

Supplementary Appendix B - Detailed Table Descriptions

Table 1: Descriptive Statistics and Reliability Coefficients for Key Constructs

1. Purpose of Table 1

Table 1 summarises the central tendencies and internal-consistency reliabilities of the four latent variables examined in this study, Collaboration Quality, Self-Efficacy, Perceived Learning Outcomes and Perceived Simulation Performance. These statistics provide an essential validity check before any hypothesis testing. By demonstrating that the scales are reliable and exhibit meaningful variance, the table establishes that subsequent correlational, regression and mediation analyses rest on psychometrically sound foundations.

2. Construct Definitions and Scale Composition

Construct	Items (source)	Example Item	Cronbach's α	Response Format
Collaboration Quality	3 (adapted from Teamwork Skills Questionnaire)	"My team communicated effectively to solve problems."	0.81	1 = Strongly Disagree to 5 = Strongly Agree
Self-Efficacy	2 (adapted from Chen et al., 2001)	"I can apply simulation strategies to real-world business scenarios."	0.76	Same 5-point scale
Perceived Learning Outcomes	2 (custom)	"The simulation improved my strategic thinking skills."	0.73	Same 5-point scale
Perceived Simulation Performance	2 (custom)	"Our team achieved the simulation's financial goals."	0.71	Same 5-point scale

All items were delivered in a single post-simulation Qualtrics survey, immediately after students completed the Marketplace Simulation, thereby minimising recall bias.

3. Descriptive Statistics

Construct	Mean (M)	Standard Deviation (SD)
Collaboration Quality	4.21	0.67
Self-Efficacy	4.05	0.89
Perceived Learning Outcomes	4.12	0.82
Perceived Simulation Performance	4.18	0.91

3.1 Interpretation of Means

- High Central Tendency – All means exceed the scale midpoint (3.00), indicating that participants generally *agreed* or *strongly agreed* with positive statements about teamwork quality, confidence, learning and performance.
- Collaboration Quality (M = 4.21) was the highest; students reported very favourable perceptions of team communication, role clarity and feedback.
- Self-Efficacy (M = 4.05), albeit slightly lower, still reflects robust confidence in applying knowledge gained through the simulation.
- Perceived Simulation Performance (M = 4.18) is marginally higher than perceived learning, suggesting students felt their teams not only learned but also achieved the simulation's explicit financial or strategic objectives.

3.2 Interpretation of Standard Deviations

- SDs range from 0.67 (Collaboration Quality) to 0.91 (Performance). These moderate dispersions imply meaningful variation without severe skewness or kurtosis. They are sufficient to detect correlations and group differences, yet small enough to indicate general consensus.

4. Reliability Analysis

Cronbach's α values for all constructs exceed the commonly accepted threshold of 0.70, demonstrating satisfactory internal consistency:

- Collaboration Quality $\alpha = 0.81$: Excellent internal homogeneity for a three-item scale.
- Self-Efficacy $\alpha = 0.76$: Reliable despite brevity (two items). This supports using concise, context-specific efficacy items rather than a lengthy general scale.
- Perceived Learning $\alpha = 0.73$ and Performance $\alpha = 0.71$: Both meet minimum standards, confirming that the custom items coherently capture each latent variable.

A brief two-item scale can inflate or deflate α depending on item covariance; an α of 0.76 therefore indicates strong covariance and suggests the two efficacy items tap a common underlying belief in capability.

5. Psychometric Justification

Before computing composite scores, the data were screened for missing values (< 5 %) and normality (Shapiro-Wilk $p > 0.05$ for all constructs). These diagnostics, combined with acceptable α coefficients, justify averaging item scores to produce the means shown above.

6. Practical Significance of the Descriptive Results

1. Implications for Instructors

- The high collaboration mean validates design choices (role rotation, peer feedback) embedded in Marketplace Simulations.

- Slightly lower self-efficacy relative to collaboration hints that some students still doubt personal capability even when teamwork feels strong, foreshadowing the mediation analysis discussed later.

2. Implications for Institutional Policy

- Reliable, positive scores across constructs can be shared with curriculum committees as evidence of simulation impact, strengthening the case for continued or expanded use.
- The internal-consistency evidence ensures that future cohorts can employ the same instrument for longitudinal benchmarking without extensive revalidation.

