career development and organizational incentive theory supplies a fourth perspective directly relevant to this study's fourth research question. Lawler's (1990) research on strategic pay and organizational incentive alignment established that professional behaviors an organization wishes to sustain are more reliably maintained when formally linked to career progression and reward structures than when treated as an unincentivized expectation, since individuals rationally allocate discretionary effort toward activities formal advancement criteria actually recognize. This perspective generates a specific, testable expectation: if a school's formal career-progression criteria do not explicitly recognize sustained technical currency, then technical-currency maintenance, where it occurs, is more likely occurring through individual instructor initiative and personal professional identity commitment than through institutionally incentivized behavior, with direct implications for how sustainable and how evenly distributed across the instructor population any observed maintenance activity actually is.

The empirical maritime literature substantiates the industry-side urgency motivating this study's inquiry. Human factors research on maritime automation, following Bainbridge's (1983) ironies-of-automation thesis and Endsley's (1995) situation awareness theory, establishes that automated systems degrade operator readiness specifically at moments intervention becomes necessary, a dynamic maritime-specific research has confirmed empirically in remote-monitoring and unmanned-vessel contexts (Man et al., 2015; Wróbel et al., 2017; Relling et al., 2019), with direct implication for instructors preparing operators for these same systems. Research validating the International Safety Management Code's continual effectiveness found formal compliance architecture's safety benefit plateauing despite continued regulatory expansion (Mok et al., 2023), and research on ISM Code implementation strategy located the missing variable in company-level implementation structure rather than regulatory content itself (Demirci & Cicek, 2022), both cautioning against assuming procedural governance alone addresses genuinely new competency-currency challenges. A scientometric review of the safety management systems literature documented a broader disciplinary shift toward organizational and cultural determinants of safety performance (Goerlandt et al., 2022), and systems-thinking research on maritime accident analysis models reinforced that safety-relevant outcomes resist explanation through single-cause factors (Banda et al., 2022), both supporting this study's treatment of instructor capacity as an organizational-systems concern rather than an individual-instructor deficiency. Research on Indonesian domestic shipping competency gaps found formal training standards lagging behind operational technology across significant sector segments (Sulistiana et al., 2025), research on port state control enforcement found compliance outcomes diverging sharply by vessel age and flag category (Mantoju, 2021), and research on regulatory compliance strategy in maritime transport found narrowly compliance-focused organizational responses producing outcomes working against a regulation's protective intent (Park et al., 2024), together establishing the sector-level competency and governance context against which this study's instructor-level findings should be interpreted. Research on maritime talent and leadership found leadership quality, rather than compensation structure, predicting sustainable maritime performance (Pantouvakis & Vlachos, 2020), and research developing a maritime social sustainability construct emphasized human and organizational factors as underexamined determinants of sector performance (Karakasnaki et al., 2023), both reinforcing this study's human-resource-centered framing. Comparative organizational research on shipping company structure found firms blending informal and formal management systems adapting most effectively to operational change (Lazakis & Van Der Meer, 2023), and corporate governance research on shipping firms found formal

governance structures and lived organizational behaviour frequently diverging (Sheikh & Alom, 2021), both offering organizational parallels relevant to interpreting any gap this study finds between formal instructor-development policy and lived instructor experience.

Synthesizing these perspectives, a clear analytical position and a clear gap emerge. Human capital theory establishes that instructor technical currency requires deliberate, ongoing institutional investment rather than persisting automatically from initial qualification (Becker, 1993; Schultz, 1961). The Job Demands-Resources model predicts that workload and resource allocation structures determine whether such investment activity is protected or crowded out (Demerouti et al., 2001; Bakker & Demerouti, 2007). The teacher professional development literature supplies specific structural criteria for evaluating whether development activity, where it occurs, actually possesses features associated with genuine competency change rather than compliance-only participation (Desimone, 2009; Darling-Hammond et al., 2017; Guskey, 2002; Ingersoll & Strong, 2011). Career incentive theory predicts that technical-currency maintenance will be more reliably sustained where formally linked to advancement structures than where left to individual initiative alone (Lawler, 1990). And the maritime-specific and sea transportation management literature establishes both the industry-side urgency of this concern, given automation's rapid trajectory, and its plausible connection to documented sector-level competency gaps (Bainbridge, 1983; Sulistiana et al., 2025). No existing study has examined how an Indonesian maritime vocational school manages instructor technical currency, professional development investment, workload structure, and career incentive alignment as an integrated human resource development function. This is the gap the present study occupies, and its conceptual position treats instructor capacity for future-oriented sea transportation instruction as a function jointly determined by institutional investment in specific human capital, the demand-resource balance instructors actually experience, the structural quality of development activity where it occurs, and the presence or absence of formal incentive alignment.

