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Conceptualizing Academics Experiences in Adopting Project-based Learning in Maritime Higher Education

An Analysis through Activity Theory

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Abstract

This study examines how academics experience the adoption of project-based learning (PBL) in maritime higher education, analyzed through Engeström's Activity Theory. While PBL has shown effectiveness in higher education, little research addresses the contradictions that arise in specific teaching and learning contexts. Using a qualitative approach, semi-structured interviews with 16 faculty members in a UAE maritime institute revealed key tensions: differing perspectives between academics and practitioners, inconsistent use of technological tools, and the absence of standardized progression rules for student projects. Faculty discussions informed recommendations such as targeted professional development, shared e-resources, and a phased PBL framework. The findings underline the need for inclusive dialogue, structured flexibility, and academic leadership in optimizing PBL implementation. This study offers a theoretically grounded and contextually novel analysis that

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informs curriculum design, stakeholder collaboration, and policy development, contributing to both academic understanding and the enhancement of professional practice in maritime higher education.

Keywords: Project-based Learning; Activity Theory; Teaching and Learning; Maritime Education

Introduction

Higher education is undergoing a profound transformation due to evolving industry demands, shifting stakeholder expectations, and an increasing focus on skill-based education. Traditionally, universities have sought to develop both hard skills, such as cognitive knowledge and professional expertise, and soft skills, including problem-solving, teamwork, and adaptability (Guo et al., 2020). However, these efforts have intensified in response to contemporary challenges, particularly the pandemic, which accelerated the transition to technology-enabled learning (Gupta, 2022). This shift underscores the urgency for higher education institutions to adopt innovative pedagogical strategies.

A key challenge is fostering students' holistic development, encompassing creativity, critical thinking, communication, collaboration, and independent learning (Gupta, 2022). Traditional teacher-centered approaches, where instructors primarily transmit knowledge and students passively receive it, often hinder these objectives (Guo et al., 2020). In contrast, research suggests that learner-centered and active learning methods enhance critical thinking, knowledge retention, motivation, interpersonal skills, and academic performance (Davenport, 2018). Consequently, a shift toward student-centered pedagogy is essential.

At the core of these pedagogical innovations lies collaborative learning, which fosters social interaction, teamwork, and shared knowledge construction. Contemporary educational research emphasizes the importance of interactive, participatory learning experiences (Parker et al., 2022). When students perceive their contributions as valuable, they participate more actively, leading to deeper learning (Adesina et al., 2022).

One prominent approach is Project-Based Learning (PBL), which has gained traction as a means to create sustainable and effective teaching models. PBL aims to engage students in real-world problem-solving and knowledge construction within authentic professional contexts (Gupta, 2022; Guo et al., 2020). Rooted in Dewey's advocacy for inquiry-based education (Dewey &

Dworkin, 1959), PBL prioritizes learners' active engagement in projects that involve driving questions, investigations, and teamwork (Krajcik, 2015).

PBL is an inquiry-driven instructional approach. Krajcik and Shin (2014) identified its six defining characteristics: a driving question, a focus on learning objectives, active student participation, collaboration, scaffolding technologies, and artifact creation. The production of artifacts that address authentic challenges differentiates PBL from other student-centered pedagogies, such as problem-based learning (Helle et al., 2006). Through PBL, students develop interdisciplinary knowledge, problem-solving abilities, critical thinking skills, and collaborative competencies (Meng et al., 2023; Hadgraft & Kolmos, 2020). Research on PBL has spanned various disciplines, particularly engineering education. Studies have explored its integration with industry engagement in the UK (Ruikar & Demian, 2013), its application in electronic engineering in Spain (Hassan et al., 2008), and its role in project-led education in Portugal (Fernandes et al., 2013). In maritime higher education, PBL has been studied as a means of enhancing training and competency development (Fedila, 2007; Gutiérrez et al., 2016).

Despite its growing adoption, PBL presents several challenges. Studies have highlighted difficulties in assessing its impact on academic attainment (Helle et al., 2006) and a lack of rigorous evaluations of learning outcomes (Guo et al., 2020). Some researchers argue that PBL’s effectiveness compared to traditional teaching remains inconclusive (Markham et al., 2003; Powell & Wimmer, 2016).

This qualitative case study aims to analyze faculty experiences with PBL at a UAE maritime institute. The study adopts a realist/interpretivist perspective to address the following research questions:

- RQ1. What are the key areas of contradiction between the different components of the PBL activity system at the investigated institute?
- RQ2. How can these tensions be used to inform the development of the PBL environment?

Based on faculty perspectives, the findings describe the core aspects of the Project-Based Learning activity, which collectively revealed a system under tension; the subsequent discussion analyzes three key contradictions that emerged from this activity system—namely, the misalignment between academic and professional perspectives, inconsistent use and support of technological tools, and critical gaps in institutional rules and support structures. By treating these tensions not as failures but as catalysts for change, the analysis then articulates how these very contradictions were leveraged to inform concrete recommendations for the effective implementation of PBL, focusing on structured stakeholder collaboration, targeted resource development, and coherent policy frameworks tailored to the maritime education context.

The significance of this study lies in its ability to contribute meaningfully across theoretical, contextual, practical, and policy domains. First, by applying Engeström's Activity Theory to the investigation of project-based learning (PBL), the study advances theoretical understanding of how pedagogical innovation unfolds within complex institutional systems. As will be examined in more detail in a subsequent discussion of this study, Activity Theory offers a dynamic framework for analyzing the interrelations between tools, rules, community, and division of labour, and how contradictions among these elements shape teaching and learning. This application reinforces the theory's relevance to higher education research and extends its use into the domain of maritime pedagogy, where it has been underutilized.

