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ARTICLE

Charismatic Leadership, Joyful Learning, and Student Engagement in Maritime Vocational Education: The Moderating Role of Gender-Based Experiences

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Abstract

This study investigates the effects of charismatic leadership and a joyful-learning approach on student engagement in a vocational maritime context at Politeknik Pelayaran Sumatera Barat. A census sampling strategy was employed (N = 368; 305 male, 63 female). Data were collected using a 20-item Likert-scale instrument (pilot-tested with n = 60) and analyzed via partial least squares structural equation modelling (PLS-SEM). The structural model explained a substantial proportion of variance in student engagement (R^2 = 0.908). Joyful learning demonstrated a large, positive, and statistically significant effect on engagement ($p < 0.001$). In contrast, charismatic leadership exhibited a small and non-significant effect ($p = 0.127$). Gender-based experiences showed a small but statistically significant direct effect on engagement ($p < 0.001$), yet did not significantly moderate the relationships between the predictors and engagement. These findings underscore the primacy of pedagogical design over instructor leadership style in fostering student engagement in vocational education. Specifically, practice-oriented and affectively engaging instructional strategies appear more influential than charismatic leadership behaviors. Practically, educators should prioritize the integration of joyful, experiential learning approaches. Future research should adopt more balanced samples, employ multi-group or experimental designs, and utilize more granular measures of gender-based experience to better elucidate subgroup differences and underlying causal mechanisms.

Keywords: Charismatic leadership; Gender-based experiences; Joyful learning; Student engagement.

1. Introduction

Student engagement is a critical indicator of learning quality, as it reflects the degree to which learners are actively involved, intrinsically motivated, and capable in attaining 21st-century competencies [1]. High engagement contributes to mastery of competencies such as critical thinking, collaboration, communication, and creativity, skills demanded by the contemporary labor market [2]. Moreover, engagement has been associated with improved learning outcomes, study retention, and

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students' academic satisfaction [3]. Therefore, efforts to enhance engagement should be a central focus of instructional strategies in higher education institutions seeking relevance amid social and technological change [4]. Measurement and evaluation of engagement constitute important tools for assessing the effectiveness of curriculum design and teaching practices in achieving contemporary learning objectives.

Conceptually, student engagement is a multidimensional construct encompassing behavioral, affective (emotional), and cognitive dimensions, which together capture students' active participation, emotional investment, and psychological commitment to the learning process [5]. The behavioral dimension refers to active participation in learning activities such as attendance, contribution to discussions, and completion of assignments [6]. The affective dimension includes interest, enthusiasm, and emotional attachment to the subject matter and instructors [7]. The cognitive dimension relates to deep thinking effort, problem-solving strategies, and engagement in metacognitive processes [8]. Several studies also add an agentic aspect that emphasizes students' initiative in shaping their own learning experiences [9].

Student engagement is shaped by multiple interrelated factors, including the quality of academic leadership and instructional practices, the design and delivery of learning approaches, the alignment of curricula with professional and industry demands, the availability and effective use of learning resources and technology, and the extent of social support within peer and institutional environments [10]. Instructors' charismatic leadership can enhance students' motivation and self-confidence through visionary communication and personal attention [11]. The joyful learning approach fosters a pleasurable learning atmosphere that increases intrinsic motivation and active participation [12]. Contextual and relevant curriculum design strengthens the meaningfulness of learning, thereby encouraging greater student involvement [13]. Access to facilities, digital learning materials, and technical support also facilitates student participation across various learning modalities [14].

Charismatic leadership in the context of lecturers or educational administrators refers to an individual's ability to inspire, motivate, and influence students through vision, emotional expression, and authentic action [15]. Charismatic leaders often exhibit persuasive communication, clarity of direction, and the capacity to build strong emotional bonds with students [16]. These characteristics produce identification, commitment, and increased intention to participate among students [17]. In educational settings, charismatic leadership also involves providing support, offering constructive feedback, and cultivating a positive learning culture [18]. Therefore, this form of leadership is regarded as an important factor that strengthens the effectiveness of teaching strategies and academic engagement.

The joyful learning approach or model is a pedagogical framework that emphasizes enjoyable, meaningful learning experiences oriented toward active student participation [19]. This approach integrates elements of play, exploration, and practical activities that stimulate students' intrinsic motivation and creativity [20]. An emotionally safe learning environment and supportive teacher facilitation are prerequisites for the effectiveness of joyful learning activities [21]. In addition to enhancing students' well-being, this approach also increases confidence and readiness for professional roles [22]. Accordingly, a joyful learning approach provides a viable pedagogical pathway for aligning active learning processes with the development of 21st-century competencies.

This study was conducted at Politeknik Pelayaran Sumatera Barat because that maritime vocational institution features a strong practical orientation and a high demand for student engagement in applied learning [23]. The study's urgency stems from the need to understand how instructors' leadership styles and the joyful learning approach can enhance engagement in the maritime education context, which is practical and technology-intensive [24]. Moreover, the role of gender-based expe-

riences as a moderating factor is examined because participation dynamics and learning experiences may differ by sex in vocational settings [25]. The study's novelty lies in its combined focus on charismatic leadership, joyful learning, and gender-based experiences moderation in the under-researched context of a maritime polytechnic [26]. The findings are expected to yield both empirical contributions to the literature and actionable recommendations for the design of instructional strategies and the formulation of academic policies in comparable institutional contexts.