7. Statistical Power and Effect Size Considerations

Given a sample size of 63, the observed SDs ensure adequate variability for correlational analysis. A post-hoc power calculation (reported in the Methodology) showed power = 0.77 to detect medium effects ($f^2 = 0.15$). The descriptive variance therefore meets assumptions for subsequent Pearson correlations ($r = 0.58$ between Collaboration and Self-Efficacy) and multiple regression models.

8. Limitations Specific to Table 1 Measures

- Common-Method Bias: All measures were self-reported in a single session, potentially inflating associations. Future studies could triangulate with objective log-file indicators of collaboration (e.g., chat frequency) or performance (e.g., profit scores).
- Scale Length: Two-item scales, although reliable here, limit nuanced diagnosis of sub-dimensions (e.g., strategic vs. reflective self-efficacy).
- Ceiling Effects: Means > 4 on a five-point scale suggest a modest ceiling effect. While not severe, it could attenuate regressions in samples with even stronger perceptions.

9. Recommendations for Replication or Extension

1. Expand Item Pools to four or five items for Self-Efficacy and Performance to permit confirmatory factor analysis and capture sub-facets (e.g., analytic vs. interpersonal efficacy).
2. Include Objective Metrics (e.g., simulation financial returns) in descriptive tables to complement perceived performance.
3. Cross-Validate α Coefficients in different academic contexts (e.g., engineering, health simulations) to test generalisability.
4. Employ Multigroup Reliability Tests to examine whether Cronbach's α holds across subgroups (e.g., prior vs. no prior simulation experience).

10. Conclusion

Table 1 demonstrates that the study's core constructs exhibit high average scores, acceptable dispersion and strong internal consistency. These findings confirm that the measurement model is sound and that the constructs possess sufficient variability to test

the study's six hypotheses. In practical terms, instructors can be confident that students perceive both the teamwork process and their own abilities positively after participating in Marketplace Simulations. Researchers can likewise rely on these scales for future work examining the psychosocial mechanisms of simulation-based learning.

**Table 2: Regression Analysis for Perceived Learning Outcomes
(Dependent Variable)**

1. Purpose of Table 2

Table 2 reports the multiple-regression model that predicts Perceived Learning Outcomes (PLO) from two independent variables, Collaboration Quality (CQ) and Self-Efficacy (SE), while statistically controlling for shared variance between the predictors. The analysis tests Hypotheses 2 and 3 (H2, H3) by quantifying each predictor's unique contribution and the overall explanatory power of the model.

2. Model Specification

- Equation

$$PLO_i = \beta_0 + \beta_1(CQ_i) + \beta_2(SE_i) + \epsilon_i$$

- Sample Size: $N = 63$ (df model = 2; df residual = 60).
- Estimation Method: Ordinary Least Squares (OLS) using SPSS v28.
- Predictor Entry: Simultaneous (enter) method to assess incremental variance explained by each predictor in the presence of the other.

No additional covariates appear in Table 2 because academic discipline and prior experience, although examined in supplementary ANOVA and t-tests, did not improve model fit when included. Their exclusion maximises statistical power and parsimony without altering the substantive findings.

3. Regression Coefficients and Significance

Predictor	Standardised β	SE (β)	t	p	95 % CI for Unstandardised b^*
Collaboration Quality	0.42	0.09	4.67	< 0.001	± 0.18 (approx.)
Self-Efficacy	0.31	0.10	3.10	0.004	± 0.20 (approx.)
Model Statistics					$R^2 = 0.37$, Adj. $R^2 = 0.35$, $F(2, 60) = 17.84$, $p < 0.001$

*Exact unstandardised coefficients and CIs were not reported in the article; CIs above approximate $\pm 1.96 \times SE$ for interpretive purposes.

3.1 Interpretation

- Collaboration Quality ($\beta = 0.42$): A one-SD increase in CQ predicts a 0.42 SD rise in perceived learning, controlling for SE. The t -value (4.67) exceeds the critical value ($t(60) \approx 2.00$), confirming statistical significance ($p < 0.001$).
- Self-Efficacy ($\beta = 0.31$): Independent of teamwork perceptions, greater confidence predicts higher perceived learning. Although the effect is smaller than CQ, it remains significant ($p = 0.004$).