Second, the study addresses an established academic issue—faculty engagement with student-centered pedagogies—within a novel and under-researched context: maritime higher education in the Gulf region. This setting presents unique structural and cultural conditions, including regulatory demands, industry alignment, and evolving technological infrastructures. By situating the inquiry in this context, the study generates insights that are both locally grounded and globally relevant, offering fresh perspectives on how PBL is interpreted and enacted by educators working within specialized professional environments.

Third, the study's design supports the enhancement of professional practice by providing a research-based foundation for improving teaching strategies and institutional support mechanisms. Through its focus on faculty experiences, it identifies systemic factors that influence the adoption and sustainability of PBL. These insights can inform the development of targeted professional development programs, instructional design improvements, and collaborative practices that better align academic goals with real-world competencies — particularly important in fields like maritime education where professional readiness is paramount.

Finally, the study contributes to policy content and approaches to policy-making by revealing how institutional structures and regulatory frameworks interact with pedagogical innovation. The findings can guide educational leaders and policymakers in refining institutional policies that support flexible, context-sensitive implementation of PBL. This includes considerations around assessment standards, resource allocation, and stakeholder engagement. In doing so, the study offers a model for evidence-informed policy development that is responsive to both educational and industry needs.

Theoretical framework

Activity Theory (AT) is a theoretical framework derived from the cultural-historical school of psychology, primarily associated with Lev Vygotsky, Alexei Leont'ev, and Yrjö Engeström. It offers a comprehensive approach to understanding the complex interactions in human activities that are mediated by tools and influenced by social and cultural contexts (Vaganova et al., 2020; Roth & Lee, 2007). AT posits that individuals are perpetually involved in a system of activity directed toward an object or goal, with learning and development emerging through these mediated interactions. This perspective highlights that individuals do not function in isolation but rather within larger systemic structures that shape their practices (Roth & Lee, 2007).

A critical aspect of Activity Theory is its conceptual model, which includes the components of subject, object, tools, community, rules, and division of labor (Figure 1). This model enables researchers and educators to assess how cultural and institutional contexts affect learning processes and organize activities.

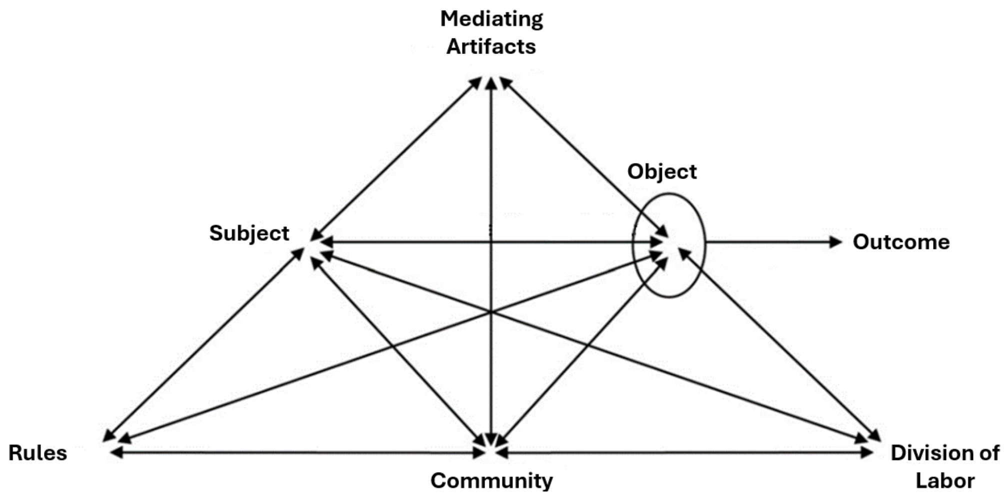


Figure 1. Engeströms (2001) extended activity system model, depicting the six interacting components of a collective activity.

In an analytical setting, the “subject” is the person or group whose agency forms the vantage point of the study, such as learners or instructors. Activities are distinguished by their “object” – the motive or purpose that gives the activity meaning and directs its transformation into an outcome. This relationship between subject and object is mediated by “tools”, which include any instruments used in the transformation process. The activity is also shaped by its “community” (the people or groups involved), explicit and implicit “rules,” and the “division of labour” that organizes how work is distributed. These components interact dynamically, constantly influencing one another as the activity evolves. In this study, the subjects are faculty members at a maritime higher education institute in the UAE, and the object is their motive for adopting PBL, all situated within a system mediated by tools, rules, community structures, and divisions of labour.

Contradictions naturally arise within an activity system when its elements become misaligned, often due to external influences. These tensions are experienced as problems that individuals strive to resolve, serving as catalysts for change and development within the activity (Ashwin, 2012; Issroff & Scanlon, 2002). The framework asserts that learning encompasses the reshaping of practices and collective understanding through ongoing interactions (Vianna & Stetsenko, 2011).

In applying Activity Theory to pedagogy in higher education, it serves as a relevant framework for several reasons. First, it provides robust tools for analyzing and redesigning teaching practices that are socially situated and collaborative. Such analysis is essential in higher education, where diverse stakeholders, including students and faculty, interact with various tools—from educational technologies to institutional policies—shaping their learning experiences (Scanlon & Issroff, 2005; Isssroff & Scanlon, 2002).

Moreover, Activity Theory accentuates the need for careful consideration of educational contexts, allowing educators to reflect on their pedagogical strategies and identify potential barriers affecting learning (Woulfin, 2016). Reflection is crucial in higher education, given the diverse student populations and disciplinary contexts educators typically encounter. For example, AT has been utilized to investigate how technology influences student engagement and learning outcomes, demonstrating its applicability in modern educational settings (Scanlon & Issroff, 2005; Isssroff & Scanlon, 2002).

