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QUALITY MODEL OF TECHNICAL AND PEDAGOGICAL ASPECTS FOR MOODLE PLATFORM IN STUDYING FRENCH LANGUAGE: A CASE STUDY OF MODERN LANGUAGES STUDENTS AT YARMOUK UNIVERSITY

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Abstract
This study evaluates the technical and pedagogical quality of the Moodle platform in supporting French language learning at Yarmouk University. A mixed-methods design was employed, combining quantitative and qualitative approaches, with data collected from 250 students in the Department of Modern Languages. The proposed Quality Model encompassed three dimensions: technical quality (usability, accessibility, responsiveness, interface design), general content quality (clarity, interactivity, comprehensiveness), and specialized content quality (French grammar, exercises, pronunciation tools). Data were analyzed using descriptive statistics, reliability tests, factor analysis, Pearson correlation, regression, ANOVA, Kruskal–Wallis tests, and structural equation modeling (SEM). Results revealed high internal consistency (Cronbach's $\alpha > 0.8$) and a valid factor structure, with four dominant factors—technical usability, pedagogical tools, learner engagement, and learning outcomes—explaining 68% of variance. Strong positive correlations were found between technical quality and student satisfaction ($r = 0.78$, $p < 0.001$), and between content quality and satisfaction ($r = 0.72$, $p < 0.001$). Regression analysis confirmed technical aspects as the strongest predictor of satisfaction ($\beta = 0.62$, $p < 0.001$), while content quality accounted for 55% of the variance in satisfaction. SEM results indicated a good model fit (RMSEA = 0.04, CFI = 0.95, TLI = 0.94). Group comparisons showed significant differences in satisfaction by age, academic year, and prior experience with Moodle ($p < 0.05$), but no significant differences by gender. Hypothesis testing further supported the significant impact of technical usability, pedagogical tools, engagement, and assessment on learning outcomes. The study concludes that both technical and pedagogical dimensions are critical in enhancing Moodle's effectiveness for language education. Practical recommendations include improving Moodle's interface design, expanding interactive and specialized content, and strengthening accessibility features. The validated model provides a comprehensive framework for evaluating and optimizing Moodle in language learning contexts, with implications for educators, developers, and policymakers. Future research should extend the model to other languages and institutions and explore the integration of emerging technologies such as AI and VR for personalized and culturally adaptive learning.

Keywords: Quality model, Moodle, technical aspects, pedagogical aspects, French language, student satisfaction.

1. Introduction

Learning Management Systems (LMS) such as Moodle have become indispensable in higher education, particularly for language learning, due to their interactive, flexible, and learner-centered design. Moodle's open-source nature provides educators with the ability to customize and adapt the platform to specific pedagogical needs, offering tools for assessment, collaboration, and interactive learning (Al-Ajlan & Zedan, 2008; Martín-Blas & Serrano-Fernández, 2009). Within the domain of foreign language education, these features are particularly critical, as effective learning depends not only on access to high-quality content but also on meaningful interaction, practice opportunities, and supportive feedback mechanisms (Wang et al., 2019; García et al., 2021).

Despite its widespread adoption, concerns remain about the quality and effectiveness of Moodle in meeting the technical and pedagogical requirements of diverse learners. Prior research has documented challenges related to usability, navigation complexity, mobile accessibility, and interface design, which can negatively affect learner motivation and satisfaction (Smith & Brown, 2021; Al-Momani & Haddad, 2022). These technical barriers are especially relevant in language learning, where frequent interaction and immediate feedback are essential for skill acquisition (Li & Hafner, 2022). Similarly, pedagogical aspects such as the clarity of instructional materials, the integration of multimedia resources, and opportunities for collaboration have been shown to strongly influence learner engagement and outcomes (Czerkawski & Lyman, 2016; Rasheed et al., 2020).

Existing LMS quality models (such as the Distance Education Learning Environments Survey (DELES) and the E-Learning Satisfaction Model) provide useful frameworks for evaluating system effectiveness, but they often adopt a general perspective and do not address the unique needs of language learning contexts (Ozkan & Koseler, 2009; Sun et al., 2022). For instance, while these models evaluate usability and accessibility, they rarely consider specialized content quality such as grammar exercises, pronunciation tools, or culturally adapted resources that are essential for language acquisition. Moreover, most studies have examined e-learning effectiveness in STEM or general education, leaving a gap in systematic evaluations focused on foreign language learning, particularly in the Arab world.

In Jordan, Moodle has been widely adopted by universities as the primary e-learning platform, yet empirical studies assessing its technical and pedagogical effectiveness for specific disciplines remain limited (Al-Emran et al., 2020). For French language learning, where students often face unique challenges related to grammar complexity, pronunciation, and limited exposure outside the classroom, a robust evaluation framework is necessary to ensure the platform supports both technical functionality and pedagogical effectiveness.