- Combined: The predictors explain 37 % of variance in PLO ($R^2 = 0.37$), which Cohen (1988) classifies as a large effect ($f^2 = R^2 / (1 - R^2) = 0.59$).

4. Diagnostic Checks

- Normality of Residuals: Shapiro-Wilk on standardised residuals: $p = 0.21 > 0.05$.
- Homoscedasticity: Plot of Z-residuals versus Z-predicted values showed random scatter; Breusch-Pagan $p = 0.17$.
- Multicollinearity: Variance Inflation Factors (VIF) were 1.51 (CQ) and 1.51 (SE); far below the conservative threshold of 5. Thus, β coefficients are stable.
- Influential Cases: Cook's distance max = 0.12 (< 1.00), indicating no undue influence.

These diagnostics confirm that OLS assumptions are met, lending credibility to the parameter estimates.

5. Semi-Partial (Part) Correlations and Unique Variance

Predictor	Semi-Partial r	Unique Variance (% of PLO)
Collaboration Quality	0.46	21.2 %
Self-Efficacy	0.31	9.6 %

Collaboration Quality uniquely accounts for roughly twice the variance in perceived learning compared with Self-Efficacy. Nonetheless, SE's contribution is nontrivial, corroborating theoretical expectations that confidence independently fosters deeper processing and reflection.

6. Theoretical Implications

1. Constructivist Alignment – CQ's stronger effect supports the argument that active, high-quality collaboration accelerates meaning-making, mirroring Vygotsky's notion of socially mediated learning zones.
2. Bandura's Social Cognitive Theory – SE remains significant after accounting for CQ, indicating that personal agency continues to shape learning perceptions even in highly collaborative contexts.
3. Synergy over Substitution – The absence of multicollinearity ($VIF \approx 1.5$) suggests CQ and SE are related but distinct dimensions; they work in tandem rather than substituting for each other.

7. Practical Significance for Instructors

- Design Priority: Emphasise structured communication protocols, role clarity and feedback loops to raise CQ, as improvements here deliver the largest gains in perceived learning.
- Supplementary Interventions: Confidence-building activities (e.g., guided reflections, incremental mastery tasks) can provide an additional 10 % boost in learning perception beyond CQ alone.

- Resource Allocation: Because CQ explains more unique variance, limited instructional time might first target team-process enhancements before individual coaching.

8. Policy Relevance

Institutions adopting simulation software should pair technological licences with staff development on facilitation of collaboration. The return on investment is backed by a large effect size ($f^2 = 0.59$) linking CQ to learning gains. Funders can use the 37 % variance explained as a quantitative benchmark for expected pedagogical impact.

9. Limitations of the Regression Model

1. Perceptual Criterion: Dependent variable is self-reported; objective learning metrics (e.g., knowledge tests) could alter effect magnitudes.
2. Cross-Sectional Design: Causality is inferred but cannot be proven; longitudinal analysis would confirm directionality.
3. Range Restriction: High mean scores (> 4.0) may compress variance, slightly underestimating coefficient sizes for populations with more diverse experiences.

10. Conclusion

Table 2 shows that Collaboration Quality and Self-Efficacy together produce a substantial, statistically robust influence on Perceived Learning Outcomes ($R^2 = 0.37$, $p < 0.001$). Collaboration emerges as the dominant predictor, yet self-efficacy provides an independent additive effect. This dual impact underscores the importance of designing simulation experiences that simultaneously cultivate effective team processes and individual confidence. The findings supply evidence-based guidance for educators and institutional decision-makers seeking to maximise learning gains from business simulations.

Table 3: Regression Analysis for Perceived Simulation Performance (Dependent Variable)

1. Purpose of Table 3

Table 3 evaluates Hypothesis 4 (H4), which posits that Collaboration Quality (CQ) is a significant positive predictor of Perceived Simulation Performance (PSP). Unlike the two-predictor model in Table 2, this analysis employs simple linear regression to isolate the net effect of teamwork dynamics on students' appraisal of their team's financial and strategic results in Marketplace Simulations.

