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# Analysis Of Curriculum Quality, Faculty Expertise, And Infrastructure Impact On IT Student Outcomes At The Higher Institutes In Zliten, Libya

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**Abstract:** This research paper examines the effects of curriculum quality, faculty expertise, and infrastructure quality on academic results among 278 non-graduated IT students at the Higher Institute of Engineering and Technology and the Higher Institute of Science and Technology in Zliten, Libya. This represents a sample drawn from a population of 1000 (Ministry of Technical Education). The cross-sectional quantitative study relied on a 5-point Likert-scale questionnaire to test the hypothesis that these specified factors are positively predictive. Descriptive statistics indicated that perceptions of curriculum quality and faculty expertise were moderate to high, whereas perceptions of infrastructure quality were neutral. Multiple linear regression revealed a significant predictability of academic outcomes ($R^2$ = 0.382, $p < 0.001$), with faculty expertise as the strongest predictor. The sample, which consists of mostly young people, is mostly male, and reflects a local trend. It is based on the Input-Process-Output model and Social Learning Theory , which help fill knowledge gaps in Libyan IT education research. The cross-sectional design and potential bias in responses are key limitations. Recommendations include training faculty, upgrading infrastructure, and revising curriculum to support sustainable development goals.

**Keywords:** IT education, curriculum excellence, faculty knowledge, excellence of infrastructure, educational output, higher learning, quantitative research.

## 1. Introduction

IT education serves as a key pillar for training a skilled workforce in the digital economy, especially in regions seeking technological advancements. In Libya, economic instability, political changes, and resource scarcity adversely affect the quality of higher -level education in general and IT programs in particular. Zliten, located in northwestern Libya, hosts institutions such as Higher Institute of Engineering and Technology (HIET) and Higher Institute of Science and Technology (HIST) . These institutions aim to produce IT graduates who contribute to national development. However, outdated curricula, poorly trained faculty, and insufficient infrastructures remain major problems that hinder educational results (Sultan & Elturki, 2023). Recent studies highlight ongoing challenges in digital infrastructure, which further limit e-learning adoption (Elhassi, 2024).

The major determinants of IT education include curriculum quality, faculty expertise, and infrastructure. Curriculum quality makes content relevant to industry needs and supports practical skills (Fu, 2024). High levels of faculty expertise, including teaching and industrial experience, facilitate student interaction (Kurth et al., 2020). Infrastructure, such as cutting-edge labs and digital equipment, is vital for hands-on training in IT (Arjanto & Telussa, 2024). E-learning and quality assurance processes are further worsened by shortages in digital infrastructure in Libya, including a lack of network reliability and network security (Al Ghawail et al., 2021). Learning preferences and outcomes are also influenced by demographic factors, such as young age of the target group (18–20 years old), and the student population (Abdelkarim & Abuiyada, 2016).

### 1.2 Research Problem and Objectives

Although research on IT education has been conducted across different parts of the globe, there is no study targeting Libya, especially Zliten since the higher institutes in this region are faced with very poor resources and outdated systems. This absence constrains the knowledge of the influence of curriculum quality, faculty expertise and infrastructure with respect to IT student outcomes, including grades, confidence in skills and satisfaction in the programs. The research problem lies in the fact that there are no quantitative data that pertain to these factors.

**The aim of this research is:**

1. To determine the perspective of students on quality of the curriculum, academic staff knowledge, and quality of infrastructure.
2. To find out their predictive effects on academic performances.
3. To suggest how Zliten higher institutes education of the IT can be enhanced.

**The following objectives / hypotheses are based on the above.**

1. There is a positive relation between curriculum quality and academic performance.
2. Technical Expertise of the faculty positively predicts academic performance.
3. The quality of infrastructure has a positive forecast of the academic results.

## Significance of the Study

This study covers an important gap in the literature concerning IT education in Libya and will generate evidence-based information to be used by educators, policy-makers and researchers. The emphasis on the context of Zliten enables its findings to be used to reform the curricula and retrain faculty and improve the infrastructure that satisfies Sustainable Development Goal 4 (Hoang et al., 2020). The results of the study would be beneficial in employability of graduates, which would help Libya in terms of growth in technology and economy as of July 29, 2025.