3. METHOD

This study used a qualitative research design, selected because the research questions concerned how instructor capacity is institutionally produced, sustained, or constrained through management practices requiring rich, interpretive access to administrative reasoning, personnel policy, and individual instructor experience, rather than predetermined quantitative measurement alone, an approach consistent with human resource development research methodology in comparable institutional contexts (Becker, 1993; Bakker & Demerouti, 2007;

Merriam & Tisdell, 2016). The study was conducted at a maritime vocational high school in Jakarta, identified generically rather than by name in keeping with standard ethical practice for research involving institutional staff who might otherwise be individually identifiable from candid disclosure regarding personnel management practice.

The population comprised three groups. Six school administrators, including the vocational program director and department heads with formal authority over staffing and professional development allocation, supplied the primary perspective on institutional investment decisions and career-progression structure. Ten vocational and technical teachers, spanning instructors responsible for navigation, engine, and technical-operations instruction, supplied the central perspective on lived experience of technical-currency maintenance, workload demand, and professional development access, selected specifically because their direct instructional responsibility for technical content makes them the population whose capacity this study's research questions concern most directly. Four human resource or personnel management staff supplied a policy-facing perspective on formal recruitment, development, and advancement criteria as documented and administered, distinct from how these policies were actually experienced by teaching staff. This three-group design, following established purposive sampling logic for organizational research (Patton, 2002), was selected because instructor human resource development is unlikely to be adequately captured through teaching staff self-report alone without corroborating administrative and personnel-policy perspective.

The primary instrument was a semi-structured interview protocol organized around four indicator domains drawn directly from this study's theoretical framework: technical currency maintenance, indicated by participants' account of specific mechanisms, institutional or personal, through which instructors update technical knowledge; professional development structure, indicated by participants' account of what triggers development investment and whether that investment exhibits the structural features Desimone (2009) associates with genuine effectiveness; demand-resource balance, indicated by participants' account of workload, administrative burden, and time availability for developmental activity; and career incentive alignment, indicated by participants' account of whether and how formal advancement criteria recognize sustained technical currency. This instrument was supplemented by document review of professional development records and staffing policy spanning three academic years, allowing interview accounts to be checked against documented institutional practice.

Data collection proceeded through individual semi-structured interviews with administrators and personnel staff, given the position-specific nature of policy-relevant disclosure, and small group discussions with teaching staff, allowing comparative discussion of shared workload and development experience across different technical specializations. Data analysis followed thematic analysis, coding data into categories aligned with this study's four indicator domains following established inductive coding procedures (Braun & Clarke, 2006); cross-source comparison, checking administrator, personnel-staff, and teacher accounts against each other and against documented institutional records; and narrative synthesis integrating these sources into the interpretive account presented below.

4. RESULTS AND ANALYSIS

Overview

Analysis of the twenty participant accounts and three years of documentary record produced four dominant findings. Table 1 summarizes the proportional distribution of coded thematic references across the three participant groups.

Table 1. Distribution of Coded Thematic References by Participant Group (%).

Theme	Administrators (n=6)	Teachers (n=10)	Personnel staff (n=4)
Personally-driven technical currency maintenance	22	38	19
Reactive, accreditation-triggered development investment	29	24	34
Workload crowding out developmental capacity	21	32	18
Absent formal career-progression incentive	28	6	29

Teachers weighted personally-driven currency maintenance and workload crowding-out most heavily among all three groups, consistent with their position as the population directly experiencing these constraints, while notably reporting the absent-incentive theme far less frequently than either administrators or personnel staff, a divergence examined further in the Discussion.