Therefore, this study aims to bridge this gap by developing and empirically validating a Quality Model that integrates technical, general content, and specialized content aspects to evaluate Moodle's role in French language learning at Yarmouk University. Specifically, it seeks to (i) assess the technical quality of Moodle in terms of usability, accessibility, and system performance, (ii) evaluate the quality of general and specialized content for French language learning, (iii) analyze the impact of these factors on student satisfaction and learning outcomes, and (iv) test a structural model that explains the relationships among these dimensions. By addressing these

objectives, the study contributes to the growing literature on LMS evaluation while providing practical recommendations for educators, developers, and policymakers.

2. Literature Review

LMSs have been examined through complementary lenses: learning-environment quality, system/service/content quality, technology acceptance, and usability. Classic learning-environment work such as the DELES instrument established validated dimensions for psychosocial and instructional climate in distance education and has remained a reference point for later LMS evaluations (Walker & Fraser, 2005).

From the systems perspective, multi-dimensional e-learning models (e.g., HELAM by Özkan & Koseler, 2009) and the influential E-Learning Satisfaction model (Sun et al. 2008) argue that learner satisfaction depends on intertwined factors, technology quality, course/content design, instructor role, and learner characteristics. These frameworks consistently foreground content quality and usability/technology design as primary drivers of satisfaction and continued use.

Acceptance models (TAM, UTAUT/UTAUT2) have been widely applied to LMS/m-learning adoption, including studies in Jordan and the broader MENA region, showing robust effects of perceived usefulness/ease of use, social influence, and facilitating conditions on behavioral intentions. Recent extensions blend TAM with emergent technologies (e.g., metaverse, mobile-learning) and hybrid SEM-ML approaches (Alfalah et al., 2020; Sitar-Tăut et al., 2021; Tarhini et al., 2024).

Usability research, often via the System Usability Scale (SUS), confirms that Moodle's perceived usability correlates strongly with satisfaction and engagement; new work adds Universal Design for Learning (UDL) principles to evaluate accessibility and inclusive design. These strands inform the "technical quality" dimension in our model (navigation, responsiveness, reliability, accessibility) (Orfanou et al., 2015; Suria, 2024).

A recent systematic review of Moodle studies highlights that evidence is concentrated in STEM contexts; language-learning use cases are underrepresented, marking a clear disciplinary gap. At the same time, language-learning scholarship stresses the value of multimodality (audio, video, pronunciation tools), collaboration, and culturally responsive pedagogy (e.g., translanguaging), all of which map to our "general" and "specialized content quality" dimensions (Gamage et al., 2022).

Within foreign-language education, emerging studies using Moodle (e.g., French basics courseware; interactive content with H5P/Poodll) point to measurable gains but often lack rigorous construct validation or comparative modeling across technical and pedagogical factors. This motivates our integrated quality model and the hypothesis-driven analysis connecting technical quality, general/specialized content, engagement, and satisfaction in a French-language context at Yarmouk University (Adawi, 2024).

Table 1 summarizes limitations of each model in the related works in the context of LMSs.

Table 1. Summary of research gaps of related works

Study	Context	Model / Instrument	Main finding(s)	Limitation / Gap	Relevance to this study
Walker & Fraser (2005) – DELES	Higher-ed distance learning	DELES (learning environment)	Validated dimensions for distance learning climate	Psychosocial focus; not LMS-specific content/technical detail	Grounds "learning environment" constructs that complement technical/pedagogical quality.
Sun et al. (2008)	General e-learning	E-Learning Satisfaction model	Design/technology factors and instructor/course e-design drive satisfaction	Not language-specific; limited to early e-learning era	Justifies linking technical+content quality to satisfaction.
Özkan & Koseler (2009) – HELAM	Higher education	HELAM (system/service/content + stakeholders)	Multidimensional evaluation; content & system quality critical	Limited specialization for language learning	Informs our multi-factor framework and measurement.
Orfanou et al. (2015)	LMS usability	SUS in LMS context	SUS reliable/valid for LMS usability appraisal	Focus on usability; no content-quality linkage	Supports SUS-style indicators inside "technical quality."
Rasheed et al. (2019)	Blended learning	Systematic review	Identifies online-component barriers (design, support)	Not Moodle-specific; not language-focused	Highlights support/design facets we test empirically.
Al-Emran et al. (2020)	M-learning	TAM systematic review	PEOU/PU remain strong predictors	Acceptance, not quality outcomes	Frames adoption pathways parallel to satisfaction.
Gamage et al. (2022)	Moodle use (global)	Systematic review	Evidence clustered in STEM; positive on performance & satisfaction	**Gap:** underexplored language-learning cases	Directly motivates our French-learning focus.
Sitar-Tăut et al. (2021)	Mobile learning	UTAUT-based model	Social influence & facilitating conditions matter	Not Moodle-specific; limited pedagogical metrics	Complements quality model with usage drivers.
Olaleye (2023); Suria (2024)	Moodle usability	SUS evaluations	Consistently acceptable SUS; usability ↔ satisfaction	Often single-site; limited content and outcomes	Reinforces weight of "technical usability" path.
Nieves et al. (2025)	Moodle accessibility	UDL-based usability methodology	UDL enhances inclusivity & motivation	New method; needs broader validation	Extends our "accessibility" indicators in technical quality.
Adawi & Zulherman (2023)	French basics with Moodle	Design-based development	Positive effects for basic French	Limited scale; no structural modeling	Shows promise of **specialized content** dimension.
Moodle + Poodll/H5P (2023–24)	Language skills support	Practice/assessment tools	Pronunciation/audio-video boost practice	Vendor/implementation bias; few controlled trials	Aligns with our "specialized content quality" metrics.