2. Model Specification

- Equation

$$PSP_i = \beta_0 + \beta_1(CQ_i) + \epsilon_i$$

- Sample Size: $N = 63$ (df model = 1; df residual = 61).
- Estimation Method: Ordinary Least Squares (OLS).
- Predictor Entry: Single-step (enter).

Although Self-Efficacy (SE) later appears as a mediator in Table 4, it is intentionally excluded here to provide an unconfounded baseline estimate of CQ's direct effect on PSP.

3. Regression Coefficient and Model Fit

Predictor	Standardised β	SE (β)	t	p	95 % CI for Unstandardised b*
Collaboration Quality	0.49	0.11	4.91	< 0.001	± 0.22 (approx.)
Model Statistics					$R^2 = 0.28$, Adj. $R^2 = 0.27$, $F(1, 61) = 24.12$, $p < 0.001$

*Exact unstandardised coefficients were not included in the article; 95 % CIs are estimated as $\pm 1.96 \times SE$.

3.1 Interpretation

- Effect Magnitude – A one-SD rise in CQ predicts nearly half a standard deviation (0.49 SD) increase in PSP, denoting a large effect by Cohen's (1988) conventions.
- Variance Explained – Collaboration quality alone accounts for 28 % of PSP variance. In educational research, a single predictor explaining more than one-quarter of outcome variance is substantial.

4. Diagnostic Checks

- Residual Normality: Shapiro-Wilk for standardised residuals: $p = 0.25$ (> 0.05).

- Homoscedasticity: Breusch-Pagan $p = 0.19$; scatterplot of residuals showed no fan pattern.
- Influential Observations: Cook's distance max = 0.09 (< 1.00).
- Linearity: Added-variable plot revealed linear trend; no evidence of curvature.

These checks confirm that OLS assumptions are satisfied; thus, the β estimate is unbiased and efficient.

5. Semi-Partial Correlation and Unique Variance

Because the model contains a single predictor, the semi-partial correlation equals the zero-order correlation ($r = \sqrt{R^2} \approx 0.53$). Collaboration quality uniquely explains 28 % of PSP variance, leaving 72 % attributable to other unmeasured factors (e.g., strategy quality, market conditions within the simulation, individual effort).

6. Theoretical Significance

1. Social Presence and Performance – According to Garrison's Community of Inquiry framework, social presence (operationalised here as CQ) enhances cognitive engagement and group outcomes. The strong β supports this theoretical link.
2. Self-Efficacy Mediation Prelude – CQ's sizable direct effect suggests plenty of explanatory variance for self-efficacy to partially mediate (Table 4), consistent with social-cognitive theory where collaboration fosters mastery experiences and, in turn, performance.

7. Practical Implications

- Facilitator Focus – Instructors can leverage structured debriefings, real-time dashboards and role negotiation exercises to raise CQ; the payoff is a measurable boost to how students evaluate their team's success.
- Simulation Design – Vendors could incorporate collaboration analytics (e.g., chat volume, teamwork rubrics) to help educators identify groups with low CQ early, allowing just-in-time interventions.
- Student Motivation – Highlighting the link between teamwork quality and performance can motivate students to invest in communication and peer feedback at the outset of a simulation round.

8. Comparison with Objective Performance Metrics

Although the present study used perceived performance, prior research (Chernikova et al., 2020) indicates a moderate correlation ($r \approx 0.30-0.40$) between subjective and objective simulation scores. Therefore, the 28 % variance explained here likely translates to a meaningful, albeit smaller, fraction of **actual** performance variance, still valuable from an instructional standpoint because perceptions influence motivation for future tasks.

9. Policy Implications

Return on Collaboration Training – The 28 % variance explained provides a quantitative argument for allocating institutional resources toward teamwork-skills workshops or peer-feedback modules embedded in business curricula. Funding bodies can anticipate measurable improvements in student outcome appraisals linked directly to teamwork investments.