Additionally, the emphasis of Activity Theory on systemic relationships and contradictions within activity systems can help educators comprehend the complexities of educational change, fostering a proactive stance toward collaborative learning. This approach encourages the implementation of culturally sustaining pedagogies that recognize and address the varying needs of students (Hirsh, 2020). By acknowledging the historical and contextual factors shaping educational practices, educators can create inclusive curricula and teaching methods aligned with students' real-life experiences and social realities (Vaganova et al., 2020; Roth & Lee, 2007).

The appropriateness of Activity Theory as the lens for examining project-based learning environments, particularly in a maritime higher education institution in the Gulf Area, stems from its integrative and contextual nature. The theory enables researchers to analyze how various elements interact to produce specific pedagogical outcomes in a culturally rich and complex educational setting. Given the distinctive characteristics of maritime education, including practical training components and collaborative learning requirements, Activity Theory offers a nuanced understanding of the challenges and opportunities within the PBL framework. This perspective allows for insights into how faculty members perceive and implement project-based methodologies, ultimately contributing to the development of more effective teaching practices and enhancing student learning experiences in the maritime domain. By employing Activity Theory, this study aims to effectively explore the entirety of the educational ecosystem, fostering a deeper understanding of the factors that influence learning and engagement in maritime studies.

Materials and methods

Study context

The study was conducted at a young higher education institute, established in 2019. It offers three bachelor's programs: Maritime Transport, Marine Engineering Technology, and Maritime Logistics and Supply Chain Management. The institute’s pedagogical model blends traditional instructor-guided courses with a sequence of mandatory student-led projects across all four years of each program.

This study applies Engeström's Activity Theory. The faculty members are the "subjects." Their main motives for adopting PBL represent the "object." This relationship is mediated by various factors: technological and evaluation tools, institutional and maritime industry rules, the broader community of stakeholders, and the division of labour concerning student autonomy. A translation of this activity system into the study's context is provided in Figure 2.

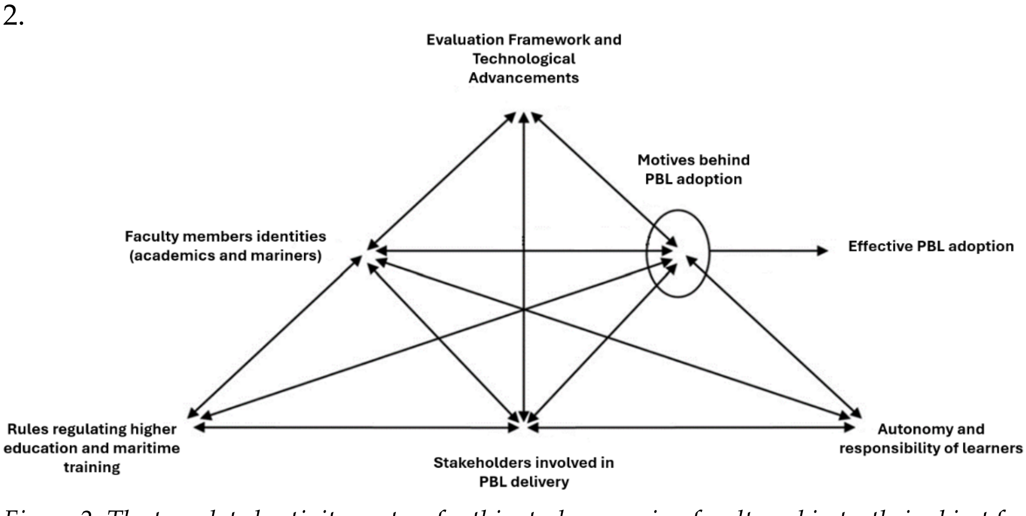


Figure 2. The translated activity system for this study, mapping faculty subjects, their object for adopting PBL, and the mediating tools, rules, community, and division of labour.

Data collection and analysis

Data were collected through semi-structured interviews with 16 faculty members. The interviews aimed to (1) identify key aspects and contradictions within the PBL activity system and (2) explore potential actions to address those contradictions. All interviews were audio-recorded with prior written consent from participants.

The data analysis followed a systematic process influenced by the methodology of Campos and Pinto (2016), which is rooted in Engeström's activity theory. The process consisted of several stages:

1. Transcription and Familiarization: Interview recordings were transcribed verbatim and repeatedly reviewed to gain a deep familiarity with the data.
2. Coding: Transcripts were imported into qualitative data analysis software for coding. An initial set of codes was developed deductively based on the components of Engeström's activity system (e.g., tools, rules, community). Subsequently, inductive coding was applied to identify emergent themes not captured by the initial framework.
3. Theme Development and Validation: Coded data were analyzed to identify recurring patterns and contradictions. To enhance reliability, a second coder familiar with activity theory reviewed a subset of transcripts (approximately 25%); any discrepancies in coding were discussed and resolved to ensure consistency. These patterns were then organized into coherent themes that described the key tensions within the PBL activity system.
4. Interpretation and Contextualization: The finalized themes were interpreted through the lens of activity theory to articulate the systemic contradictions. The findings were continually contextualized within the specific setting of the maritime institute to ensure their validity.

This structured approach ensured a rigorous analysis that directly addressed the study's aim of diagnosing contradictions to inform PBL development.

The Sample Selected

Participants were selected using a snowball sampling technique, which was effective for reaching faculty deeply embedded in the institute's PBL network. Initial participants were identified based on their central roles in PBL delivery and were asked to recommend colleagues with relevant experience. Recruitment continued until thematic saturation was reached, meaning new interviews ceased to yield novel insights into the core research questions concerning systemic contradictions. A sample of 16 participants was sufficient to achieve this saturation, providing a comprehensive range of perspectives across academic ranks, programs, and experience levels (see Table 1).