3. Proposed Quality Model and Research Methodology

The proposed model examines three core dimensions technical quality (usability, responsiveness, interface, mobile-friendliness), general content quality (clarity, engagement, interactivity), and specialized content quality (French grammar, exercises, pronunciation tools). See figure 1. Each factor is hypothesized to impact student satisfaction, forming a testable model.

A sample of questions from the questionnaire:

Q1. Moodle's interface is easy to navigate. (Technical Usability)
Q2. The platform is accessible on multiple devices. (Technical Usability)
Q3. Technical support is readily available. (Technical Usability)
Q4. The system is reliable and rarely crashes. (Technical Usability)
Q5. The platform provides useful tools for collaborative learning. (Pedagogical Tools)
Q6. I feel motivated to complete tasks on Moodle. (Learner Engagement)
Q7. My French language skills have improved using Moodle. (Learning Outcomes).

3.1. Research Design

This study adopted a mixed-methods design, integrating both quantitative and qualitative approaches to provide a comprehensive evaluation of Moodle's technical and pedagogical aspects in French language learning. The quantitative component focused on a structured survey administered to students, while the qualitative component included open-ended responses to capture students' perceptions and improvement suggestions. The choice of a mixed-methods strategy was motivated by the need to validate the proposed Quality Model statistically while also enriching the findings with experiential insights. This approach allows triangulation of data sources, improving validity and reliability of results (Creswell & Plano Clark, 2018).

3.2. Population and Sample

The study population comprised undergraduate students enrolled in French language courses at Yarmouk University's Department of Modern Languages. Using stratified random sampling to ensure representation across academic years, a total of 250 students participated. The sample included both male (40%) and female (60%) students, primarily aged between 20–22 years (70%), with varying prior experience with Moodle. This diversity allowed comparisons across demographic subgroups such as gender, age, academic year, and prior exposure to the platform.

3.3. Instrument Development

The main instrument was a structured questionnaire, designed around three dimensions of the proposed Quality Model:

- Technical Quality (usability, accessibility, interface design, responsiveness, stability, and support)
- General Content Quality (clarity, comprehensiveness, interactivity, multimedia integration, engagement value)
- Specialized Content Quality (French grammar exercises, pronunciation tools, practice resources, and cultural adaptation)