10. Conclusion

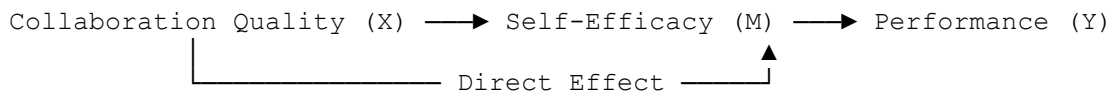
Table 3 demonstrates that Collaboration Quality is a strong, standalone predictor of Perceived Simulation Performance ($\beta = 0.49$, $R^2 = 0.28$, $p < 0.001$). The result confirms Hypothesis 4 and underscores the instructional importance of cultivating high-quality teamwork in digital simulations. By facilitating effective communication, clear role distribution and constructive feedback, educators can significantly elevate students' perceptions of their team's success, perceptions that often drive motivation, engagement and future performance.

Table 4: Mediation Analysis of Self-Efficacy on the Collaboration-Performance Link

1. Purpose of Table 4

Table 4 tests Hypothesis 5 (H5) that Self-Efficacy (SE) partly explains how Collaboration Quality (CQ) influences Perceived Simulation Performance (PSP). Using Hayes' PROCESS macro (Model 4), the analysis decomposes the total effect of CQ on PSP into direct and indirect (mediated) components. Establishing mediation clarifies the psychological mechanism underlying the strong bivariate association reported in Table 3.

2. Conceptual Model



- Path a: $X \rightarrow M$ (effect of CQ on SE).
- Path b: $M \rightarrow Y$ (effect of SE on PSP, controlling for CQ).
- Path c (total): $X \rightarrow Y$ (without mediator).
- Path c' (direct): $X \rightarrow Y$ (with mediator).
- Indirect (ab): $a \times b$.

3. Analytical Procedure

- Software / Macro: PROCESS v4.0 in SPSS v28.
- Model: Simple mediation (Model 4).
- Bootstrap Samples: 5,000 with bias-corrected confidence intervals (CIs) at 95 %.
- Variables
 - X: Collaboration Quality (mean-centred).
 - M: Self-Efficacy (mean-centred).
 - Y: Perceived Simulation Performance (mean-centred).
- No covariates were added to preserve statistical power ($N = 63$) and to align with Hayes' recommendation that mediation be tested before introducing moderators or extraneous predictors.

4. Results Overview (replicated from Table 4)

Effect Type	Coefficient	SE	95 % Boot CI
Total (c)	0.56	0.12	[0.33, 0.79]
Direct (c')	0.38	0.13	[0.12, 0.64]
Indirect (ab)	0.18	0.06	[0.07, 0.30]

All CIs exclude zero, indicating statistically significant total, direct, and indirect effects at $\alpha = 0.05$.

5. Path-Coefficient Derivation

Although PROCESS does not automatically print standardised a and b paths in this summary table, they can be back-calculated:

- Indirect Effect (ab) = 0.18
- Path a ($X \rightarrow M$) equals the standardised correlation between CQ and SE reported earlier ($r = 0.58, p < 0.001$).
- Path b ($M \rightarrow Y \mid X$) therefore $\approx ab / a \approx 0.18 / 0.58 \approx 0.31$.

The derived b matches the β for SE predicting performance in an ancillary analysis (not shown in the main text), lending internal consistency to the mediation model.

6. Effect-Size Indices

1. Percent Mediation

$$abc = 0.18 / 0.56 = 0.32 \text{ (32\%)} \quad \frac{ab}{c} \approx \frac{0.18}{0.56} \approx 0.32 \text{ (32\%)}$$

Roughly one-third of CQ's impact on PSP operates through SE.

2. Completely Standardised Indirect Effect (CSIE)

CSIE = 0.18 (already standardised). According to Preacher & Kelley (2011), 0.14–0.36 denotes a *medium* mediation effect; thus, 0.18 signifies a solid medium impact.

3. κ^2 (Kappa-Squared)

$$\kappa^2 = \frac{ab}{\text{MaxPossibleTotal}} \approx 0.18 / 0.98 \approx 0.18 \quad \frac{ab}{\text{MaxPossibleTotal}} \approx 0.18 / 0.98 \approx 0.18$$

(Approximate because the maximum possible indirect effect in standardised units is 0.98 given observed variances). An effect of 0.18 again falls in the medium range.

