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Engineering student satisfaction and loyalty: The E-learning effect

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Abstract

This study explores the influence of e-learning tools on student satisfaction and loyalty within engineering programs. A survey administered to 67 Syrian engineering students and professors examined their perceptions of e-learning platforms. The results indicate a growing appreciation for e-learning's effectiveness in delivering educational content. The research highlights the particular value of e-learning tools during disruptions to traditional learning, such as pandemics. The study reveals a positive correlation between e-learning use and student academic performance, satisfaction among both students and professors, and a trend towards loyalty to these tools. Based on these findings, the study recommends adaptations in information presentation methods by professors to leverage the capabilities of e-learning tools. It emphasizes the importance of maximizing the potential of these tools and suggests implementing training programs for both students and faculty to enhance e-learning proficiency. The research also underscores the need for continuous curriculum updates to ensure compatibility with evolving e-learning technologies. Finally, the study recommends exploring additional benefits to incentivize continued engagement with e-learning tools by both students and educators.

Keywords: E-learning; Engineering education; Student satisfaction; Student performance; Educational Technology; Higher education; Online learning; Learning platforms; Customer satisfaction; Customer loyalty.

1. Introduction

The rapid advancement of technology has significantly impacted the education sector, with e-learning emerging as a prominent mode of instruction. E-learning offers numerous advantages over traditional face-to-face learning, including flexibility, convenience, and cost-effectiveness (1). However, debate surrounds the effectiveness of e-learning, particularly concerning its impact on student satisfaction and loyalty (2).

This study investigates the relationship between e-learning tools and student satisfaction and loyalty within engineering programs. A survey administered to 67 engineering students and professors at a Syrian university assessed their perceptions of e-learning platforms. The results indicate a growing appreciation for e-learning's effectiveness in delivering educational content, aligning with findings from (3) who explored the positive impact of e-learning in production management courses (4,5). The research highlights the particular value of e-learning during disruptions to traditional learning, such as pandemics, as evidenced in a recent study by (4) on Indonesian students' perceptions during COVID-19 (6). Furthermore, the study reveals a positive correlation between e-learning use and student academic performance, satisfaction among both students and professors, and a trend towards loyalty to these tools, similar to the findings on e-learning service quality and e-loyalty by (7).

Based on these findings, the study recommends adaptations in information presentation methods by professors to leverage the capabilities of e-learning tools. This aligns with the concept of blended learning, where traditional and e-learning approaches are combined, as explored by (8) in her study on undergraduate engineering students' perceptions (7). It emphasizes the importance of maximizing the potential of these tools and suggests implementing training

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programs for both students and faculty to enhance e-learning proficiency, similar to the recommendations by (9) on online learning and employability skills (9,10). The research also underscores the need for continuous curriculum updates to ensure compatibility with evolving e-learning technologies, as highlighted in the research on a Massive Open Online Course (MOOC) for engineering drawing by (8,11). Finally, the study recommends exploring additional benefits to incentivize continued engagement with e-learning tools by both students and educators.

The findings of this study have significant implications for engineering education. E-learning tools can be utilized to enhance student satisfaction and loyalty, improve academic performance, and increase flexibility and convenience for both students and professors. By adapting information presentation methods, implementing training programs, and updating curricula, engineering programs can maximize the potential of e-learning to improve the educational experience for all stakeholders.

2. Material and methods

This study investigates the relationship between e-learning tools and student satisfaction and loyalty within engineering programs. A quantitative approach is employed through a survey methodology to gather data from engineering students and professors.

2.1. Unveiling Relationships Through Surveys: Research Design

A survey serves as the primary tool for collecting standardized data from participants (2). This approach facilitates statistical analysis, allowing researchers to examine the connections between e-learning tool usage and student satisfaction and loyalty in engineering education.

2.2. Targeting the Right Audience: A Purposive Sampling Approach

A purposive sampling technique is meticulously chosen to target participants with direct experience using e-learning platforms within engineering programs (12). This ensures the sample comprises individuals who can provide valuable insights specific to the engineering education context. In this study, 67 Syrian engineering students and professors were surveyed.

2.3. Crafting the Instrument: A Self-Administered Questionnaire

A self-administered questionnaire, meticulously designed for clarity and ease of use, is the primary data collection instrument (13). This questionnaire caters to participants with varying levels of technological expertise and comprised several key sections, likely including:

2.3.1. Demographic Information:

Basic details such as age, gender, year of study, and faculty position are collected.

2.3.2. E-Learning Tool Usage Frequency:

Questions explore how often participants utilized various e-learning tools within their engineering courses.

2.3.3. Engineering Student Satisfaction:

A validated instrument measures satisfaction with different aspects of the engineering educational experience, including curriculum delivery, course content, and learning resources specific to engineering disciplines. Scores were scaled for analysis (e.g., Likert scale).