Despite a growing body of research on student engagement, charismatic leadership, and joyful-learning approaches, significant gaps persist in the literature. In particular, there is a paucity of rigorous quantitative evidence from vocational maritime contexts, alongside a limited number of studies that examine these instructional factors concurrently rather than in isolation. This limitation is especially pronounced in practice-oriented and technology-intensive training environments, where hands-on engagement is central and prior research has frequently relied on small-scale or predominantly qualitative samples. Moreover, the moderating role of gender-based experiences in shaping responses to leadership and pedagogical approaches has been underexplored, leaving uncertainty about subgroup differences in vocational contexts. To address these gaps, the present study uses PLS-SEM on a large total sample (n = 368) at Politeknik Pelayaran Sumatera Barat to test the concurrent effects of charismatic leadership and joyful learning on practical-skill engagement and to evaluate gender-based experiences as a formal moderator. The study's novelty, therefore, lies in its integrated empirical model, its focus on maritime vocational education, and its direct implications for designing leadership-informed, joyful instructional strategies that enhance hands-on competence.

In general, this study aims to examine the effects of Charismatic Leadership and the Joyful Learning approach on Student Engagement in learning, with gender-based experiences as a moderating factor. Specifically, these aims are formulated into five hypotheses as follows:

- **Hypothesis 1 (H1)** = Charismatic leadership has a positive and significant effect on student engagement in learning.
- **Hypothesis 2 (H2)** = The joyful learning approach has a positive and significant effect on student engagement in learning.
- **Hypothesis 3 (H3)** = Gender-based experiences have a positive and significant effect on student engagement in learning.
- **Hypothesis 4 (H4)** = Gender-based experiences moderate the effect of charismatic leadership on student engagement in learning.
- **Hypothesis 5 (H5)** = Gender-based experiences moderate the effect of the joyful learning approach on student engagement in learning.

1.1 Theoretical Framework

1.1.1 Leadership

Leadership research is grounded in foundational theoretical frameworks, including Weber's concept of charisma [27], Burns and Bass's transformational leadership theory [28], and broader perspectives on social influence and educational leadership [29]. Collectively, these frameworks explain how leader vision, symbolic action, and relational dynamics shape follower motivation and behaviours.

In vocational higher education, leadership encompasses strategic, instructional, and operational dimensions that influence curriculum–industry alignment, ensure pedagogical rigor in practice-based training, and uphold safety and professional standards in workplace-oriented programs [30]. Within maritime vocational institutions, commonly adopted leadership approaches include transactional (task-oriented), transformational/charismatic (vision-driven and motivational), servant (learner-centered

support), and distributed leadership (shared governance involving instructors and industry partners) [31].

Charismatic leadership is selected in this study due to its emphasis on inspirational communication, emotional resonance, and the modelling of professional values, which are theoretically well suited to fostering student motivation and identification in hands-on, high-stakes training environments. Examining charismatic leadership alongside instructional design enables an assessment of whether leader-driven motivational mechanisms provide additional explanatory power beyond pedagogical approaches within the socio-technical context of maritime vocational education at Politeknik Pelayaran Sumatera Barat.

1.1.2 Joyful Learning

The theoretical foundations of joyful learning draw on constructivist and experiential-learning perspectives together with self-determination and flow theories, which foreground intrinsic motivation, autonomy, and immersive challenge as drivers of sustained engagement [32]. In vocational higher education, joyful learning denotes pedagogies that render authentic, practice-oriented tasks enjoyable and meaningfully challenging, thereby aligning competency development with positive affective states [33]. Typical joyful-learning modalities in maritime vocational contexts include simulation-based exercises, scenario-driven drills, gamified assessments, project-based / problem-based learning, and collaborative workshops that replicate shipboard operations [34]. These modalities are designed to reduce anxiety, increase confidence, and foster sustained participation by embedding timely feedback, reflection, and opportunities for mastery within realistic professional tasks [35]. Operationalizing joyful learning in this study, therefore, captures a set of instructional strategies expected to enhance intrinsic motivation and hands-on engagement critical for seafaring competence.

1.1.3 Learning Engagement

Learning engagement is supported by multidimensional theoretical frameworks that integrate behavioral, emotional, cognitive, and agentic components, as articulated in foundational work by Fredricks et al. and by proponents of self-determination theory [36]. Within vocational higher education, engagement refers to the extent to which learners actively participate in practical training, invest cognitive effort in problem solving, and exhibit emotional commitment to professional development [37].

Expected manifestations of student engagement in maritime vocational programs include consistent participation in simulator and onboard training activities, consistent adherence to safety protocols, proactive collaboration and help-seeking behaviors, and persistence in the acquisition and mastery of technical competencies [38]. These manifestations reflect both surface-level performance behaviors (attendance, task completion) and deeper indicators of learning, such as metacognitive strategy use and agentic contributions to the learning environment [39]. Consequently, measurement of engagement in this context requires instruments sensitive to hands-on behaviors, affective attachments to practice, and cognitive strategies that support durable skill acquisition.