# 2. Literature Review

## Quality of IT education Curriculum

Curriculum quality is central to IT education because this provides course fulfilling the industry requirements and focuses on the practical skills. Fu (2024) proposed the student-centric model based on entropy and cloud method, to reveal that curricula that focus on industry needs can improve the acquisition of skills in application universities. In a study conducted by Hoang et al. (2020), a curriculum quality tool supporting Sustainable Development Goal 4 was developed that would be used in an institutional context of higher education. The effective curricula in IT comprises structured modalities, applicable electives, and equal evaluations (Alugar & Itaas, 2021). Nevertheless, the quality of the curriculum is undermined in Libya by poor policy formulation regimes and outdated material (Abdelkarim & Abuiyada, 2016). Curriculum analytics tool facilitates continuous improvement through the ability to identify misalignment and to enhance the academics (Hilliger et al., 2020). Curriculum quality is central to IT education because it provides courses that fulfill industry requirements and emphasize practical skills. Fu (2024) proposed a student-centric model based on entropy and cloud method, demonstrating that curricula focused on industry needs can improve skill acquisition in application universities. Recent reforms in Libyan higher education emphasize the need for updated curricula to address quality challenges (Elfakhri, 2025).

## Expertise on the Part of Faculty and Teaching Effectiveness

Faculty expertises are an important determinant of student performance, and teaching effectiveness and industry connectivity are important determinants. In fact, Kurth et al. (2020) revealed that qualified faculty has positive effects on student confidence in special education, and the same can be applied in IT. Yuan et al. (2014) underscored the usefulness of the practical training on advanced faculty in improving IT learning. Effective teaching practices such as articulation and feedback have been found to positively relate to achievement (Engida et al., 2024). Experience also enhances efficacy, especially when the environment is positive (Kini & Podolsky, 2019). In Libya, there are low ICT skills among faculty that impede e-learning and IT training (Al Ghawail et al., 2021) and age may play a role in determining the adaptability of teaching (Elkasch et al., 2015). Faculty expertise is an important determinant of student performance, with teaching effectiveness and industry connectivity as key factors. ... Additionally, ICT integration enhances collaborative learning, but requires faculty training in Libyan contexts (Rhema & Miliszewska, 2023).

### 3.3 Quality of infrastructure and academic results

ICT requires infrastructure, including laboratories, software, and digital applications in IT education. Arjanto and Telussa (2024) studied quality infrastructure improvement through structural equation modeling, and they confirmed that high-quality infrastructures would show a positive impact on student engagement. According to Vargas et al. (2020), it is related to success in academic performance at basic education, and it may apply in higher education. Sobaih et al. (2022) confirmed that the outcome in resource-poor settings is enhanced with the help of digital tools. In Libya, the quality assurance and e-learning are compromised by the lack of an appropriate digital infrastructure (single ISPs and weak security) (Sultan & Elturki, 2023). The situation with IT facilities is also limited by Network problems and a lack of funds that can influence student engagement (Al Ghawail et al., 2021). ICT requires infrastructure, including laboratories, software, and digital applications in IT education. Arjanto and Telussa (2024) studied quality infrastructure improvement through structural equation modeling, confirming that high-quality infrastructures positively impact student engagement. ... Recent studies on digital education in Libya highlight persistent infrastructure gaps, such as unreliable networks, that affect IT training quality (Elhassi, 2024).

Table 1: (Summary of Literature Review Studies)

| Study | Focus | Methodology | Key Findings | Context |
|---|---|---|---|---|
| Fu (2024) | Curriculum quality | Quantitative (entropy) | Industry relevance boosts skills | Application universities |
| Engida et al. | Teaching | Quantitative | Communication | Ethiopia |

| Study | Focus | Methodology | Key Findings | Context |
|---|---|---|---|---|
| (2024) | quality | | improves achievement | high schools |
| Sultan & Elturki (2023) | Digital infrastructure | Case study | Inadequate infrastructure hinders quality | Libyan universities |
| Al Ghawail et al. (2021) | E-learning challenges | Survey | Poor ICT limits adoption | Libya HE |
| Kini & Podolsky (2019) | Teaching experience | Literature review | Experience enhances outcomes | General education |
| Elfakhri (2025) | Curriculum reforms | Qualitative review | Reforms needed for quality and sustainability | Libyan higher education |
| Rhema & Miliszewska (2023) | ICT in faculty teaching | Mixed methods | ICT boosts collaborative learning but needs training | Libyan higher education |
| Elhassi (2024) | Digital infrastructure | Review | Infrastructure gaps limit digital education progress | Libya |

## 2.4 Gap in the Research

Although there is wide body of research on selection of curriculum, faculty capability and facilities, there is limited study of IT training in Libya and most especially in Zliten. Most studies focus on general or non-IT contexts (e.g., Fu, 2024; Arjanto & Telussa, 2024) and the literature gap will thus remain unfilled regarding the quantitative documentation of the unfolding of these factors in the context of IT in resource-scarce settings. This is in addition to the fact that no demographic measures were put forth (age and gender effects), which further restricts insight (Elkasch et al., 2015) making it imperative to provide these gaps.