Rank (Pseudonym)	**no**	**%**
PhD (DR1, DR2, etc.)	6	38
Master Mariner (MM1, MM2, etc.)	5	31
Chief Engineer (CE1, CE2, etc.)	5	31
Gender	**no**	**%**
male	12	75
female	4	25
Age	**no**	**%**
30-39	2	13
40-49	12	75
50-55	2	13
Program	**no**	**%**
Maritime Transport	6	38
Marine Engineering Technology	5	31
Maritime Logistics & Supply Chain Management	5	31
Ethnicity	**no**	**%**
Arab	7	44
European	6	38
South Asian	3	19
Years of Experience with PBL	**no**	**%**
<3	1	6
3-6	6	38
7-10	5	31
>10	4	25

Table 1. Overview of the study participants.

Results

This section describes the key aspects of the PBL teaching activity as perceived by the participants of this study.

The subject of the PBL activity system

The findings revealed two distinct forms of faculty identities within the institute, each with divergent perspectives on the PBL model. The first group consists of academicians who hold PhD degrees and come from traditional university backgrounds. These faculty members are highly supportive of the

PBL model, viewing it as a transformative approach to student learning. As DR2 noted:

> "PBL encourages students to engage in deep learning, allowing them to grasp complex concepts through inquiry-based methods. This approach fundamentally changes how they think, analyse, and interpret reality, which is crucial for their overall intellectual development."

In contrast, the second group comprises master mariners and chief marine engineers who bring extensive maritime experience to their teaching roles. This group does not hold terminal degrees but possesses Certificates of Competence (COC), certifying their ability to perform specific roles on maritime vessels. Their scepticism towards the PBL model stems from their belief in a curriculum closely aligned with the COC requirements, focusing on practical skills and competencies necessary for maritime professions. MM3 expressed this viewpoint, stating:

> "Our primary goal should be to ensure students meet the Standards of Training and Certification for Watchkeepers (STCW). The PBL model, with its focus on inquiry and deep learning, doesn't necessarily prepare students for the specific tasks and responsibilities they'll face on board ships."

The object of the PBL activity system

In examining the object component of the faculty activity system, it became evident that there were two distinct key motives driving the faculty's engagement with the PBL model. The first motive, predominantly adopted by the academicians, was centered around producing an enhanced, inquiry-based learning experience for students. Faculty members with this focus believed that the PBL model could foster high-level problem-solving and critical thinking skills, offering educational benefits that traditional courses could not match. DR5 articulated this stance, stating:

> "Our goal with PBL is to cultivate a learning environment where students can engage deeply with the material. By tackling real-world problems, they develop critical thinking and problem-solving abilities that are crucial for their future careers."

Conversely, the second motive, held by the master mariners and chief engineers, was primarily driven by a need to comply with the college's requirements for adopting the PBL model. This group viewed the PBL approach more as an institutional mandate than an educational enhancement. As such, their primary focus was on fulfilling these requirements rather than on the potential pedagogical benefits of PBL. CE2 expressed this perspective, saying:

> "While we recognize the need to implement PBL as part of the college's curriculum, our main concern is ensuring it aligns with the practical training standards required by the industry. Compliance with PBL requirements is essential, but it shouldn't overshadow the fundamental competencies our students need to master."

The artifacts of the PBL activity system

The discussion on artifacts revealed a consensus among most faculty members, irrespective of their identities or backgrounds, regarding the inadequacies in supporting guidelines and documentation for PBL courses. Faculty members consistently highlighted the absence of clear, standardized guidelines and documents, which are crucial for ensuring a unified and coherent approach to adopting and implementing PBL methodologies. DR4 remarked:

> "There's a significant gap in the resources provided to us. Without comprehensive guidelines, it's challenging to ensure we're all moving in the same direction when it comes to PBL delivery."

Additionally, the interviews uncovered a widespread lack of awareness among faculty members concerning the available software and hardware on campus that could support and enhance their PBL activities. Many faculty expressed that they were either unaware of the technological resources at their disposal or uncertain about how to effectively integrate these tools into their PBL courses. This lack of awareness further complicates the implementation of PBL, as faculty members are unable to leverage potentially beneficial technologies that could enrich the learning experience. DR1 highlighted this issue, saying:

> "I often hear about various tools and technologies that could benefit our PBL courses, but there's no clear communication or training on what's available and how we can use it effectively."

The rules of the PBL activity system

In general, the academicians believed that all curriculum changes should primarily reference the standards set by the Commission for Academic Accreditation (CAA) of the Ministry of Education, which is the main regulator of higher education and assurer of academic quality in the UAE. They argued that adherence to these standards ensures the academic rigor and quality necessary for a comprehensive educational experience. As DR3 stated:

> "Aligning our curriculum with the CAA standards is crucial. It ensures that our educational programs maintain high academic quality and meet the national requirements for higher education."

In contrast, several master mariners and chief marine engineers insisted that the STCW requirements should be the focal point for curriculum design. They emphasized that without meeting these requirements, students would be unable to obtain their Certificates of Competence (COC) through the Ministry of Energy and Infrastructure, which oversees maritime teaching and training in the UAE. CE4 highlighted this point, saying:

> "Our priority must be the STCW standards. If our students don't meet these requirements, they won't be able to obtain their COC, regardless of their academic achievements. This is essential for their future careers in the maritime industry."

The community of the PBL activity system

The 'community' element of the faculty activity system also revealed differing perspectives regarding the involvement of research assistants in PBL delivery. Academicians believed that they should be the primary instructors for PBL courses, assuming the role of supervisors to ensure the quality and effectiveness of the learning experience. They argued that research assistants might lack the necessary teaching experience and pedagogical skills to oversee such courses effectively. DR6 explained:

> "As experienced educators, we should lead the PBL courses to maintain high instructional standards. Research assistants, while valuable, may not have the requisite teaching experience to manage these complex learning environments."