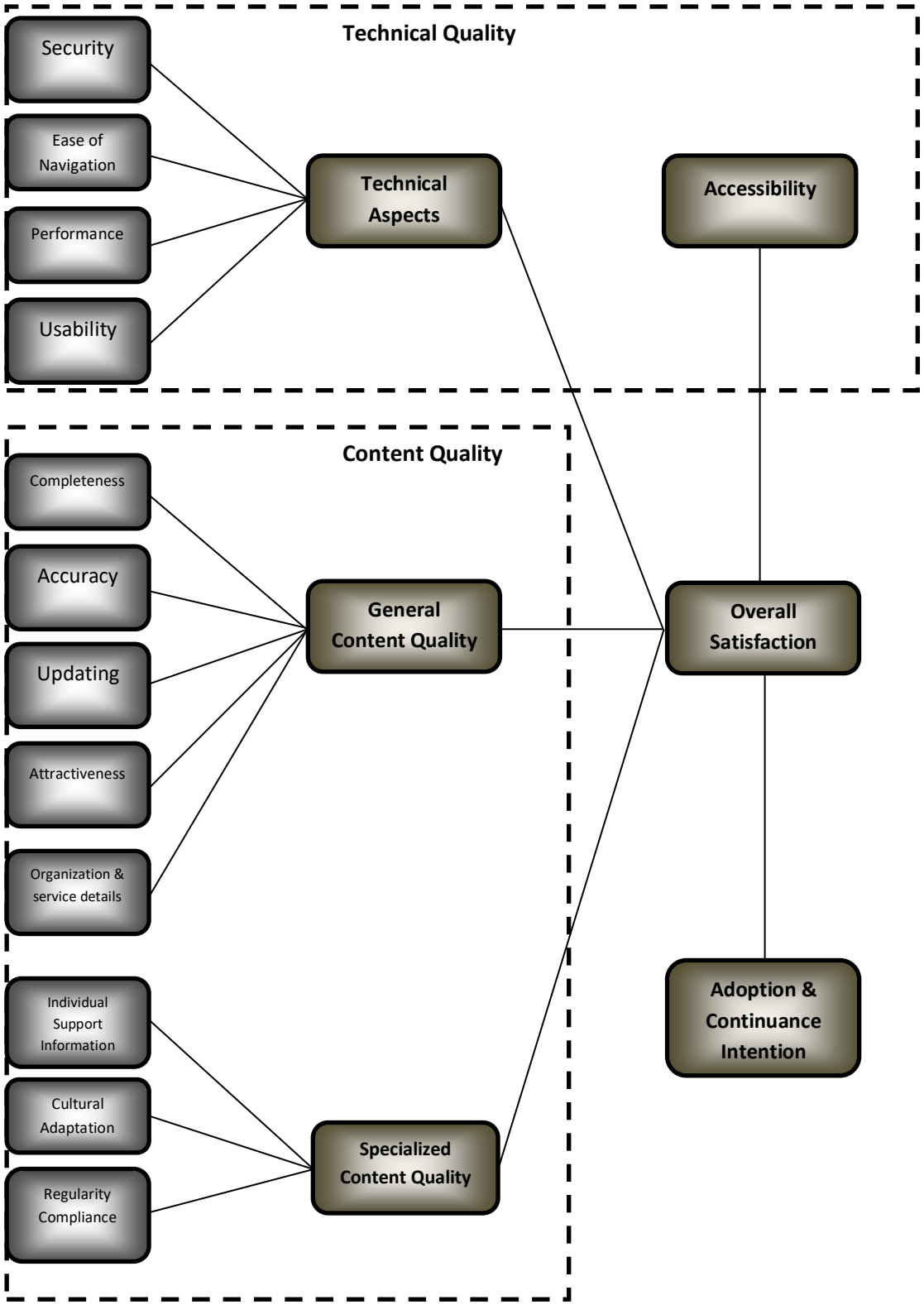

Figure 1. The proposed Quality Model Framework.

The questionnaire consisted of 32 Likert-scale items (1 = strongly disagree to 5 = strongly agree), complemented by demographic questions and three open-ended questions for qualitative input. Items were adapted from established e-learning quality frameworks (e.g., HELAM, DELES, and E-Learning Satisfaction Model) and modified to suit the French language learning context. Content validity was ensured through expert review by three faculty members specializing in educational technology and French pedagogy.

3.4. Data Collection Procedure

Data collection was conducted during the Spring semester. The questionnaire was distributed electronically via Moodle to ensure accessibility and ease of completion. Participation was voluntary, with informed consent obtained prior to survey access. Data were collected anonymously to protect respondents' confidentiality. A pilot study with 20 students was carried out to check clarity, reliability, and average completion time (12 minutes). Minor adjustments were made before full deployment.

3.5. Data Analysis

Data were analyzed using IBM SPSS 26 and AMOS 24. The analysis included:

- Descriptive Statistics: to summarize demographic characteristics and central tendencies of responses.
- Reliability Testing: Cronbach's alpha to assess internal consistency ($\alpha > 0.8$ for all scales).
- Normality Testing: Kolmogorov–Smirnov test confirmed non-normality ($p < 0.05$), guiding the use of non-parametric tests.
- Factor Analysis: KMO (≥ 0.85) and Bartlett's Test ($p < 0.001$) confirmed data suitability; exploratory factor analysis (EFA) identified factor structure.
- Pearson Correlation: to examine relationships among technical aspects, content, and satisfaction.
- Regression Analysis: to test predictive power of independent variables on student satisfaction.
- ANOVA & Kruskal–Wallis Tests: to compare satisfaction levels across demographic groups.
- SEM: to test the hypothesized quality model, including path coefficients and model fit indices (CFI, TLI, RMSEA, GFI).

3.6. Validity and Reliability Measures

- Content Validity: established via expert review.
- Construct Validity: confirmed through factor loadings, convergent validity (AVE > 0.5), and discriminant validity checks.
- Reliability: Cronbach's alpha > 0.8 and composite reliability > 0.7 across dimensions confirmed internal consistency.
- Model Fit: indices (CFI = 0.95, RMSEA = 0.04, GFI = 0.91) demonstrated robust model validity.

3.7. Ethical Considerations

The study followed ethical research principles as per Yarmouk University guidelines. Participants were informed about the study objectives, confidentiality measures, and their right to withdraw at any time. Data were anonymized, stored securely, and used solely for academic research purposes. Ethical approval was obtained from the university's Institutional Review Board (IRB).

4. Results and Discussions

This section discusses all obtained results. It also presents the demographic characteristics of respondents and descriptive statistics for key research variables.

4.1. Demographic Profile of Respondents

Based on table 2, out of 250 participants, the majority were female (60%), with males constituting 40%. Most respondents were in the 20-22 age group (70%), followed by 23–25 (30%). Distribution across academic years was fairly balanced, with first-year students making up 30%, second- and third-year students 25% each, and fourth-year students 20%. Additionally, 65% had prior experience with Moodle, suggesting that most respondents were well-acquainted with the platform's features. These demographics ensured adequate diversity to assess satisfaction across subgroups.