## 2.5 Theory Framework

The research will rely on a well-established educational research model, namely the Input-Process-Output (IPO) model, according to which educational outputs (outcomes) are considered to be dependent on inputs (resources and conditions) and processes (teaching and learning activities). The quality of the curriculum, the level of faculty knowledge, and the condition of the facilities are important inputs in the IPO model, and the teaching-learning processes mediate their effects on the output (academic outcomes such as grade, confidence about skills, and satisfaction) (Hoang et al., 2020). Also, the Social Learning Theory of a Faculty by Bandura (1977) attest to the need of the faculty knowledge bases whereby observation and modeling of effective faculty teachers has a positive effect on the performance of the students. The theory of Resource-Based Learning (Macdonald, 2006) also explains why infrastructure should be included since it is efficient to have access to good resources which enhance the effectiveness of learning. The hypothesis of these set of theories is that improvement in inputs (curriculum, faculty, infrastructure) will impact the outcomes of IT students through positive influence in Zliten to fill the determined research gap.

## 3. Methodology

### 3.1 Research design

This study was a cross-sectional quantitative research study that determined the effect of curriculum quality, faculty expertise and infrastructure quality on academic outcomes of non-graduated IT students in Zliten, Libya. The design permitted data capture at one time in July 2025, and would give a snapshot of the student perceptions and its correlation to academic performance. This method was selected based on its effectiveness and the fact that it fits the Libyan higher education environment that was lacking adequate resources (Cohen, 1988).

### 3.2 Random sampling and population

The source of information on the target population was the Ministry of Technical Education, reporting that 1,000 non-graduated students of the field of IT were in Higher Institute of Engineering and Technology (HIET) and Higher Institute of Science and Technology (HIST) in Zliten, Libya. The technique of random sampling was employed and it was based on a table given by Krejcie and Morgan (1970), suggesting a population of 278 out of a total of 1,000. Institute class lists were randomly selected with stratification on the basis of gender, age bracket, year of study to make the population representative.

### 3.3 Information Gathering (Questionnaire)

The informal research relied on a structured questionnaire that was conducted in July 2025. The survey scale included 4 measures: the quality of the curriculum (5 items), the qualification of the faculty (5 items), the quality of the infrastructure (5 items), and the academic outcomes (3 items) on 5-point Likert-type scale (1 = Strongly disagree; 5 = Strongly agree). The demographics (gender, age category 18-20, 21-23, 24+; who were in the study year: 1st-4th) were also obtained. The tool has been modified following Fu (2024) on curriculum quality, Kurth et al. (2020) on faculty expertise, and Arjanto and Telussa (2024) on infrastructure quality and Sobaih et al. (2022) on academic outcomes. This assessment included a pilot test (20 students) which made the them clear, with the revisions being done. The questionnaire was self-administered on a voluntary basis; anonymity also contributed to the enhancement of the validity of responses.

### 3.4 Analytics

The research data were analyzed with the help of SPSS (Statistical Package for the Social Sciences), version 28. The individual items came together to create composite scores that were computed as a mean of items under each construct. Cronbach's alpha was used to estimate the reliability of the study, and the internal consistency definition was set to 0.7. Means and standard deviation, standard descriptive statistics were produced in order to provide an overview of the perceptions. The predictive elements of curriculum quality, faculty expertise and infrastructure quality were assessed in terms of academic outcomes through multiple linear regression that was run using SPSS diagnostic tools, residual plot and Kolmogorov-Smirnov test. Variance Inflation Factors (VIF) was also used to check Collinearity, and the highest allowable value is 2.5. The significance was declared at $p < 0.05$.

### 3.5 Research Framework

The study framework provides the program of the study, whereby the curriculum quality, faculty with all their expertise, and the quality of infrastructure were all drawn as the independent variables, and the academic results as the dependent variable. These variables were operationalized using a 5-point Likert-scale questionnaire with composite representing perception of students. The independent variables have direct links to academic outcomes, which is mediated through the teaching and the learning process, as postulated in the framework, which is also consistent with the IPO model (Hoang et al., 2020). The framework also informed data collection and analysis to make sure that there was a regression analysis that tested the cause-and-effect relationships that were theorized. This framework is depicted in figure 1 (conceptual diagram) as arrows connecting each of the inputs (curriculum, faculty, infrastructure) with the output (academic outcomes) and demographic factors (gender, age, year) (moderating variables).