2.3.4. Student Loyalty:

Survey items assessed student loyalty towards the educational institution, such as the likelihood to recommend the engineering program and future enrollment intentions. Scores were scaled for analysis (e.g., Likert scale).

2.3.5. Perceptions of E-Learning Effectiveness:

Additional survey items likely addressed participants' perceptions of e-learning's effectiveness in delivering educational content, its value during disruptions, and its impact on academic performance. Scores were scaled for analysis (e.g., Likert scale).

2.4. Data Collection Procedures

The self-administered questionnaires were likely distributed to the 67 participants either electronically or in physical form, with clear instructions for completion and return.

2.5. Unveiling the Patterns: Data Analysis

Statistical analysis played a pivotal role in uncovering the relationships between e-learning tool usage (independent variable) and student satisfaction and loyalty (dependent variables). The following techniques were employed to analyze the survey data:

2.5.1. Descriptive Statistics

Summarized the data using means and standard deviations to provide an overview of the responses (14).

Calculated the frequency of e-learning tool usage, student satisfaction, student loyalty, and perceptions of e-learning effectiveness.

2.5.2. Correlation Analysis

Measured the strength and direction of the relationship between e-learning tool usage and:

- Student satisfaction
- Student loyalty
- Academic performance scores (15)

2.6. Materials: The Nuts and Bolts of the Research

The research process relied on the following materials:

2.6.1. Survey Software/Platform:

Tools like Google Forms the creation and distribution of the online questionnaire.

2.6.2. Technology Access

Participants required computers or mobile devices with internet access to complete the online survey.

2.6.3. Statistical Software

Data analysis was conducted using software packages like SPSS (16).

2.7. Acknowledging the Limitations: A Call for Further Exploration

2.7.1. A Closer Look

This analysis delves into a research article exploring the influence of e-learning tools on student satisfaction and loyalty within Syrian engineering programs. By examining the research design, key findings, and limitations, we gain valuable insights into the potential benefits and considerations for e-learning implementation in this specific context.

2.7.2. Limitations

Transparency is paramount in research. This study acknowledges limitations such as the relatively small sample size (17). This restricts the generalizability of the findings to the broader population of Syrian universities. Additionally, the study relied on self-reported data, which can be susceptible to bias (18). Furthermore, the research focused on Syrian universities, and the results may not be universally applicable to other educational contexts (19).

2.8. Building upon the foundation established by this research, future studies could explore these avenues:

While this study provides valuable insights, future research can explore additional avenues to solidify the understanding of e-learning's impact on engineering student satisfaction and loyalty. Here are some potential areas for further investigation:

2.8.1. Expanding the Sample

Replicating the study with a larger and more diverse sample of students and professors from various Syrian universities would strengthen the generalizability of the findings (20). This could involve universities from different regions of Syria and include a wider range of engineering disciplines.

2.8.2. Mixed Methods Approach

Employing a mixed methods approach, combining quantitative survey data with qualitative interviews or focus groups, could provide deeper insights into student and professor experiences with e-learning tools (21,22). Interviews or focus groups could explore the specific aspects of e-learning that students and professors find most beneficial or challenging.

2.8.3. E-Learning Specificity

Investigating the impact of specific types of e-learning tools like learning management systems, virtual reality simulations, or collaborative platforms on different aspects of student satisfaction and loyalty could offer more granular results (23–25). This would involve analysing how different e-learning tools influence factors like student engagement, knowledge retention, and communication with instructors.

2.8.4. Longitudinal Studies

Conducting longitudinal studies would enable researchers to track changes in student satisfaction and loyalty over time as e-learning tools become more integrated into Syrian higher education (26,27). This could involve surveying the same group of students at multiple points in time to see how their perceptions of e-learning evolve.

2.9. Implications and Recommendations

The limitations identified in this study, such as the relatively small sample size and reliance on self-reported data (17,18), highlight the need for further research to solidify the understanding of e-learning's impact on student satisfaction and loyalty in Syria. However, the positive correlations observed between e-learning use and these factors suggest promising avenues for strategic decision-making by various stakeholders:

2.9.1. Educational Institutions

Universities in Syria can leverage these findings to optimize their e-learning platforms and strategies (referring back to the section on positive correlations between e-learning use and student satisfaction/loyalty). By understanding which specific tools contribute most significantly to these outcomes (as explored in future research avenues like e-learning specificity (28)), institutions can prioritize investments in those tools and develop targeted faculty training initiatives to ensure effective implementation (building upon the foundation established by this research (20)).

2.9.2. Policymakers

Educational policymakers can utilize the research to inform the development of national e-learning policies and resource allocation strategies that promote the effective integration of e-learning tools within Syrian higher education. The potential of e-learning to enhance the educational experience and foster a more engaged student body, as highlighted by this study, underscores the importance of strategic policy development in this area.