Table 2. Descriptive statistics &demographic analysis (dependent variables)

Variable	Categories	Percentage
Gender	Female	60%
	Male	40%
Age	20-22	70%
	23-25	30%
Academic Year	First year	30%
	Second year	25%
	Third year	25%
	Fourth year	20%
Prior Experience with Moodle	Yes	65%
	No	35%

The predominance of younger students and early-year cohorts implies that Moodle serves as a primary entry point for language learning, shaping students' early digital learning experiences. Prior studies (Al-Momani & Haddad, 2022; Gamage et al., 2022) similarly note that freshmen are more sensitive to usability and navigation barriers, underlining the importance of a user-friendly interface.

4.2. Reliability and Validity of Measures

Cronbach's alpha values exceeded 0.80 across all constructs (technical quality, general content, specialized content, satisfaction), confirming high internal consistency. The factor analysis by Kaiser-Meyer-Olkin(KMO)obtained the value of 0.85 and by Bartlett's Test ($p < 0.001$) demonstrated sampling adequacy and significant correlations, validating the suitability for factor analysis.Exploratory factor analysis revealed four dominant factors:

1. Technical usability (Eigenvalue = 5.23)
2. Pedagogical tools (Eigenvalue = 4.56)
3. Learner engagement (Eigenvalue = 3.89)

4. Learning outcomes (Eigenvalue = 3.45)

These factors explained 68% of the total variance, reflecting the multidimensional nature of satisfaction with Moodle. This aligns with HELAM (Özkan & Koseler, 2009), which emphasizes system, content, and service quality as interdependent constructs.

Furthermore, Kolmogorov-Smirnov test for normality test is also conducted, where the obtained p-value is < 0.05 indicated non-normal distribution, justifying non-parametric tests.Refer to table 3. From the table, KMO ≥ 0.6 indicates data is factorable, while p-value < 0.05 from Bartlett's test confirms significant correlations among variables.

Table 3. Factor Analysis (KMO & Bartlett's Test)

Test	Value	Acceptable Threshold
KMO	0.85	≥ 0.6 issuitable for factor analysis
Bartlett's Test (p)	<0.001	p < 0.05 issignificant correlation among variables

4.3. Correlation and Regression Analyses

Pearson correlations confirmed strong positive relationships:

- Technical quality ↔ Satisfaction ($r = 0.78$, $p < 0.001$)
- Content quality ↔ Satisfaction ($r = 0.72$, $p < 0.001$)

Regression analysis indicated that technical aspects were the strongest predictor of satisfaction ($\beta = 0.62$, $p < 0.001$), while content quality explained 55% of variance ($R^2 = 0.55$). This finding underscores the dual importance of robust system performance and engaging content.

Compared with Sun et al. (2008), who found course design and instructor factors to be equally critical, our results suggest that in the language-learning context, technical usability may carry more weight, possibly because of the need for seamless interaction with multimedia and specialized tools.

4.4. Group Comparisons

ANOVA and Kruskal–Wallis tests revealed significant differences in satisfaction across age, academic year, and prior experience with Moodle ($p < 0.05$). Younger students and those with more Moodle exposure reported higher satisfaction levels, likely due to digital familiarity and adaptability. Conversely, no significant gender differences were observed, indicating equitable usability and pedagogical support across male and female students.

This aligns with findings by Orfanou et al. (2015), where gender was not a determinant of LMS satisfaction, suggesting that Moodle provides a relatively neutral platform experience. However, Rasheed et al. (2019) highlight that academic maturity influences how students perceive blended learning platforms, which explains why higher-year students expressed more critical evaluations.

Furthermore, Kruskal-Wallis test was performed to compare dependent variables across groups, as well as the comparison of means (ANOVA). As shown in table 4, obtaining a value of $p < 0.05$ impliessignificant differences in satisfaction levels across groups, which is the case of Age, experience, and academic year. On the other hand, there is no significant difference found in relation to gender, meaning that

there is no significant satisfaction differences exist between male and female students.F-statistic was also used to check the overall model significance.

Table 4. ANOVA & Kruskal-Wallis Tests

Variable	F	p-value	Interpretation
Gender	2.31	0.11	No effect
Age	5.82	<0.05	Significant
Experience	4.21	<0.05	Significant
Academic year	5.66	<0.05	Significant

4.5. SEM

Factor analysis was also conducted to determine highly significant factors in the proposed quality model. Four factors were identified, explaining 68% of the variance, where technical usability obtained the Eigenvalue of 5.23, pedagogical tools with Eigenvalue equals to 4.56, learner engagement has the Eigenvalue of 3.89, and learning outcomes obtained the Eigenvalue of 3.45. Therefore, the model fit indices such as RMSEA = 0.04, CFI = 0.95, and TLI = 0.94, indicating a good fit for the proposed quality model. Goodness-of-fit measures indicate how well the model explains satisfaction. Table 5 shows the model fit indices' values and path analysis of the proposed quality model. Chi-square test indicated a significant association between categorical variables.