On the other hand, the team of practitioners, including master mariners and chief engineers, advocated for giving research assistants key responsibility for delivering PBL courses. They believed this approach would allow practitioners to focus on delivering core maritime and engineering courses, which require the expertise of individuals holding Certificates of Competence (COC) as mandated by the Standards of Training, Certification, and Watchkeeping (STCW) conventions. CE5 expressed this view, stating:

> "Research assistants should take on the PBL courses, freeing us to concentrate on the essential maritime and engineering subjects that cannot be taught by anyone without the appropriate COC. This division of labour ensures that all courses are delivered by those best qualified to teach them. Hiring me to teach such courses is like installing a twin-turbo V8 on a Fiat. It is an epic misfit."

The division of labour in the PBL activity system

The 'division of labour' within the faculty activity system presented a notable divergence in the delivery of PBL courses, reflecting a spectrum between faculty-centered and student-centered activities. Discussions with some faculty members revealed that PBL courses are often delivered similarly to traditional courses, with faculty making the majority of key decisions regarding the selection of topics and the methods of investigation. These faculty members tend to maintain control over the course structure, guiding students closely through predefined pathways. DR1 noted:

> “While we incorporate PBL elements, we still find it necessary to steer the topics and methodologies to ensure that the learning outcomes align with our academic standards and objectives. You must understand the calibre of students you are dealing with.”

In contrast, other groups of faculty members demonstrated a deep understanding of and commitment to student empowerment within PBL courses. They recognized these courses as excellent opportunities to instil autonomy, accountability, self-learning, reflection, and life-long learning skills in students. These faculty members advocate for a more student-centered approach, where students have significant input into the selection of topics and the ways in which they will be explored, thereby fostering a sense of ownership and active engagement in their learning process. DR4 expressed this perspective, stating:

> “PBL courses are designed to be student-driven. By allowing students to choose their topics and determine their investigative approaches, we help them develop crucial skills like autonomy, critical thinking, and life-long learning, which are essential for their professional and personal growth.”

Discussion

This section discusses the key contradictions within the PBL teaching activity and how they were used to inform its effective implementation at the institute. Our analysis identified three central contradictions, visualized as tensions within the activity system triangles (Figures 3-5). These are not isolated issues but interconnected tensions that collectively hinder PBL implementation.

Identifying the key contradictions within the PBL teaching environment

The subject-object-artifact contradiction

The first contradiction lies between faculty identities (subject), their motives (object), and the lack of a unified evaluation framework (artifact) (Figure 3). This tension reflects a fundamental divide in educational philosophy. Academicians, aligned with constructivist pedagogy (Krajcik & Shin, 2014), saw PBL's object as fostering deep learning. Practitioners, bound by the need for industry compliance, viewed the object as meeting certification requirements. This divergence created a dual-purpose system. Without a shared artifact—a standardized framework to evaluate PBL's effectiveness—these groups lacked a common ground to reconcile their goals, leading to inconsistent implementation. This finding echoes Gibbes and Carson (2014), who identified similar tensions between pedagogical innovation and institutional compliance.

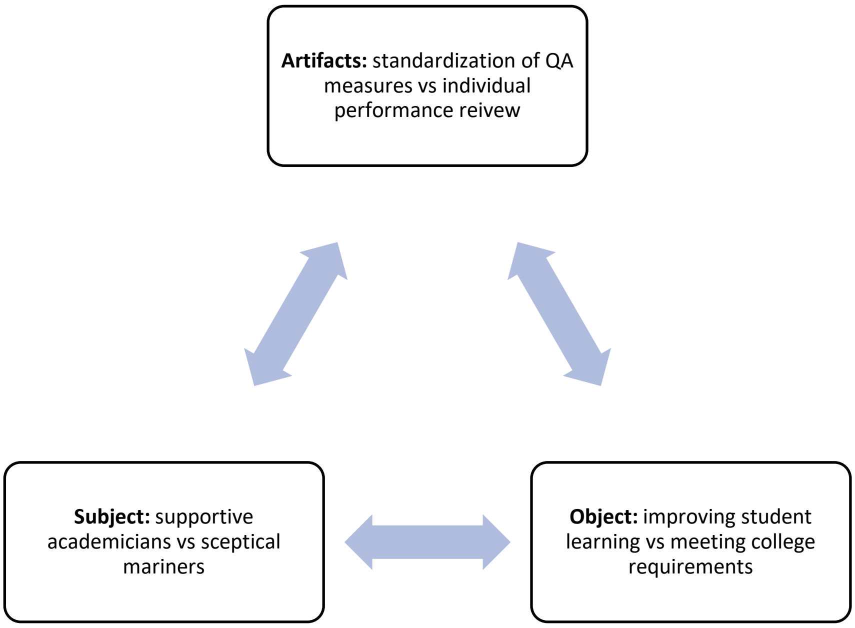
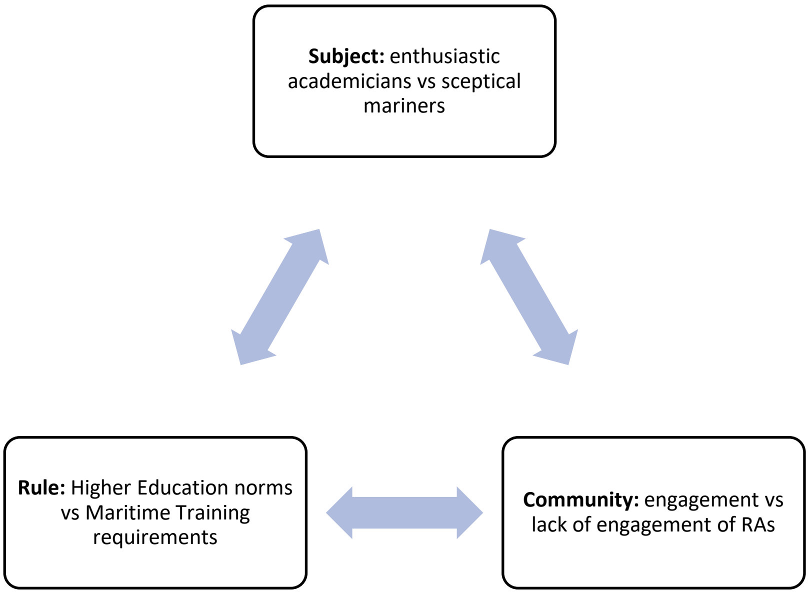


Figure 3: The primary contradiction within the subject-object-artifact relationship of the PBL activity system, highlighting tensions between faculty identities, motives, and evaluation tools.