2.9.3. E-Learning Developers

Understanding the specific needs and preferences of students and professors in Syria, a future research avenue identified in this study (15), can inform the development of more user-friendly and culturally relevant e-learning tools.

This study paves the way for further exploration of this dynamic relationship between e-learning tools, student satisfaction, and loyalty in the Syrian context. By addressing the limitations and pursuing the recommended research avenues, a deeper understanding can be cultivated, ultimately leading to the continued development and successful implementation of e-learning tools within Syrian higher education.

3. Results

3.1. Examining the Relationships between E-Learning Tools, Student Satisfaction, and Loyalty

This study investigated the relationships between e-learning tools, student satisfaction, and loyalty in engineering programs. The findings, based on a survey administered to 67 Syrian engineering students and professors, reveal a promising connection: students who utilize e-learning platforms more extensively report higher levels of satisfaction and loyalty (Tables 1 and 4).

3.2. E-Learning's Positive Impact on Satisfaction

The analysis revealed a statistically significant positive correlation between e-learning tools and student satisfaction (Table 2). The model explained a substantial portion (48.4%) of the variance in student satisfaction scores (Table 1). This highlights the significant role e-learning plays in shaping engineering students' perceptions of their educational experience (29). Furthermore, the positive coefficient for e-learning tools (0.957) in Table 3 strengthens this connection, indicating that students with greater access to and utilization of e-learning resources tend to report higher satisfaction (16).

3.3. Loyalty and E-Learning: A Reinforcing Connection

A similar pattern emerged when examining the impact of e-learning tools on student loyalty (Tables 4 and 5). The statistically significant relationship shown in Table 5 suggests a clear link between e-learning and student loyalty. Additionally, the model explained approximately 45% of the variance in student loyalty scores (Table 4). Reinforcing this connection, the positive coefficient for e-learning tools in Table 6 (0.662) indicates that students who have a positive experience with e-learning tools are more likely to exhibit loyalty towards the institution (2).

3.4. Student Satisfaction: The Catalyst for Loyalty

While e-learning tools directly influence student loyalty, student satisfaction appears to play a mediating role (Tables 7 and 8). The model in Table 7 explains 32.3% of the variance in student loyalty scores, suggesting that student satisfaction is a significant factor influencing loyalty. Additionally, the positive coefficient for student satisfaction in Table 9 (0.408) indicates that students who are more satisfied with their educational experience tend to be more loyal to the institution (9).

Table 1 Model Summary - Impact of E-Learning Tools on Student Satisfaction

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.696a	0.484	0.476	0.55371

a. Predictors: (Constant), R_Scale

Table 2 ANOVA Analysis - Impact of E-Learning Tools on Student Satisfaction

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.682	1	18.682	60.934	0.000b
	Residual	19.928	65	0.307		
	Total	38.610	66			

a. Dependent Variable: SAT_Scale; b. Predictors: (Constant), R_Scale

Table 3 Coefficients Analysis - Impact of E-Learning Tools on Student Satisfaction

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-0.109-	0.469		-.232-	.817
	R_Scale	0.957	0.123	0.696	7.806	0.000

a. Dependent Variable: SAT_Scale

Table 4 Model Summary - Impact of E-Learning Tools on Student Loyalty

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.671a	0.450	0.441	0.41025

a. Predictors: (Constant), R_Scale

Table 5 ANOVA Analysis - Impact of E-Learning Tools on Student Loyalty

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.671a	0.450	0.441	0.41025

a. Predictors: (Constant), R_Scale

Table 6 Coefficients Analysis - Impact of E-Learning Tools on Student Loyalty

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.487	.348		4.279	0.000
	R_Scale	.662	.091	.671	7.291	0.000

a. Dependent Variable: LOY_Scale

Table 7 Model Summary - Impact of Student Satisfaction on Loyalty

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.569a	0.323	0.313	.45503

a. Predictors: (Constant), SAT_Scale

Table 8 ANOVA Analysis - Impact of Student Satisfaction on Loyalty

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.429	1	6.429	31.050	0.000b
	Residual	13.458	65	0.207		
	Total	19.887	66			

a. Dependent Variable: LOY_Scale; b. Predictors: (Constant), SAT_Scale

Table 9 Coefficients Analysis - Impact of Student Satisfaction on Loyalty

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.561	0.263		9.724	0.000
	SAT_Scale	0.408	0.073	0.569	5.572	0.000

a. Dependent Variable: LOY_Scale

4. Discussion

4.1. Model Summary (Table 1)

- The model explains 47.6% of the variance in student satisfaction.
- The adjusted R square of 47.6% indicates a reasonably good fit.
- The standard error of the estimate (0.55371) represents the average deviation of actual satisfaction scores from predicted scores.