1.1.4 Gender-Based Experiences

The concept of gender-based experiences is informed by gender schema theory, social role theory, and intersectional perspectives, which emphasize how societal norms and institutional practices shape differential opportunities, identities, and expectations [40]. In vocational higher education, gender-based experiences include students' perceptions of inclusivity, differential treatment by instructors or peers, access to practical tasks and mentoring, and the internalization of gendered beliefs about technical competence [41].

Common gendered experiences in maritime vocational settings comprise biased task allocation, reduced sense of belonging among women, safety- or privacy-related concerns during practical exercises, and unequal access to informal professional networks [42]. Gender-based experiences were chosen as a moderator because maritime training remains male-dominated, and such socialized experiences may condition how students respond to leadership cues and joyful-learning interventions [43]. Explicitly measuring gender-based experiences, therefore, enables the study to assess whether structural and perceptual factors amplify or attenuate the effectiveness of instructional and leadership strategies in promoting engagement.

2. Methods

This study employed a quantitative causal-comparative design with path analysis based on Partial Least Squares Structural Equation Modeling (PLS-SEM) [44]. The analysis aimed to examine the effects of Charismatic Leadership and the Joyful Learning approach on Student Engagement, and to assess the moderating role of gender-based experiences on the influence of these two exogenous variables on the endogenous variable.

The research instrument was a closed-ended questionnaire using a five-point Likert scale (1 = Strongly disagree to 5 = Strongly agree) [45]. The questionnaire comprised four latent constructs: Charismatic Leadership (CL) (5 indicators), Joyful Learning (JL) (5 indicators), Student Engagement (SE) (5 indicators), and Gender-based experiences (GBE) (5 indicators), for a total of 20 items. Items were developed from a literature review and theories relevant to each variable and were adapted to the context of students at Politeknik Pelayaran Sumatera Barat. The questionnaire blueprint is presented in Table 1.

Table 1. Research Questionnaire

Variable	Indicator	Code
Charismatic Leadership (X1)		
	Inspiring vision	CL1
	Persuasive and enthusiastic communication	CL2
	Emotional expression and personal magnetism	CL3
	Ability to motivate and empower	CL4
	Building trust and interpersonal relationships	CL5
Joyful Learning (X2)(Jensen & Lykke, 2022 [21]; Li & Kangas, 2024 [12])		
	Enjoyable, play-based learning activities	JL1
	Practical/experiential learning	JL2
	A safe, creative classroom atmosphere that supports exploration	JL3
	The teacher's role as facilitator/scaffolding	JL4
	Relevance and enhancement of confidence / professional assurance	JL5
Student Engagement (Y)(Heilporn et al., 2024 [36]; Assefa et al., 2025 [46])		
	Behavioral participation	SE1
	Compliance and task consistency	SE2
	Emotional/affective attachment	SE3
	Cognitive engagement (deepening)	SE4
	Agentic / initiative in learning	SE5
Gender-Based Experiences (M)		
	Influence of gender on active participation	GBE1
	Differential treatment by instructors according to gender	GBE2
	Influence of gender on comfort in joyful learning activities	GBE3
	Access and support for learning practices	GBE4

	Influence of gender norms on academic self-confidence	GBE5

Source: Research Instrument (2026)

The study population comprised students enrolled at Politeknik Pelayaran Sumatera Barat during the 2025/2026 academic year. The main sample consisted of 368 students from the Nautical, Nautical Technology, and Sea Transportation programs, selected using a total sampling approach [47].

For instrument development, a pilot sample of 60 trainees (ANT III and ATT III) participating in professional development courses at the polytechnic in 2026 was employed to evaluate content validity, preliminary reliability, and item clarity [48]. Questionnaire items were derived from an extensive review of validated scales and theoretical constructs related to charismatic leadership, joyful learning, student engagement, and gender-based experiences, and were subsequently adapted to the maritime vocational context.

Content and face validity were established through expert review involving maritime educators, a measurement specialist, and experienced lecturers, who assessed item relevance, clarity, and representativeness, and provided item-level revisions. The pilot test (n = 60) further examined item clarity and internal consistency; items exhibiting ambiguous wording or low item–total correlations were revised or removed prior to the main data collection.

Data were collected using a structured survey administered online (Google Forms) during the period specified by the researchers [49]. Respondents received an explanation of the study's purpose, assurances of confidentiality, and an informed-consent statement [50]. Data collection continued until the target sample size (n = 368) was reached, after which the data were imported into SmartPLS 3 for analysis. In the full sample, measurement quality was evaluated using PLS-SEM by examining indicator outer loadings, composite reliability (CR), and average variance extracted (AVE), while discriminant validity was assessed with the Fornell–Larcker criterion and HTMT ratios [44]. Collectively, these procedures, including theoretical grounding in the literature, expert validation, pilot testing and refinement, and subsequent statistical evaluation, ensured that the final 20-item instrument demonstrated satisfactory levels of content validity, internal consistency, convergent validity, and discriminant validity for use in the study.