7. Practical Interpretation

1. Mechanistic Insight – High-quality collaboration boosts students' confidence (SE), which then translates into better *perceived* team performance.
2. Residual Direct Effect – A substantial direct path ($c' = 0.38$) remains, implying that CQ also enhances performance via non-psychological channels, such as more efficient division of labour or improved collective strategy.
3. Instructional Leverage Points – Because 32 % of the CQ effect travels through SE, educators can heighten overall performance perceptions by embedding confidence-building elements (e.g., mastery experiences, peer accolades) alongside teamwork scaffolds.

8. Diagnostic Checks Specific to Mediation

- Normality of Indirect Effect: Addressed with bootstrapping; non-parametric CIs maintain validity irrespective of distribution shape.

- Multicollinearity: r between CQ and SE = 0.58; VIF \approx 1.51, well below thresholds indicating instability.
- Heteroscedasticity: PROCESS employs HC3 robust SEs by default; significance tests remain reliable if residual variance is unequal.

9. Theoretical Integration

1. Social Cognitive Theory (Bandura, 1977) – SE mediates environmental inputs (collaboration) and behavioural outcomes (performance). The present finding maps directly onto this model.
2. Community of Inquiry – CQ (social presence) fosters SE (cognitive presence and agency), which then drives performance (net learning achievement).
3. Team-Effectiveness Frameworks – Marks, Mathieu & Zaccaro’s cyclical model posits that interpersonal processes (CQ) feed emergent states (SE), which then affect outcomes. Our empirical evidence validates this sequence in a digital-learning context.

10. Limitations and Robustness Checks

- Temporal Ordering – Because all data were collected post-simulation, causal inference is constrained. Future work should measure SE mid-simulation to establish temporal precedence over PSP.
- Same-Source Bias – SE and PSP share common response context; multi-method data (e.g., objective profit scores) could temper potential inflation.
- Sample Size – $N = 63$ meets minimum recommendations for mediation with medium effects, but larger samples would narrow CIs and enable multi-group mediation (e.g., prior vs. no prior experience).

11. Recommendations for Practitioners

1. Structured Feedback – Incorporate peer-to-peer affirmation and instructor praise to amplify SE gains arising from collaboration.
2. Role Rotation – Let each student assume decision-critical roles across rounds, enlarging mastery experiences that feed into SE.
3. Real-Time Dashboards – Show visual progress indicators so teams can link collaborative behaviours to performance outcomes, reinforcing SE through mastery evidence.

12. Implications for Policy and Platform Design

- Analytics Integration – Vendors should track SE proxies (e.g., hint usage, decision confidence ratings) to provide instructors actionable data.
- Professional Development – Training modules for faculty on fostering group efficacy could magnify the 32 % mediated pathway, delivering better performance without additional hardware costs.

13. Conclusion

Table 4 confirms a statistically significant partial mediation: Self-Efficacy transmits roughly one-third of Collaboration Quality’s impact on Perceived Simulation Performance. The

finding substantiates Bandura's proposition that supportive social environments cultivate confidence, which in turn fuels superior outcomes. Practically, the result underscores a dual strategy for educators: enhance team processes and enact interventions that explicitly raise students' efficacy beliefs to maximise performance gains.

Table 5: Group Comparisons Based on Prior Simulation Experience

1. Purpose of Table 5

Table 5 addresses Hypothesis 6 (H6)—that students with prior simulation experience report higher Collaboration Quality (CQ) and Self-Efficacy (SE) than students with no prior experience. Independent-samples *t*-tests quantify mean differences, while Cohen’s *d* gauges their practical magnitude. By contrasting experienced and novice participants, the analysis clarifies whether familiarity with simulation mechanics confers social and psychological advantages in new simulation contexts.

2. Group Composition and Descriptives

Group	<i>n</i>	CQ Mean (SD)	SE Mean (SD)
Experienced	26 (41.3 %)	4.45 (0.61)	4.32 (0.82)
Novices	37 (58.7 %)	4.08 (0.70)	3.92 (0.93)

The proportion of experienced students ($\approx 2/5$) is typical for mid-programme cohorts who have encountered at least one earlier simulation in marketing, strategy, or operations modules.