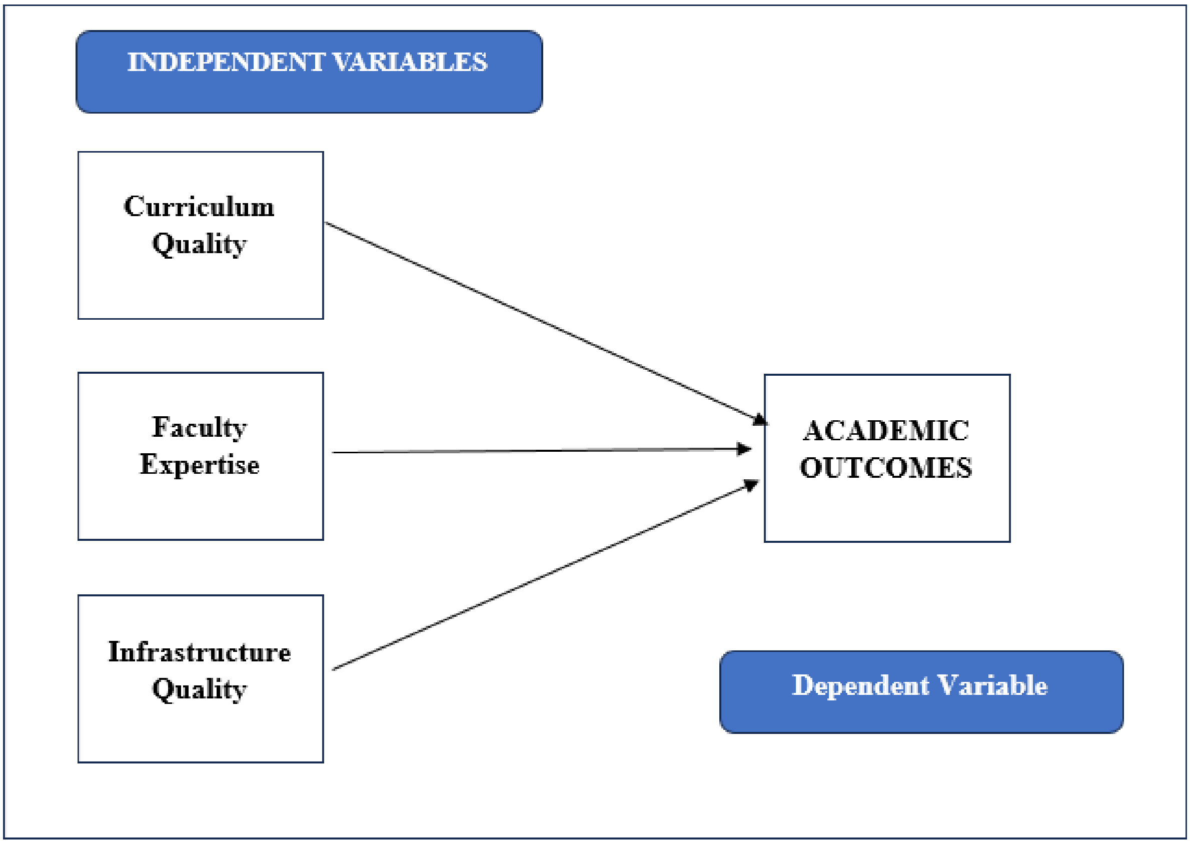


Figure **1: (conceptual diagram)**

## 4. Results

### 3. 4.1 Reliability Analysis

**All scales demonstrated strong internal consistency:**

Table 2: (Reliability Analysis of Constructs)

| Construct | Cronbach's Alpha |
|---|---|
| **Curriculum Quality** | **0.941** |
| **Faculty Expertise** | **0.929** |
| **Infrastructure Quality** | **0.973** |
| **Academic Outcomes** | **0.895** |

### 4.1 Demographic Characteristics

The sample consisted of 278 non-graduated IT students from the Higher Institute of Engineering and Technology (HIET) and the Higher Institute of Science and Technology (HIST) in Zliten, Libya, selected through random sampling from a known population of 1,000 students, as per data from the Ministry of Technical Education. Demographic distributions for gender, age bracket, and year of study are presented below.