3. Results and Discussion

3.1 Results

The presentation of the results is organized into three main sections: (1) tests of instrument validity and reliability to ensure the appropriateness of measurement indicators; (2) respondent characteristics that describe the sample; and (3) data analysis using SEM–PLS to examine causal relationships and moderation effects.

3.1.1 Validity and Reliability Tests of the Instrument

The instrument pilot test was conducted with 60 respondents who were not included in the main sample; the critical Product-Moment r value at a significance level of $\alpha = 0.05$ for $n = 60$ ($df = n-2$) is 0.2542. The validity criterion employed in this study stipulates that an item is considered valid when its correlation coefficient ($r_{\text{calculated}}$) is greater than or equal to the critical value (r_{table}) at a significance level of $\alpha = 0.05$. The reliability criterion was that a construct is considered reliable when Cronbach's Alpha ≥ 0.70. Validity and reliability tests in this study were performed using SPSS 24.0. The results of the validity and reliability tests are shown in Table 2.

Table 2. Hasil Uji Validitas dan Reliabilitas Instrumen

Variabel	Indikator	r-hitung	Keterangan	Cronbach's Alpha	Keterangan
Kepemimpinan Karismatik (X1)	CL1	0,772	Valid	0,958	Reliabel
	CL2	0,847	Valid	0,957	Reliabel
	CL3	0,776	Valid	0,958	Reliabel
	CL4	0,519	Valid	0,961	Reliabel
	CL5	0,855	Valid	0,957	Reliabel
Pembelajaran Menyenangkan (X2)	JL1	0,840	Valid	0,957	Reliabel
	JL2	0,805	Valid	0,958	Reliabel
	JL3	0,842	Valid	0,957	Reliabel
	JL4	0,808	Valid	0,957	Reliabel
	JL5	0,314	Valid	0,964	Reliabel
Keterlibatan Siswa (Y)	SE1	0,845	Valid	0,957	Reliabel
	SE2	0,842	Valid	0,957	Reliabel
	SE3	0,814	Valid	0,957	Reliabel
	SE4	0,879	Valid	0,957	Reliabel
	SE5	0,840	Valid	0,957	Reliabel
Pengalaman Berbasis Gender (M)	G1	0,603	Valid	0,960	Reliabel
	G2	0,702	Valid	0,959	Reliabel
	G3	0,825	Valid	0,957	Reliabel
	G4	0,772	Valid	0,958	Reliabel
	G5	0,256	Valid	0,965	Reliabel

Sumber: Hasil analisis SPSS (2026)

Based on Table 2, all instrument items show $r_{\text{calculated}} \geq 0.2542$, so every item is declared valid at $\alpha = 0.05$. Cronbach's Alpha coefficients for each construct are also very satisfactory (≥ 0.957), indicating high internal consistency and that the instrument can be considered reliable. Accordingly, the research instrument is suitable for primary data collection and for subsequent SEM–PLS analysis.

3.1.2 Respondent Characteristics

The respondents' demographic distribution is presented by gender-based experiences, cohort (batch), study program, semester level, and competence level. Frequency and percentage details for each category are provided in Table 3.

Table 3. Respondents Demography

Characteristics	Category	Frequency (n)	Percentage (%)
Gender	Male	305	82,88
	Female	63	17,12
Batch	VII	70	19,02
	IX	118	32,06
	X	180	48,92
Study Program	Nautical	105	28,53
	Technology Nautical	80	21,74
	Sea Transportation	183	49,73
Semester	2nd	180	48,92
	4th	118	32,06
	6th	30	8,15
	8th	40	10,87
Competence Level	ANT III (D-III)	105	28,53
	ATT III (D-III)	80	21,74
	D-IV	183	49,73

TOTAL	**368**	**100**

Sumber: Respondent Data 2026

According to the data in Table 3, of the 368 respondents, the majority are male (305; 82.88%) and only 63 are female (17.12%). The largest cohort is X (180; 48.92%), and the largest study program is Sea Transportation (183; 49.73%). Most respondents are in the 2nd semester (180; 48.92%), and nearly half of the respondents hold D-IV competence level (183; 49.73%).

3.1.3 Data Analysis

Before testing the structural model, the PLS algorithm was run, and outer loadings were inspected. Outer loadings indicate how strongly each indicator reflects its latent construct and thus provide an initial check on indicator reliability and convergent validity. In practice, indicators with higher loadings are taken to measure the intended construct well; loadings are expected to meet common thresholds (generally 0.50–0.70). The outer loading values are reported in Table 4.