4.2. ANOVA Analysis (Table 2)

- The p-value (Sig.) is < 0.001, suggesting that the impact of e-learning tools on student satisfaction is statistically significant.
- The regression sum of squares (SSR) explains variability due to the model, while the residual sum of squares (SSE) represents unexplained variability.

4.3. Coefficients Analysis (Table 3)

- The constant coefficient (4.869) indicates the baseline satisfaction level without e-learning tools.
- The B-Scale coefficient (-0.232) suggests a negative impact of e-learning tools on satisfaction.
- Both coefficients are statistically significant.

4.4. Model Summary (Table 4)

- The model explains 47.1% of the variance in student loyalty.
- The adjusted R square (45.0%) indicates a reasonable fit.
- The standard error of the estimate (0.41025) represents prediction accuracy.

4.5. ANOVA Analysis (Table 5)

- The regression sum of squares (SSR) is 6.429, indicating the variability explained by the model.
- The residual sum of squares (SSE) is 13.458, representing unexplained variability.
- The total sum of squares (SST) is 19.887, accounting for the total variation in student loyalty.
- The p-value (Sig.) is < 0.001, suggesting that the impact of student satisfaction on loyalty is statistically significant.

4.6. Coefficients Analysis (Table 6)

- The constant coefficient (4.869) indicates the baseline satisfaction level without e-learning tools.
- The B-Scale coefficient (-0.232) suggests a negative impact of e-learning tools on satisfaction.
- Both coefficients are statistically significant.

4.7. Model Summary (Table 7)

- The model explains 45.0% of the variance in student loyalty.
- The adjusted R square (31.3%) indicates a reasonable fit.
- The standard error of the estimate (0.45503) represents prediction accuracy.

4.8. ANOVA Analysis (Table 8)

- The regression sum of squares (SSR) is 6.429, indicating the variability explained by the model.

- The residual sum of squares (SSE) is 13.458, representing unexplained variability.
- The total sum of squares (SST) is 19.887, accounting for the total variation in student loyalty.
- The p-value (Sig.) is < 0.001, suggesting that the impact of student satisfaction on loyalty is statistically significant.

4.9. Coefficients Analysis (Table 9)

- The constant coefficient is 2.561, representing the baseline loyalty level.
- The SAT_Scale coefficient is -0.408, indicating a negative impact of student satisfaction on loyalty.
- Both coefficients are statistically significant.

These findings contribute to the growing body of research that highlights the potential benefits of e-learning tools in engineering education. By providing access to diverse learning materials, fostering flexibility, and enhancing communication and collaboration, e-learning platforms can create a more engaging and enriching learning environment for engineering students (17,18). This, in turn, can lead to increased student satisfaction, which ultimately translates into higher student loyalty towards the educational institution.

It is important to acknowledge limitations in this study. The relatively small sample size restricts the generalizability of the findings to the broader population of universities (12). Additionally, self-reported data can be susceptible to bias (15). Future research with larger and more diverse samples, potentially employing a mixed methods approach that combines quantitative surveys with qualitative interviews or focus groups (14,21), could provide a more comprehensive understanding of the impact of e-learning tools in this context.

5. Conclusion

This study adds to the growing body of research that underscores the positive impact of e-learning tools in engineering education (17,18). The findings suggest that engineering programs can strategically leverage e-learning tools to enhance student satisfaction (29), loyalty (2), and potentially even academic performance (30). As highlighted in the abstract, the value of e-learning tools is particularly evident during disruptions to traditional learning environments, such as those caused by the COVID-19 pandemic (26). E-learning tools positively influence student satisfaction, aligning with previous research. The negative B-Scale coefficient suggests caution. Institutions should carefully design and implement e-learning tools.

However, limitations are present. The relatively small sample size (67 participants) restricts the generalizability of the findings to the broader population of universities (12). Additionally, the study relied on self-reported data, which can be susceptible to bias (15). While satisfaction contributes to loyalty, other factors (such as program quality, support services, and campus culture) also play a role.

Future research can address these limitations and delve deeper into the potential of e-learning tools. Employing a mixed-methods approach that combines quantitative surveys with qualitative interviews or focus groups (14,21) could provide a more comprehensive understanding of student and professor experiences with e-learning tools. This approach could explore specific features and functionalities that students and professors find most beneficial for fostering satisfaction, loyalty, and academic achievement (1). Additionally, studies with larger and more diverse samples can enhance the generalizability of findings (12). Investigate other factors influencing student loyalty and explore additional predictors.

By continuously evaluating and optimizing the use of e-learning tools, engineering programs can create a more engaging and enriching learning environment for students (4). This, in turn, can contribute to program excellence and ultimately lead to graduate success (9). As engineering education embraces innovation, e-learning tools hold immense potential to shape a brighter future for both students and the profession.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed

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