Technical Currency Maintained Through Personal Rather Than Institutional Effort

Teachers across technical specializations consistently described maintaining their own technical currency through personal initiative, informal professional networks, self-funded external courses, personal reading of industry publications, rather than through systematic institutional mechanism. Figure 1 presents the proportional distribution of technical-currency maintenance mechanisms teachers described, aggregated across all ten teacher participants.

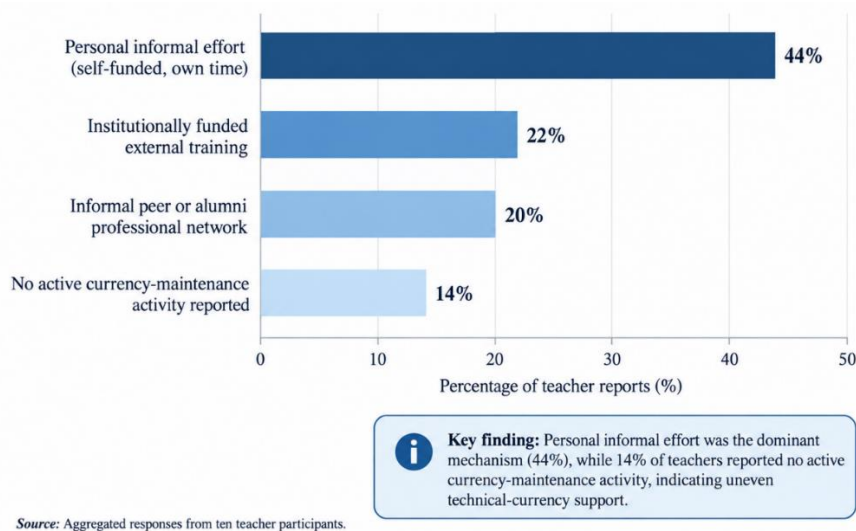


Figure 1. Proportional Distribution of Instructor Technical-Currency Maintenance Mechanisms

Personal informal effort was by a substantial margin the most frequently reported mechanism, confirming this study's expectation, derived directly from Becker's (1993) human capital theory, that specific human capital investment left to individual initiative rather than institutional structure will be inconsistently and unevenly maintained; the fourteen percent of teachers reporting no active currency-maintenance activity at all represents a meaningful minority whose technical knowledge is, on this study's evidence, depreciating without institutional intervention or, evidently, sufficient personal-initiative compensation.

Professional Development Investment Structured Reactively

The second theme, weighted most heavily by personnel staff and administrators, concerned when and why institutional professional development investment actually occurs. Table 2 presents documented professional development activities across the three-year review period, categorized by triggering condition and cross-referenced against Desimone's (2009) structural quality criteria.

Table 2. Documented Professional Development Activity by Triggering Condition and Structural Quality (3-Year Period).

Triggering condition	Number of documented activities	Proportion of total development budget	Exhibits sustained, job-embedded structure (Desimone, 2009)
Accreditation or certification renewal requirement	14	61%	No (one-time session format)
Administrator-initiated response to specific industry feedback	5	22%	Partial (single follow-up session)
Teacher-initiated request, approved	4	14%	Yes, in 3 of 4 cases
Systematic, scheduled technology-currency review	0	0%	N/A

No documented professional development activity across the three-year review period originated from a systematic, scheduled technology-currency review process; the substantial majority of both activity count and budget allocation traced to accreditation or certification renewal requirements delivered in a one-time session format lacking the sustained, job-embedded structure Desimone (2009) and Darling-Hammond et al. (2017) both identify as necessary for genuine practice change. Notably, the small number of teacher-initiated, approved development requests showed the strongest structural quality, three of four exhibiting sustained rather than one-time engagement, suggesting that when instructors themselves identify and pursue a specific development need, the resulting activity is more likely to possess the features associated with genuine effectiveness than institutionally mandated, compliance-driven activity, a pattern with direct implication for how future development investment might be better targeted.

Workload Structures Crowding Out Developmental Capacity

The third theme, weighted heavily by teachers specifically, directly tested this study's third research question through the Job Demands-Resources framework. Figure 2 presents teachers' self-reported allocation of discretionary professional time across competing demands.