Table 4. Outer Loading Result

Indicator	Charismatic Leadership (X1)	Joyful Learning (X2)	Student Engagement (Y)	Gender-Based Experiences (M)
CL1	0,945			
CL2	0,880			
CL3	0,859			
CL4	0,940			
CL5	0,875			
JL1		0,905		
JL2		0,898		
JL3		0,876		
JL4		0,866		
JL5		0,873		
SE1			0,930	
SE2			0,765	
SE3			0,890	
SE4			0,882	
SE5			0,866	
GBE1				0,707
GBE2				0,757
GBE3				0,881
GBE4				0,830
GBE5				0,833

Source: SEM-PLS Result Analysis

As shown in Table 4, all indicators exhibit high outer loadings, ranging from 0.707 (G1) to 0.945 (CL1), thereby exceeding the recommended threshold (0.50–0.70). This indicates satisfactory indicator reliability and supports the convergent validity of each reflective construct examined. Consequently, no indicators needed to be removed at this stage, and all items were retained for subsequent analyses. The subsequent analytical step involved computing composite reliability and average variance extracted (AVE) for each construct, followed by an assessment of discriminant validity before the evaluation of the structural model and hypothesis testing. The resulting composite reliability and AVE values are presented in Table 5.

Table 5. Reliability & Validity Result

Parameter	Cronbach's Alpha	Rho_A	Composite Reliability	Average Variance Extracted (AVE)
Charismatic Leadership (X1)	0.941	0.943	0.955	0.811
Gender-Based Experiences (M)	0.863	0.885	0.901	0.646
Joyful Learning (X2)	0.930	0.932	0.947	0.781
Moderating Effect 1	0.989	1.000	0.989	0.788
Moderating Effect 2	0.991	1.000	0.992	0.829
Student Engagement (Y)	0.918	0.927	0.939	0.754

Source: SEM-PLS Result Analysis

Table 5 shows that all constructs demonstrate very good reliability and convergent validity: Cronbach's Alpha and rho_A exceed the 0.70 threshold, composite reliability values are all > 0.90, and AVE values are all > 0.60. These conditions indicate that the indicators are internally consistent and explain a sufficient portion of each construct's variance to meet the requirements for reliability and convergent validity. Notably, the moderation constructs show very high reliability, indicating the stability of the formed interaction indicators. In addition, the Common Method Bias (CMB) can be seen from the collinearity diagnostics by the VIF result. If VIF < 5, it indicates that CMB is unlikely [**ref53**], so these findings are likely driven by method effects.

Table 6. Collinearity Statistics (VIF)

Indicator	VIF Charismatic Leadership (X1)	VIF Joyful Learning (X2)	VIF Student Engagement (Y)	VIF Gender-Based Experiences (M)
CL1	3.847			
CL2	3.105			
CL3	2.760			
CL4	3.162			
CL5	2.732			
JL1		3.711		
JL2		3.703		
JL3		3.030		
JL4		2.760		
JL5		2.772		
SE1			4.525	
SE2			1.883	
SE3			3.179	
SE4			2.998	
SE5			2.644	
GBE1				1.615
GBE2				1.750
GBE3				2.766
GBE4				2.207
GBE5				1.958

Source: SEM-PLS Result Analysis

Based on Table 6, all indicator VIF values for the four constructs are below the critical threshold of 5 (range: 1.615–4.525), indicating no serious multicollinearity among the indicators. Consequently, the risk of common method bias (CMB) in these data is minimal, and the results are unlikely to be attributable to method effects; thus, interpretations of the relationships among variables can be regarded as methodologically valid. Then, an inner-model analysis was conducted by inspecting R^2 to evaluate whether the structural relationships provide

meaningful explanatory power and to compare or assess model improvement. R-Square values are reported in Table 7.

Table 7. R-Square Result

Variable	R Square	R Square Adjusted
Student Engagement (Y)	0.908	0.906

Source: SEM-PLS Result Analysis

As shown in Table 7, the R-Square result indicates that the model explains 90.8% of the variance in Student Engagement (R^2 = 0.908), meaning that the exogenous variables in this study, including charismatic leadership, joyful learning, and their interaction effects with gender-based experiences, have very strong explanatory power with respect to student engagement. The adjusted R-Square (0.906) is nearly identical, suggesting that adding predictors did not result in substantial overfitting and that the model remains stable after correction for the number of predictors. The remaining ~ 9.2% of variance is unexplained by the model and may be attributable to variables not included in the analysis or to measurement error. However, this magnitude may partly reflect sample-specific characteristics, measurement overlap, or common-method variance, or model overfitting, and therefore requires replication with independent or more balanced samples and alternative designs to confirm generalizability. The F-Square values are presented in Table 8.