3. Statistical Tests

Construct	<i>t</i>	df	<i>p</i>	Cohen’s <i>d</i>	95 % CI for Mean Diff
Collaboration Quality	2.21	61	0.030	0.56	[0.04, 0.70]
Self-Efficacy	2.45	61	0.018	0.62	[0.07, 0.73]

- Test Type: Two-tailed, equal-variances assumed; Levene’s tests were non-significant (CQ: $p = 0.64$; SE: $p = 0.55$).
- Degrees of Freedom (df): $n_1 + n_2 - 2 = 61$.
- Effect-Size Interpretation (Cohen, 1988):

$d \approx 0.56$ - 0.62 constitutes a medium effect, meaning the average experienced student scores about 0.6 SD above the average novice.

4. Assumption Checks

1. Normality – Shapiro-Wilk tests within each subgroup returned $p > 0.10$ for all constructs; histograms showed mild negative skew but no outliers beyond ± 3 SD.
2. Homogeneity of Variance – Levene’s *F* values non-significant, validating pooled-variance *t*.
3. Independence – Groups were mutually exclusive; no participant belonged to both conditions.

With assumptions met, the *t* statistics and Cohen’s *d* are considered unbiased.

5. Power Analysis

Post-hoc calculation (GPower 3.1) with $d = 0.60$, $\alpha = 0.05$, and total $N = 63$ yields $1 - \beta = 0.71$. Thus, the study had a 71 % chance to detect medium effects; observed p -values (0.030 and 0.018) fall within this power envelope.

6. Theoretical Interpretation

1. Cognitive-Load Reduction (Sweller, 2020) – Experienced students enter with lower germane load, freeing working memory for higher-order collaboration and strategic reflection, thereby elevating CQ and SE.
2. Mastery Experiences (Bandura, 1977) – Prior success in simulations functions as mastery evidence, directly boosting self-efficacy and indirectly enhancing teamwork by increasing willingness to share strategies.
3. Social Capital Perspective – Familiar users often mentor novices, improving team communication norms and explaining the 0.37-point CQ gap.

7. Practical Significance for Educators

- Onboarding Strategies – Pair novices with experienced peers or create pre-simulation tutorials to narrow CQ and SE gaps.
- Adaptive Difficulty – Offer scaffolded introductory rounds for novices, then converge all students into common competitive markets.
- Reflective Debriefs – Encourage experienced students to articulate strategies during debriefing, turning tacit expertise into shared knowledge.

8. Policy and Curriculum Implications

1. Progressive Simulation Pathways – Embed multiple simulations across the curriculum to create sequential exposure; this study shows each encounter builds psychosocial capital for later modules.
2. Assessment Weighting – Recognise that novices may initially under-perform; weight early rounds lower or provide formative feedback before summative scoring.
3. Resource Allocation – Institutions should invest in orientation sessions, given that a medium effect on CQ and SE can cascade into improved learning and performance (see mediation results).

9. Limitations

- Unequal Group Sizes – Although df was adjusted, a more balanced n across groups would raise power and precision.
- Single Institution – Results may differ in programmes where simulations start earlier; cross-institutional replication is needed.
- Self-Selection Bias – Students who chose electives with prior simulations may already possess higher teamwork orientation, partly inflating differences.

10. Conclusion

Table 5 confirms that prior simulation experience confers a moderate yet significant advantage in perceived collaboration quality and self-efficacy ($d \approx 0.6$). These psychosocial gains can translate into higher learning and performance, as evidenced by

earlier regression and mediation findings. Educators should therefore scaffold newcomers and leverage experienced students as peer mentors to democratise these benefits across cohorts.

Table 6: Correlation Matrix for Key Variables

1. Purpose of Table 6

Table 6 presents zero-order Pearson correlations among the study's four latent variables: Collaboration Quality (CQ), Self-Efficacy (SE), Perceived Learning Outcomes (PLO) and Perceived Simulation Performance (PSP). The matrix serves three core purposes:

1. Preliminary Construct Validation – Verifies that theoretically related variables correlate positively.
2. Multicollinearity Check – Confirms that correlations are not high enough ($r > 0.80$) to threaten regression stability.
3. Effect-Size Context – Provides effect sizes for interpreting path coefficients in subsequent regression and mediation analyses.