The subject-rules-community contradiction

The second contradiction involves faculty identities (subject), conflicting regulatory frameworks (rules), and the inconsistent role of research assistants (community) (Figure 4). Academicians operated under the rules of the national academic accreditor (CAA), while practitioners adhered to international maritime conventions (STCW). This regulatory misalignment shaped their view of the community. Practitioners, prioritizing STCW-mandated teaching, argued research assistants should deliver PBL. Academicians believed their pedagogical expertise was essential for quality assurance. This finding extends the work of Issroff and Scanlon (2002) on how contradictions arise from external influences. Here, two external regulatory bodies created internal tensions



regarding roles and responsibilities.

Figure 4. The secondary contradiction within the subject-rules-community relationship, illustrating tensions between faculty identities, regulatory frameworks, and the role of research assistants.

The tools-rules-division of labour contradiction

The third contradiction emerged between technological tools, ambiguous progression rules, and an inconsistent division of labour (Figure 5). A core principle of PBL is that projects should scaffold in complexity (Krajcik, 2015). However, no clear rules defined this progression. Consequently, project difficulty often remained static, preventing the division of labour from shifting meaningfully from teacher-centered to student-centered. Technology use was also fragmented. Some faculty used advanced software to empower students; others underutilized these tools. This inconsistency prevented students from progressively developing autonomy, a key intended outcome of PBL (Hadgraft & Kolmos, 2020).

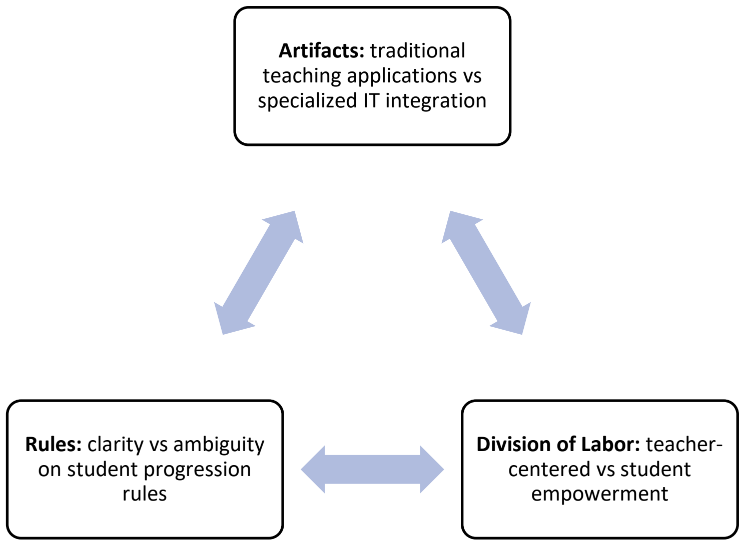


Figure 5. The tertiary contradiction within the tools-rules-division of labour relationship, showing tensions between technological tools, progression guidelines, and the distribution of teaching responsibilities.

Informing PBL Development Through Contradictions

Following Engeström (2001), we treated these contradictions not as failures but as catalysts for change. Faculty discussions translated these tensions into concrete improvement strategies.

Addressing the subject-object-artifact contradiction

Faculty discussions led to adopting the Kirkpatrick (2009) model to establish a common evaluation framework (Table 2). This addressed concerns raised in prior reviews about weak measurement tools in PBL (Guo et al., 2020). By combining reaction, learning, behavior, and results measures—such as CLO feedback, pre/post-tests, and alumni surveys—the model provides a structured yet flexible way to capture PBL outcomes across academic and professional domains.

Level	Description/Scope	Proposed Institutional Evaluation Tools
Reaction	Whether learners find the training engaging, favourable, and relevant to their jobs. Includes feedback on CLOs, course material, content relevance, and instructor knowledge.	Student Satisfaction with Course Course Evaluation Report by Faculty Student Reflection

Learning	Whether learners acquire the intended knowledge, skills, and competencies. Covers horizontal (PM skills) and vertical (subject knowledge) learning.	Pre- and post-assessments Presentation/discussion; rubrics covering horizontal (external e.g., leadership team, IAC representative) and vertical learning (internal e.g., faculty panel).
Behaviour	Whether participants were truly impacted by the learning and if they're applying what they learn.	Alumni Survey Employer Satisfaction Graduate Survey
Results	Measuring learning against high level pre-defined performance indicators	# projects achieving awards # projects endorsed by the industry #projects evolving into research/ innovations

Table 2. Implementation of the Kirkpatrick (2009) model of evaluation in the study context.

Addressing the subject-rules-community contradiction

To bridge regulatory and role-related divides, the institute introduced professional development sessions on PBL pedagogy, a shared e-resource repository, and peer mentorship. These initiatives align with earlier calls for faculty training and shared resources to reduce variability in PBL delivery (Mettas & Constantinou, 2006; Frank & Barzilai, 2004). Integrating technologies like AUTOCAD and MATLAB also addressed the need to connect PBL with authentic industry practices (Gutiérrez et al., 2016). Collectively, these measures foster a more cohesive teaching community while balancing STCW compliance with broader learning objectives.