Table 8. F-Square Result

Variable	Student Engagement (Y)
Charismatic Leadership (X1)	0.017
Gender-Based Experiences (M)	0.068
Joyful Learning (X2)	0.758
Moderating Effect 1	0.020
Moderating Effect 2	0.000

Source: SEM-PLS Result Analysis

F-square (f^2) values show each predictor's contribution to the explained variance (R^2) of Student Engagement: Joyful Learning has a very large effect (f^2 = 0.758), Gender a small effect (f^2 = 0.068), Charismatic Leadership a negligible effect (f^2 = 0.017), Moderating Effect 1 a marginal/small effect (f^2 = 0.020), and Moderating Effect 2 essentially no effect (f^2 = 0.000). Thus, Joyful Learning is the primary driver of Student Engagement in this model, while Charismatic Leadership and the moderators add little practical explanatory power, and Gender contributes only modestly. Then, the predictive relevance (Q^2) can be seen in Table 9

Table 9. Construct Cross-validated Redundancy

Variable	Q^2 (=1-SSE/SSO)
Student Engagement (Y)	0.670

Source: SEM-PLS Result Analysis

Based on Table 8, the construct cross-validated redundancy (Q^2 = 1 − SSE/SSO) for Student Engagement is 0.670, indicating substantial predictive relevance of the model for this endogenous construct. Given that Q^2 values above zero indicate predictive relevance and conventional benchmarks (e.g., 0.35) denote a large effect, a Q^2 of 0.670 demonstrates very strong out-of-sample predictive capability for Student Engagement. The Model fit (Standardized Root Mean Square residual / SRMR) can be seen in Table 10.

Table 10. Model-Fit Result

Parameter	Saturated Model	Estimated Model
SRMR	0.079	0.078

Source: SEM-PLS Result Analysis

As shown in Table 10, Table 10 reports SRMR values of 0.079 (saturated) and 0.078 (estimated), which meet conventional fit criteria (≤ 0.08) as suggested by Hu and Bentler (1999). Consequently, the model can be considered to fit the data well, with limited evidence of misspecification. The recommended next step is to assess discriminant validity before evaluating the structural model and testing hypotheses. The Heterotrait-Monotrait Ratio (HTMT) result can be seen in Table 11.

Table 11. Heterotrait-Monotrait Ratio (HTMT)

Variable	Charismatic Leadership (X1)	Gender-Based Experiences (M)	Joyful Learning (X2)	Moderating Effect 1	Moderating Effect 2	Student Engagement (Y)
Charismatic Leadership (X1)						
Gender-Based Experiences (M)	0.752					
Joyful Learning (X2)	0.821	0.845				
Moderating Effect 1	0.751	0.655	0.728			
Moderating Effect 2	0.692	0.667	0.750	0.813		
Student Engagement (Y)	0.833	0.846	0.800	0.768	0.770	

Source: SEM-PLS Result Analysis

Based on Table 11, most HTMT ratios are below the conservative threshold of 0.85 (range: 0.655–0.846), indicating generally acceptable discriminant validity across the constructs. Then, the discriminant validity results from Fornell-Larcker are displayed in Table 12.

Table 12. Fornell-Larcker Result

Variable	Charismatic Leadership (X1)	Joyful Learning (X2)	Student Engagement (Y)	Gender-Based Experiences (M)
Charismatic Leadership (X1)	**0.900**			
Joyful Learning (X2)	0.780	**0.878**		
Student Engagement (Y)	0.772	0.868	**0.884**	
Gender-Based Experiences (M)	0.699	0.804	0.842	**0.868**

Source: SEM-PLS Result Analysis

According to the Fornell–Larcker criterion in Table 12, the square roots of AVE (diagonal) for each construct; Charismatic Leadership = 0.900, Joyful Learning = 0.878, Student Engagement = 0.884, and Gender-based experiences = 0.868, are greater than the corresponding inter-construct correlations. Therefore, discriminant validity is satisfied for all four constructs in this model. The path model clearly represents the hypothesized structure and displays statistical evidence supporting the proposed theoretical relationships. Figure **??** presents the study's path model.

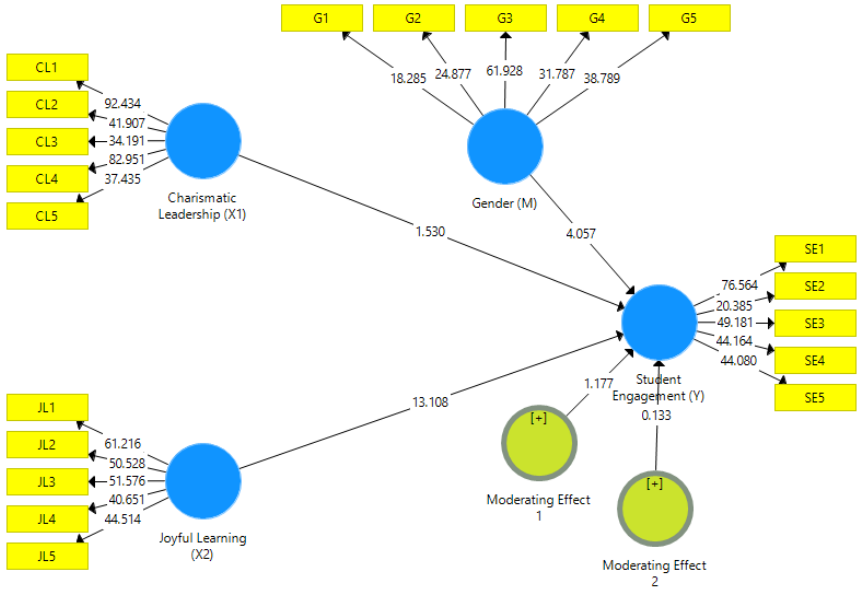

Figure 1. Path Model.