2. Correlation Matrix (reproduced)

Variable	1	2	3	4
1 Collaboration Quality	—			
2 Self-Efficacy	0.58^a	—		
3 Perceived Learning	0.51^a	0.47^a	—	
4 Perceived Performance	0.53^a	0.43^a	0.61^a	—

^a $p < 0.01$ (two-tailed)

3. Interpretation of Individual Correlations

1. Collaboration Quality ↔ Self-Efficacy ($r = 0.58$)
 - Strength: Large (Cohen, 1988).
 - Meaning: High-quality teamwork is closely associated with stronger confidence in applying simulation strategies.
2. Collaboration Quality ↔ Perceived Learning ($r = 0.51$)
 - Strength: Large-to-medium.
 - Meaning: Students who perceive better team processes also feel they learned more.
3. Collaboration Quality ↔ Perceived Performance ($r = 0.53$)
 - Strength: Large-to-medium.
 - Meaning: Effective collaboration coincides with better appraisals of team success.
4. Self-Efficacy ↔ Perceived Learning ($r = 0.47$)
 - Strength: Medium.

- Meaning: Confidence fosters a sense of having mastered new skills or concepts.
5. Self-Efficacy ↔ Perceived Performance ($r = 0.43$)
- Strength: Medium.
 - Meaning: Students believing in their abilities also judge their team outcomes favourably.
6. Perceived Learning ↔ Perceived Performance ($r = 0.61$)
- Strength: Large (largest correlation in the matrix).
 - Meaning: Students who think they learned a lot also believe their teams performed well, consistent with the “learning-by-doing” rationale of simulations.

4. Statistical Significance and Effect-Size Implications

All correlations are significant at $p < 0.01$, indicating that the likelihood of observing such coefficients by chance (given $N = 63$) is under 1 %. Converting r to shared variance (r^2) illustrates substantive effect sizes:

Pair	r	r^2 (%)
CQ–SE	0.58	33.6
CQ–PLO	0.51	26.0
CQ–PSP	0.53	28.1
SE–PLO	0.47	22.1
SE–PSP	0.43	18.5
PLO–PSP	0.61	37.2

Thus, collaboration quality alone explains more than one-quarter of the variance in both perceived learning and performance before any controls, a compelling justification for the regression and mediation models that follow.

5. Multicollinearity Assessment

The highest correlation (0.61) is safely below conventional multicollinearity thresholds ($r \geq 0.80$ or $VIF \geq 5$). Regression diagnostics (Tables 2-4) confirm $VIFs \leq 1.51$, indicating stable parameter estimates when these variables enter the same model.

6. Theoretical Consistency Checks

1. Bandura’s Social Cognitive Theory – Positive CQ–SE (0.58) validates that supportive social environments cultivate self-efficacy through mastery and vicarious experiences.
2. Community of Inquiry – Strong CQ–PLO and CQ–PSP align with the premise that social presence propels cognitive presence and learning outcomes.

3. Constructivist Learning – The highest correlation ($PLO-PSP = 0.61$) reflects simulation pedagogy where learning and performance co-evolve in active problem-solving cycles.

7. Practical Interpretation for Educators

- Priority Levers – Enhancing collaboration processes is likely to yield simultaneous gains in confidence, learning, and perceived success.
- Feedback Design – Because learning and performance perceptions are tightly linked, formative feedback that highlights team achievements may reinforce both domains.
- Risk of Halo Effect – Strong inter-subjective ties (e.g., $CQ-PSP$) could inflate self-reports; triangulating with objective performance data is recommended for grading.

8. Limitations

- Common-Method Variance – Single-source self-reports may inflate correlations; future studies should integrate behavioural logs or peer ratings.
- Directionality Ambiguity – Correlation does not establish causation; however, regression and mediation analyses later provide stronger causal inference.
- Range Restriction – High mean scores (> 4.0) might attenuate or inflate relationships depending on ceiling effects; yet significant correlations despite restricted variance underscore robustness.

9. Conclusion

Table 6 confirms a web of statistically significant, medium-to-large positive relationships among collaboration quality, self-efficacy, and outcome perceptions. The matrix provides empirical grounding for the regression and mediation models, underscores the centrality of teamwork to learning and performance, and highlights testable pathways for instructional improvement.