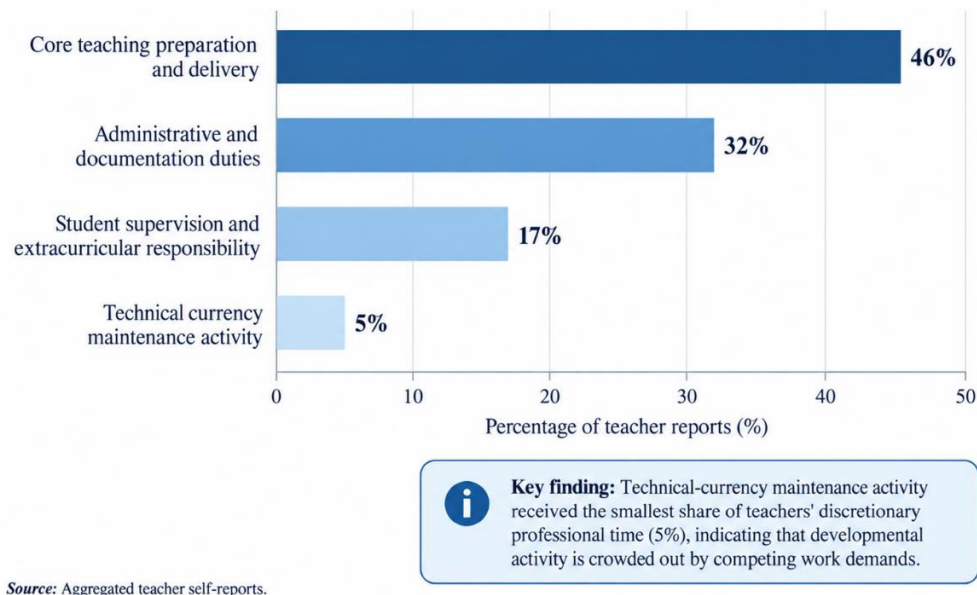


Figure 2. Teacher-Reported Allocation of Discretionary Professional Time.

Technical-currency maintenance activity received the smallest share of teachers' self-reported discretionary time allocation by a wide margin, directly consistent with the Job Demands-Resources model's prediction that discretionary developmental activity is systematically crowded out under conditions of high competing demand (Demerouti et al.,

2001; Bakker & Demerouti, 2007). Several teachers explicitly described wanting to engage in more active technical updating but described this as consistently displaced by administrative documentation and teaching-preparation demands they considered more immediately consequential to day-to-day performance evaluation, a direct illustration of the demand-resource imbalance the theoretical framework anticipates.

Absent Formal Career-Progression Incentive for Technical Currency

The fourth theme directly answered this study's fourth research question and revealed the most striking cross-group divergence in the entire dataset. Administrators and personnel staff both confirmed, and documentary review corroborated, that the school's formal career-progression and evaluation criteria did not explicitly incorporate technical-currency maintenance as a recognized or rewarded dimension of instructor performance; advancement criteria instead centered on tenure, formal qualification level at hiring, and administrative or teaching-load performance metrics unrelated to ongoing technical updating specifically. Teachers, notably, reported this absence far less frequently than administrators or personnel staff, a divergence this study interprets, following Lawler's (1990) career-incentive theory, as evidence that teachers may not have fully recognized technical-currency maintenance as a distinct, potentially incentivizable performance dimension at all, having instead internalized it as a personal professional responsibility disconnected from institutional reward structure, precisely the outcome career-incentive theory predicts when an organization's formal advancement criteria do not explicitly recognize a given behavior.

Taken together, these findings answer this study's four research questions directly: instructors maintain technical currency predominantly through personal rather than institutional mechanism, with a meaningful minority maintaining no active mechanism at all; professional development investment is triggered predominantly by accreditation and certification renewal requirements delivered in structurally weak, one-time formats rather than systematic technology-currency review; workload structure allocates the smallest share of discretionary instructor time to technical-currency maintenance specifically, consistent with Job Demands-Resources predictions; and no formal career-progression incentive currently links advancement to sustained technical currency, an absence teachers themselves under-recognize relative to administrators and personnel staff.