The bootstrap plot displays indicator loadings for each construct and the latent-variable path coefficients obtained from the PLS analysis. At the measurement level, several indicators show large contributions to their constructs (e.g., CL1 = 92.434; SE1 = 76.564; JL1 = 61.216), which indicates adequate indicator quality for measurement. At the structural level, the numeric path coefficients indicate that Joyful Learning has the largest effect on Student Engagement (13.108), followed by the direct effect of Charismatic Leadership on Student Engagement (1.530) and the effect of gender-based experiences on Student Engagement (4.057).

The two moderation effects (interaction products) display relatively small values (approximately 1.177 and 0.133), which numerically suggest weak to modest moderation of the X on Y relationships by gender-based experiences. To determine the statistical significance of these relationships, t-statistics or p-values from the bootstrap must be examined. Table 13 presents the hypothesis testing results.

Table 13. Hypotheses Testing

Hypothesis	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
CL → SE	0.069	0.079	0.045	1.530	0.127
JL → SE	0.655	0.647	0.050	13.108	0.000
GBE → SE	0.166	0.165	0.041	4.057	0.000
GBE × CL → SE	-0.062	-0.074	0.053	1.177	0.240
GBE × JL → SE	-0.007	0.006	0.052	0.133	0.894

Source: SEM-PLS Result Analysis

Based on Table 13 and the significance criterion $\alpha = 0.05$ ($p < 0.05$), the hypothesis tests can be summarized as follows:

- **Hypothesis H1** is rejected because the coefficient for Charismatic Leadership on Student Engagement is positive but not statistically significant ($O = 0.069$; $t = 1.530$; $p = 0.127$).
- **Hypothesis H2** is accepted: the Joyful Learning approach has a large, positive, and statistically significant effect on Student Engagement ($O = 0.655$; $t = 13.108$; $p = 0.000$).

- **Hypothesis H3** is also accepted because the direct effect of Gender-based experiences on Student Engagement is positive and significant ($O = 0.166$; $t = 4.057$; $p = 0.000$).

For moderation, H4 and H5 are rejected because both interaction effects are not significant (GBE × CL → SE: $O = -0.062$; $t = 1.177$; $p = 0.240$; GBE × JL → SE: $O = -0.007$; $t = 0.133$; $p = 0.894$), indicating that gender-based experiences do not moderate the relationships between charismatic leadership or joyful learning and student engagement. The practical implication is that joyful learning is the primary predictor of student engagement, charismatic leadership has a weak effect, and gender-based experiences influence engagement directly but do not alter the strength of the X on Y relationships.

From the path coefficients and t-statistics results above, it can be stated that path coefficients reported in the structural model are standardized estimates (β) and indicate the strength and direction of the relationships between constructs. Statistical significance of each path was evaluated using nonparametric bootstrapping with 5,000 resamples (two-tailed test). These findings report bootstrapped t-statistics, *p*-values, and 95% bias-corrected confidence intervals (CI) for each path. A path is considered statistically significant if the bootstrapped t-statistic exceeds the critical value for a two-tailed test ($|t| > 1.96$ for $p < 0.05$) or if the 95% CI does not include zero. Because statistical significance alone can be misleading, this research also reports standardized path coefficients (β) to convey magnitude and direction, and effect sizes (f^2) and confidence intervals to convey practical importance.

3.2 Discussion

Hypothesis H1 was rejected despite the positive coefficient for Charismatic Leadership because its effect on student engagement did not reach statistical significance; this may be attributable to the dominance of other factors, limitations in the measurement of the leadership construct, or the maritime institutional context that minimizes the impact of individual leadership on daily academic life [51]. This finding aligns with several studies reporting weak or inconsistent leadership effects on student engagement when methodological and contextual conditions differ [52]. However, contrary to studies that report a significant effect of charismatic leaders, discrepancies may arise from differences in sample composition, measurement instruments, or omitted mediating variables [53]. Therefore, future research is recommended to apply more in-depth leadership measurement, including mediators such as academic motivation or organizational climate, and adopt longitudinal or qualitative designs to capture the dynamics of leadership effects [54]. In addition, a more balanced sample and multi-group tests could help determine whether leadership effects vary across student subgroups [55].

Hypothesis H2 was supported, indicating that the Joyful Learning approach has a positive and significant effect on student engagement because enjoyable instructional methods enhance motivation, attention, and active participation, key factors in building academic engagement, particularly in vocational contexts that require practical skills [56]. This result is consistent with previous studies showing that engaging and relevant instructional design increases both student engagement and learning outcomes [57]. Differences with some studies that report smaller effects may be due to variation in the quality of Joyful Learning implementation, instructor competence, or the characteristics of the courses examined [58]. For future research, intervention studies (experimental or quasi-experimental) are recommended to test causality, systematically measure the quality of Joyful Learning implementation, and explore mediators such as learning interest or self-efficacy [59]. Moreover, extending the sample to other institutions and to different courses would help assess the generalizability of the findings [60].