Addressing the tools-rules-division of labour contradiction

A phased PBL framework adapted from Morgan (1983) clarified student progression (Figure 6). Year 1 introduced small-scale projects with basic tools; Year 2 expanded into interdisciplinary projects with advanced software; Year 4 culminated in comprehensive, industry-aligned projects. This phased model ensured scaffolding, consistent technology integration, and gradual student autonomy. Comparable staged approaches have proven effective in other professional fields (Fernandes et al., 2013).

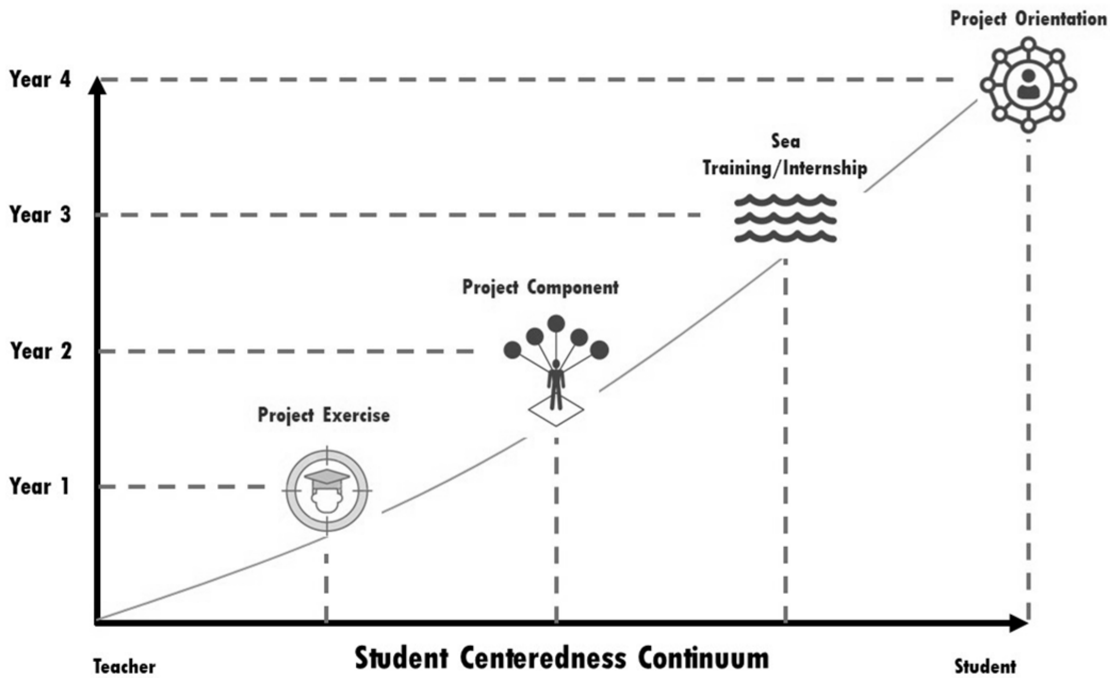


Figure 6. The application of Morgan's (1983) progressive model of PBL, outlining the phased transition of project complexity and student autonomy from Year 1 to Year 4.

Figure 7 illustrates the three main contradictions identified in this study (dashed triangles) and the corresponding action plans developed to address these challenges.

In summary, this study advances the application of Activity Theory in higher education research. It demonstrates how the theory can diagnose implementation challenges not as individual resistances but as systemic contradictions between interacting components of an activity system. The findings extend previous work by Gibbes and Carson (2014) by identifying a unique set of contradictions arising from the clash between professional vocational training and academic higher education standards within a maritime context.

Furthermore, this research contributes a practical blueprint for leveraging Activity Theory. It shows how identified contradictions can be systematically translated into actionable design principles—such as structured evaluation frameworks, targeted professional development, and phased pedagogical models—to reconfigure an activity system. This process moves beyond theoretical diagnosis to intervention, offering a replicable approach for other institutions navigating complex pedagogical changes.

By explicitly addressing these systemic tensions, the proposed strategies aim to transform contradictions into drivers of development, ultimately creating a more coherent and effective PBL environment for maritime education.

While the findings and proposed strategies offer a framework for addressing PBL contradictions, several limitations to this study must be acknowledged. Its reliance on semi-structured interviews with 16 faculty members, while providing depth, may introduce potential biases inherent in self-reported data. Furthermore, the exclusive focus on faculty perspectives omits the critical student viewpoint, which is an equally vital component of the PBL activity system. Grouping faculty with divergent motives into a single activity system, though analytically useful, may also oversimplify nuanced differences in how these distinct groups implement PBL. Finally, the study's context is confined to a single maritime institute in the UAE, which may limit the direct transferability of the findings to other higher education contexts or geographical regions without further investigation.