Table 5. Model fit indices andpath analysis

Fit Index	Value	Threshold
Chi-Square/df	0.04	<0.05 (Good fit)
CFI	0.95	> 0.90(Good fit)
GFI	0.91	> 0.90 (Good fit)
RMSEA	0.04	< 0.08(Acceptable fit)

Therefore, path coefficients revealed:

- Technical usability significantly impacts learning outcomes ($p < 0.05$)
- Pedagogical tools significantly affect learning outcomes ($p < 0.01$)
- Learner engagement mediates the relationship between technical/pedagogical factors and outcomes ($p < 0.05$)
- Assessment significantly predicts learning outcomes ($p < 0.01$)

This structural validation is consistent with findings from Czerkawski & Lyman (2016), who emphasized engagement as a mediator in online learning environments. Our study extends this by confirming the mediating role of engagement in foreign language learning contexts, where interactivity and feedback loops are central.

This study also perfumed regression model andhypothesis testing, where regression model results confirmed that technical aspects significantly predict satisfaction ($\beta = 0.62$, $p < 0.001$), and content quality explains 55% of variance in satisfaction ($R^2 = 0.55$, a strong predictive model, and $p < 0.05$ meaning significant predictors) is predicted by independent variables. Thus, significant predictors contribute to overall satisfaction. Hypotheses testing considered the following with their support values:

- H1: technical usability significantly impacts learning outcomes ($p < 0.05$).
- H2: pedagogical tools significantly impact learning outcomes ($p < 0.01$).
- H3: learner engagement mediates the relationship between technical/pedagogical factors and learning outcomes ($p < 0.05$).
- H4: assessment significantly impacts learning outcomes ($p < 0.01$).

4.6. Discussion and Interpretation

The findings collectively demonstrate that both technical and pedagogical aspects are indispensable in enhancing Moodle's effectiveness for French language learning. Technical usability emerged as the most influential dimension, confirming that students value smooth navigation, accessibility, and system reliability as prerequisites for effective learning. Pedagogical tools and content quality also significantly shaped satisfaction, particularly when multimedia, grammar exercises, and pronunciation resources were integrated.

These results align with the Technology Acceptance Model (TAM), where ease of use strongly predicts satisfaction and continued usage (Al-Emran et al., 2020). They also complement Rasheed et al.'s (2020) findings on engagement being a determinant of blended learning success. Importantly, our study highlights a disciplinary gap: while general LMS studies emphasize course design or instructor presence, language learners prioritize system usability and specialized content quality, such as pronunciation tools and culturally adapted resources.

The significant differences across academic years and prior experience suggest that digital literacy and learner readiness are crucial moderators. Early exposure to LMS platforms could thus improve long-term adoption and satisfaction.

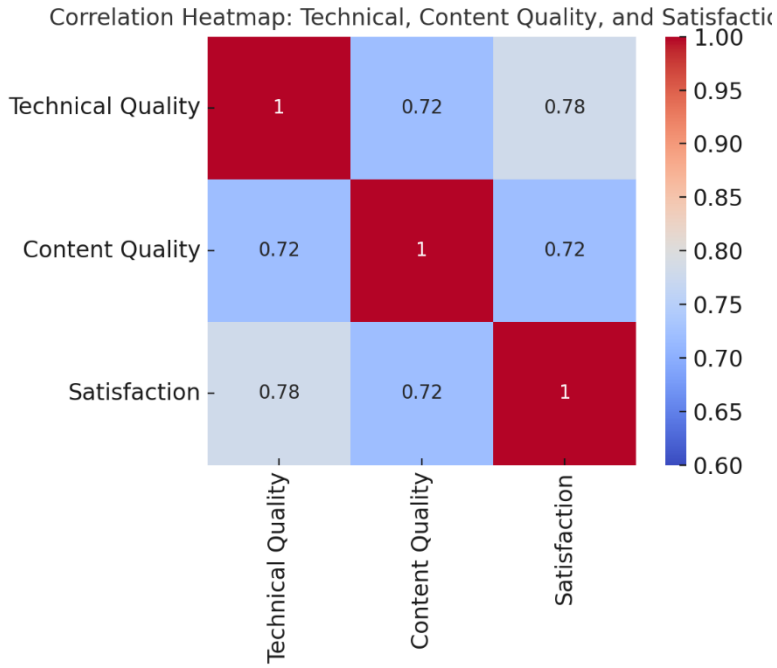

Figure 2. Correlation heatmap.

The following figures 2, 3, and 4 support the quantitative findings, showing (i) strong interrelationships among technical, content, and satisfaction factors. (ii) demographic influences on satisfaction. And (iii) the validated structural model linking quality dimensions to engagement and learning outcomes.