Hypothesis H3 was supported because the direct effect of Gender-based experiences on Student Engagement was positive and significant, indicating a difference in mean engagement between gender-based experiences within this sample, a phenomenon that may be related to sociocultural differences, learning preferences, or gender-based experiences representation in the maritime environment [61]. This finding is consistent with several studies that have found gender-based differences in engagement, where one group tends to participate more [62]. However, differing results in other research, where no gender-based experience differences or opposite patterns have been observed, may stem from specific contextual factors (such as male dominance in maritime institutions), sample size, or differential control of confounding variables [63]. Recommendations for future studies include multi-group analyses to compare structural paths across gender-based experiences, collection of qualitative data to understand underlying mechanisms, and control of additional variables such as

field practice experience or social support [64]. Furthermore, researchers should consider using more nuanced measures of gender (e.g., gender identity or social roles) to capture the complexity of its influence [65].

Hypothesis 4 was rejected because the interaction effect of Charismatic Leadership on Student Engagement, as moderated by gender-based experiences, was not significant; this indicates that gender-based experiences do not moderate the relationship between charismatic leadership and student engagement in this sample. Possible explanations include a leadership effect that is relatively uniform across genders or limited statistical power to detect interaction effects [66].

This result parallels studies reporting no gender-based experience moderation in the relationship between leadership and educational outcomes when contextual or organizational cultures promote equal treatment of all students [67]. Conversely, studies that report gender-based experiences moderation may differ due to the method of forming interaction variables (indicator product versus multi-group), unbalanced gender-based experiences distribution, or uncontrolled mediators [68]. For future research, the use of multi-group analysis as an alternative test of moderation, increasing sample size to strengthen power, and considering other contextual moderators (e.g., work experience, instructional role) are advised [69]. It is also recommended to refine moderator measurement (e.g., continuous variables or role-based gender scales) to better capture moderation nuances [70].

Hypothesis 5 was rejected because the interaction between the Joyful Learning approach and Student Engagement, as moderated by gender-based experiences, was not significant, meaning that the effect of Joyful Learning on student engagement did not differ meaningfully between gender-based experiences groups in this study. This outcome may be explained by the general effectiveness of enjoyable instructional approaches across genders, or by limited sample size and gender-based experiences imbalance, reducing the ability to detect moderation [71].

The finding is consistent with studies showing that certain instructional methods are effective across gender-based experiences, while it contrasts with research that reports gender-specific responses to pedagogical approaches [72]. Inter-study differences can be attributed to contextual variation, the quality of Joyful Learning implementation, or differences in how moderation effects are measured [73]. Future research should test moderation using richer gender-based experiences measures, conduct multi-group tests to examine pathway differences, and explore alternative moderators such as learning styles, intrinsic motivation, or learning-environment support [74]. Additionally, experimental studies that manipulate elements of Joyful Learning could help determine whether and how effects differ among student subpopulations [75].

The exceptionally high R^2 for Student Engagement ($R^2 = 0.908$; adjusted $R^2 = 0.906$) suggests substantial explanatory power but also requires a cautious and critical interpretation. Such a large in-sample explained variance can reflect a genuinely strong model, yet it may alternatively signal overfitting, multicollinearity among predictors, or inflation due to common method variance, given the cross-sectional self-report design; therefore, the finding should not be taken as definitive evidence of causal completeness. To address these concerns, this finding notes the need for robustness checks (e.g., effect size (f^2), predictive relevance (Q^2), model fit (SRMR), and HTMT ratio). Limitations are also strengthened by explicitly acknowledging potential omitted predictors (e.g., prior achievement, intrinsic motivation, classroom climate, and teacher effects), the study's cross-sectional design that precludes causal inference, and the sample's contextual specificity which may limit generalizability; accordingly, recommendations for future research include longitudinal or experimental designs, external validation with independent samples, and inclusion of additional theoretically relevant covariates to confirm whether the high explained variance persists under more stringent tests.

4. Conclusion

This study at Politeknik Pelayaran Sumatera Barat demonstrates that a joyful learning approach exerts a strong positive effect on student engagement, whereas charismatic leadership exhibits a limited direct effect. This pattern contributes to the refinement of student engagement theory by emphasizing the primacy of pedagogical design—particularly experiential and practice-oriented learning mechanisms that foster intrinsic motivation—over leader charisma within vocational maritime education contexts. Theoretically, the findings encourage integration of instructional and leadership perspectives by suggesting that leadership effects may operate indirectly (e.g., via classroom climate or teacher facilitation) rather than as primary drivers of hands-on engage-

ment. Practically, curriculum designers and maritime educators should embed joyful, simulation-based and problem/project-based activities into course syllabi, align assessment with authentic performance tasks, and invest in instructor professional development to operationalize joyful pedagogy. At the policy level, vocational education authorities should incorporate standards and funding for simulation facilities, mandate training in maritime pedagogy, require monitoring of implementation fidelity, and promote gender-equity initiatives to ensure inclusive access to practical learning. Finally, given the very high explained variance, these implications should be pursued alongside methodological replication using multi-source, multi-group, or longitudinal designs to confirm generalizability.

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