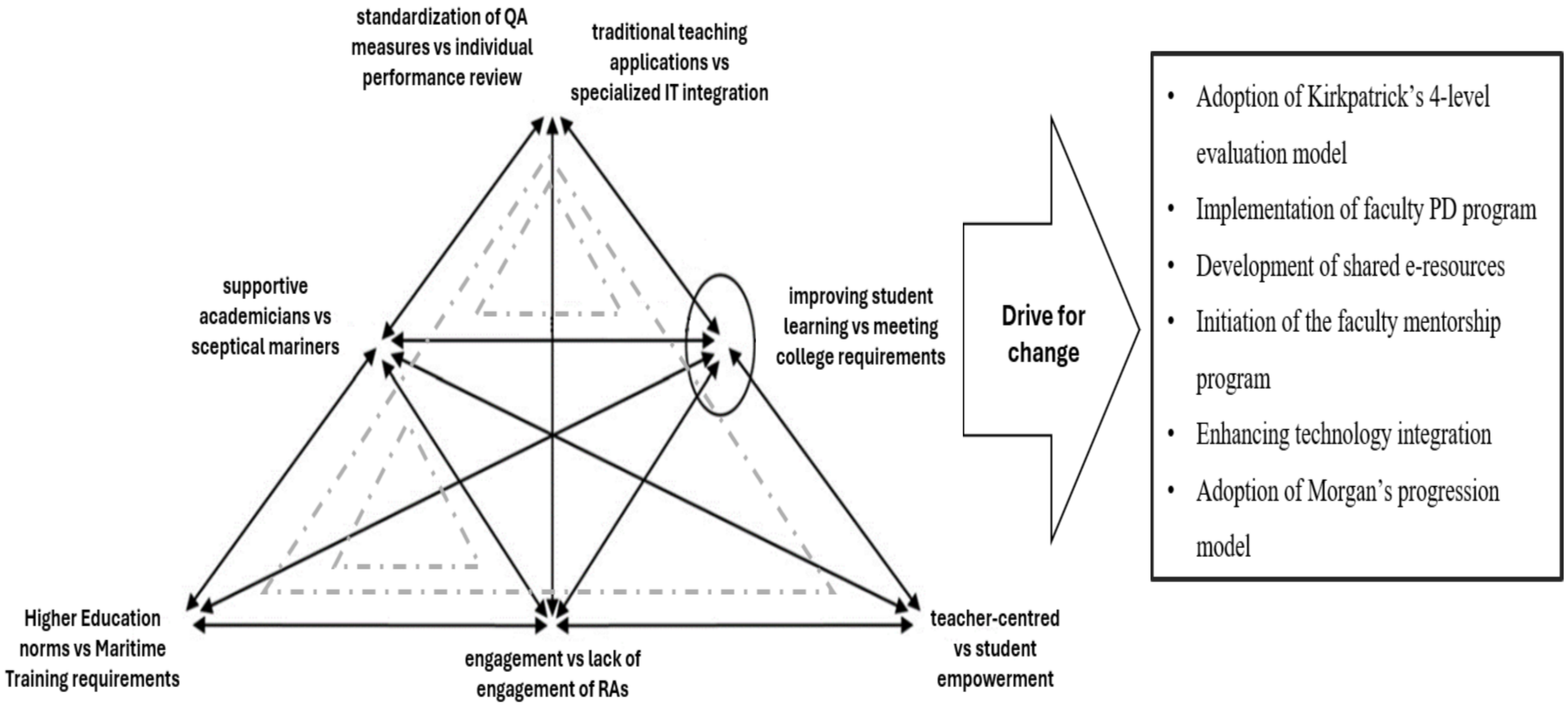


Figure 7. A synthesis of the three key contradictions identified in the faculty activity system and the corresponding strategic initiatives designed to address them.

Conclusion

Reflecting on this study provides valuable lessons that extend beyond its immediate findings. The most profound lesson was the critical importance of acknowledging and addressing diverse faculty identities. The distinct perspectives of academics and practitioners revealed a fundamental tension, suggesting that mitigation requires deliberate, inclusive dialogue. This insight underscores the necessity of creating an environment where educational ideals and industry requirements are viewed as complementary, not mutually exclusive.

A further lesson involves the necessity for a standardized yet flexible PBL framework. The inconsistencies in tool usage and unclear progression rules highlighted the need for structured guidance that remains adaptable to different disciplines. This balance is crucial for fostering innovation without compromising the quality of student learning.

The discussions with faculty emphasized the value of collective input. The proposed strategies—such as targeted professional development, shared e-resources, and mentorship programs—reflect a broader principle: an educational system's strength lies in its community. Encouraging collaboration and peer support leads to a more cohesive PBL implementation.

The study also highlighted the role of leadership in resolving systemic contradictions. Strong academic leadership is essential to articulate a unified vision for PBL and to provide the necessary support and training for faculty.
In summary, this study suggests that successful PBL implementation requires an approach that values faculty diversity, promotes structured flexibility, leverages community, and relies on effective leadership.

The recommendations from this study, while contextual, offer a transferable framework for other institutions. For educators and administrators seeking to implement similar changes, the following actionable steps are proposed:

- For Faculty Development: Instead of generic workshops, institutions can implement differentiated training sessions. Separate tracks could be developed for faculty with industry-heavy backgrounds (focusing on pedagogical theory and PBL's long-term benefits) and for research-focused academics (focusing on industry standards and competency-based outcomes). This tailored approach addresses the identity-based contradictions directly.
- For Standardizing Flexibility: Administrators can adopt a "framework with examples" model for PBL progression. A central policy could

define core principles (e.g., projects must increase in complexity and student autonomy year-on-year), supplemented by a digital repository of annotated project examples from different disciplines. This provides clear rules (standardization) while allowing for disciplinary adaptation (flexibility).

- For Leveraging Community: A practical first step is to formalize a "PBL mentorship program", pairing PBL-skeptical faculty with experienced PBL advocates within the same disciplinary field. This builds community and provides practical, relatable support, moving beyond top-down mandates.
- For Leadership: Leadership should focus on creating bridging objects. For example, forming a joint committee comprising academic leaders and industry-experienced practitioners to co-design key PBL evaluation metrics that satisfy both academic accreditation and professional certification standards can align conflicting priorities.

Looking forward, future studies could explore the student perspective on these tensions. Longitudinal research is also needed to assess the sustained impact of such strategic changes on career readiness. Examining the effectiveness of these implementation strategies in different educational contexts will further refine their applicability.

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Conflict of Interest

The author reports there are no competing interests to declare.

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