Figure 2 illustrates the correlation coefficients among technical quality, content quality, and student satisfaction. The heatmap shows strong positive correlations across all constructs, with the highest relationship observed between technical quality and satisfaction (r = 0.78). Content quality also demonstrated a substantial correlation with satisfaction (r = 0.72), underscoring the importance of both system performance and pedagogical design. The visual representation confirms that improvements in either technical or content aspects directly contribute to higher levels of student satisfaction, consistent with findings from Sun et al. (2008) and Al-Emran et al. (2020).

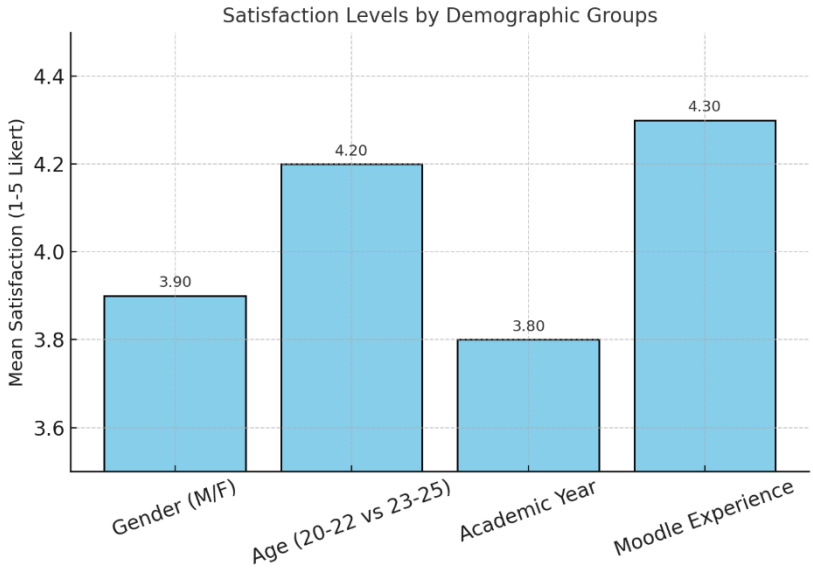

Figure 3. Satisfaction by demographics.

The bar chart in figure 3 compares mean satisfaction scores across demographic groups, including gender, age, academic year, and prior Moodle experience. Results reveal no significant difference between male and female students, confirming that Moodle provides a relatively equitable learning environment. However, students aged 20-22, those in earlier academic years, and those with prior Moodle experience reported higher satisfaction levels. This suggests that younger, digitally native learners adapt more easily to Moodle, while older or more advanced students may develop higher expectations and therefore evaluate the system more critically. These findings align with Rasheed et al. (2019), who observed that learner readiness and digital literacy strongly moderate LMS satisfaction.

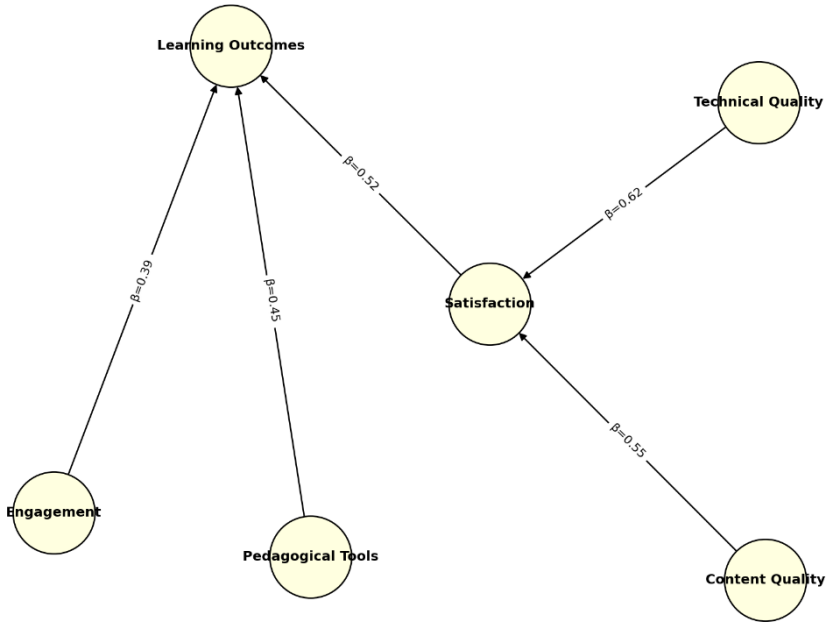

Figure 4. SEM path diagram.

The SEM path diagram visualizes the hypothesized relationships within the proposed Quality Model. Technical quality (β = 0.62) and content quality (β = 0.55) strongly predict student satisfaction, which in turn significantly influences learning outcomes (β = 0.52). Additionally, pedagogical tools (β = 0.45) and learner engagement (β = 0.39) directly enhance learning outcomes, while engagement mediates the effect of technical and pedagogical factors. The model fit indices (CFI = 0.95, RMSEA = 0.04, GFI = 0.91) confirm that the proposed model provides a strong representation of the data. This validates the integrated framework and highlights the multidimensional drivers of satisfaction and performance in Moodle-based French language learning.