5. DISCUSSION

These findings reconnect directly to this study's four research questions while substantially extending the human capital, Job Demands-Resources, and teacher professional development frameworks into a maritime vocational instructor population none has previously examined jointly. The predominance of personally-driven technical currency maintenance, documented in Figure 1, confirms Becker's (1993) prediction that specific human capital investment left to individual initiative produces uneven, individually variable outcomes, and extends this finding by quantifying its practical consequence: a meaningful minority of instructors report no active currency-maintenance mechanism at all, meaning their technical knowledge is depreciating without either institutional or personal intervention.

The reactive, structurally weak professional development pattern documented in Table 2 extends this programme's curriculum governance research in a theoretically significant direction. That research found curriculum revision reactively triggered by external accreditation mandate rather than industry signal; this study's finding that instructor professional development follows the identical reactive pattern, and additionally lacks the sustained, job-embedded structure Desimone (2009) and Darling-Hammond et al. (2017) identify as necessary for genuine effectiveness, suggests this is not a curriculum-specific governance quirk but a more general institutional orientation toward compliance-driven rather than genuinely developmental activity, extending across both documents and people. This finding also engages productively with Guskey's (2002) caution regarding development-change sequencing: since the school's development activity currently lacks the sustained structure Guskey's own research associates with durable change, the school may be caught in a self-reinforcing pattern where weak development investment produces limited visible instructor change, which in turn provides administrators no evidence to justify increased investment, a dynamic this study's cross-sectional design can identify but not fully resolve.

The workload findings in Figure 2 confirm the Job Demands-Resources model's core prediction directly, while also supplying a specific, actionable diagnostic: technical-currency maintenance is measurably and substantially crowded out by administrative and documentation demand specifically, a demand category several teachers described as having increased over their tenure, meaning the demand side of the imbalance is plausibly worsening even as the resource side remains essentially unaddressed. The absent career-incentive finding, and specifically the divergence between teachers' and administrators' recognition of this absence, offers this study's most theoretically generative contribution, consistent with organizational behavior research on how unincentivized expectations become normalized rather than

contested (Lawler, 1990): where an organization never formally recognizes a behavior as a distinct, rewardable performance dimension, the individuals expected to perform it may experience it as an unexamined personal responsibility rather than an institutional gap warranting advocacy. This finding also carries a direct equity implication: since technical-currency maintenance depends substantially on individual initiative and personal financial investment, instructors with greater personal resources are structurally better positioned to maintain currency than equally capable instructors lacking these resources, an inequality the absent formal incentive and support structure does nothing to correct.

This study's strength lies in its triangulated, three-population design combined with three years of documentary record, allowing self-reported practice to be checked against actual documented development investment and personnel policy. Its principal limitation is the single-institution design, which cannot establish how representative this school's specific patterns are across Indonesia's broader maritime vocational education sector, and the cross-sectional design cannot establish whether identified patterns have worsened, stabilized, or improved over a longer institutional history. The practical implications point directly toward restructuring professional development triggering, workload allocation, and career incentive design as an integrated instructor human resource development system. Future research should extend this study's design across multiple Indonesian maritime vocational institutions, and should test directly whether introducing a formal, incentive-linked technical-currency requirement measurably improves instructor-reported currency-maintenance activity and, ultimately, the sector-level competency gaps documented in Indonesia's broader maritime workforce literature.

6. CONCLUSION

This study examined how a maritime vocational high school in Jakarta manages instructor human resource development for future sea transportation instruction. Technical currency was maintained predominantly through personal rather than institutional effort; professional development investment followed a reactive, structurally weak pattern paralleling this programme's curriculum governance findings; workload structures allocated minimal discretionary time to technical updating; and no formal career-progression incentive recognized sustained technical currency, an absence teachers themselves under-recognized relative to administrative staff. These findings extend human capital theory, the Job Demands-Resources model, and the teacher professional development literature into maritime vocational instructor development, connect instructor-level capacity to sector-level competency gaps

documented elsewhere, and support restructured professional development, protected developmental time, and incentive-linked career advancement as preconditions for sustainable future sea transportation workforce preparation.

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