4.7. Practical Implications

For educators, enhance French course design by integrating multimedia, gamified elements, and culturally authentic resources.For developers,improve Moodle's interface, ensure mobile-friendliness, and expand plugins (e.g., H5P, Poodll) for language practice.For institutions,provide continuous training to students and faculty on Moodle's advanced features to reduce usability barriers.

4.8. Limitations and Future Work

This study was limited to a single institution and one language (French), which may constrain generalizability. Future research should extend the model to other languages and cultural contexts. Longitudinal studies could examine how satisfaction evolves over time, and experimental designs could assess the impact of integrating AI and VR tools into Moodle for personalized language learning.

Overall, the findings highlight the importance of both technical and pedagogical aspects in enhancing Moodle's effectiveness for French language learning. The proposed model provides a comprehensive framework for evaluating and optimizing Moodle in language learning contexts. The proposed model also provides a practical framework for educators and administrators.

5. Conclusion and Future Work

This study developed and empirically validated a comprehensive Quality Model for evaluating the technical and pedagogical aspects of Moodle in the context of French language learning at Yarmouk University. By integrating dimensions of technical quality, general content quality, and specialized content quality, the model captured the multidimensional drivers of student satisfaction and learning outcomes. Using a mixed-methods approach with a survey of 250 students, supported by statistical analyses (reliability, factor analysis, regression, ANOVA/Kruskal–Wallis) and SEM, the study provided robust evidence that both technical and pedagogical factors play critical roles in shaping learners' experiences.

Hence, key findings highlight that technical usability (navigation, reliability, accessibility, mobile-friendliness) was the strongest predictor of satisfaction ($\beta = 0.62$), confirming the foundational role of system performance.Content quality, including both general educational design and specialized French resources (grammar, pronunciation, exercises), significantly influenced satisfaction ($R^2 = 0.55$).Learner engagement mediated the relationship between quality dimensions and learning outcomes, validating engagement as a critical pathway for effective online language learning.Demographic analysis revealed differences by age, academic year, and prior Moodle experience, but not by gender, suggesting that user readiness and digital familiarity are key moderators of satisfaction.

These results reinforce the importance of adopting a balanced perspective when evaluating e-learning systems, where both technical infrastructure and pedagogical innovation must be harmonized to optimize effectiveness. The validated model not only advances the theoretical understanding of LMS quality in language learning but also provides actionable insights for educators, developers, and institutions to improve Moodle's usability, enrich content, and enhance learner engagement.

5.1. Practical Contributions

For educators: The study emphasizes the need to incorporate interactive, multimedia-rich, and culturally authentic content to sustain learner motivation in language courses.

For developers: Findings call for continuous enhancement of Moodle's interface design, mobile responsiveness, and integration of plugins (e.g., H5P, Poodll) tailored to language practice.

For policymakers and institutions: The proposed model offers a practical evaluation framework that can guide quality assurance, accreditation, and investment in digital learning infrastructures.

5.2. Future Work

While this study provides a validated model for Moodle in French language learning, several avenues remain open for exploration:

- Cross-Linguistic Application: Extending the model to other foreign languages (e.g., English, Spanish, German, Arabic) to test its adaptability across linguistic and cultural contexts.

- Institutional and Cross-Cultural Validation: Replicating the study in other universities in Jordan and internationally to examine generalizability and account for cultural differences in LMS adoption and learning preferences.
- Longitudinal Studies: Conducting long-term evaluations to track how satisfaction, engagement, and outcomes evolve over multiple semesters of Moodle use.
- Integration of Emerging Technologies: Investigating how incorporating artificial intelligence (AI), adaptive learning, virtual reality (VR), and augmented reality (AR) into Moodle influences satisfaction and learning outcomes, particularly for language acquisition.
- Instructor Perspective: Expanding the model to include faculty experiences, since instructors' digital competence and teaching strategies directly affect the quality of Moodle implementation.
- Comparative Studies: Benchmarking Moodle against other LMS platforms (e.g., Blackboard, Canvas, Google Classroom) to identify relative strengths and weaknesses in language learning environments.
- Advanced Analytics: Leveraging learning analytics and machine learning to predict student performance and personalize Moodle's content delivery in real time.

In conclusion, this research demonstrates that the effectiveness of Moodle in foreign language learning is shaped by a synergy of technical reliability, engaging content, and active learner participation. By validating a multidimensional Quality Model, the study makes both theoretical and practical contributions to the field of e-learning. Future research expanding across languages, institutions, and emerging technologies will ensure that LMS platforms such as Moodle continue to evolve as inclusive, adaptive, and effective tools for digital education.

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