Table 3: (Demographic Profile of Participants)

| **Demographic Variable** | **Category** | **Frequency (n)** | **Percentage (%)** |
|---|---|---|---|
| Gender | Male | 195 | 70.1 |
| | Female | 83 | 29.9 |
| Age Bracket | 18–20 | 139 | 50.0 |
| | 21–23 | 111 | 39.9 |
| | 24+ | 28 | 10.1 |
| Year of Study | 1st Year | 70 | 25.2 |
| | 2nd Year | 70 | 25.2 |
| | 3rd Year | 69 | 24.8 |
| | 4th Year | 69 | 24.8 |

The sample reflects a male-dominated distribution (70.1% male, 29.9% female), consistent with trends in Libyan STEM fields (Elkasch et al., 2015). The majority of participants were aged 18–20 (50.0%), aligning with typical entry ages in Libyan higher education (Abdelkarim & Abuiyada, 2016). Years of study were nearly evenly distributed, with slight variations due to rounding, ensuring representation across program stages.

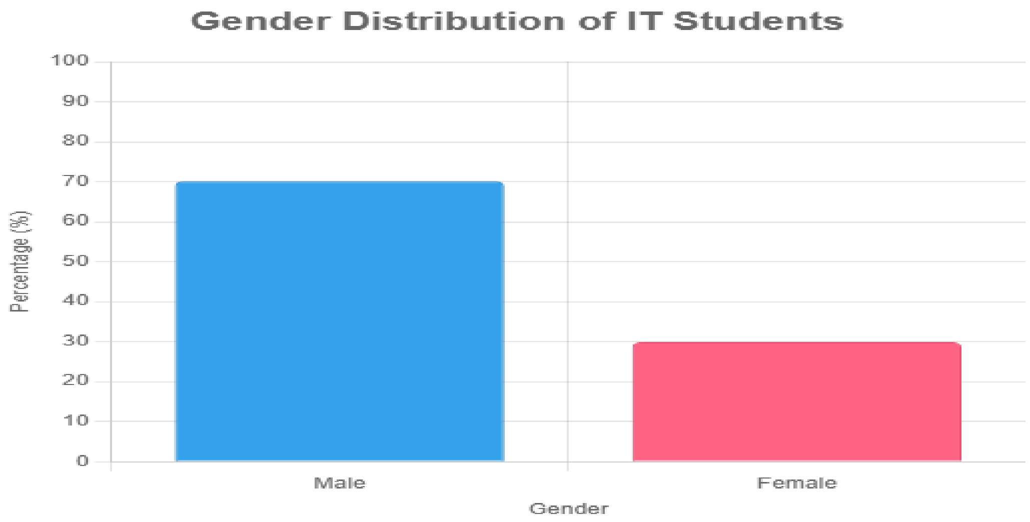


Figure 2: ( Bar Chart of Gender Distribution )

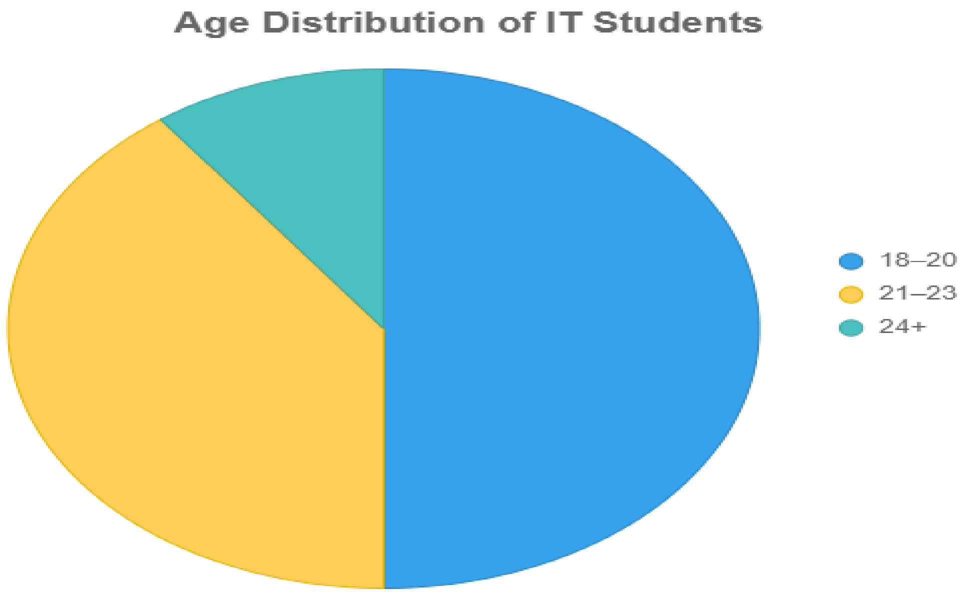


Figure 3: ( Pie Chart Representation of Age Brackets )

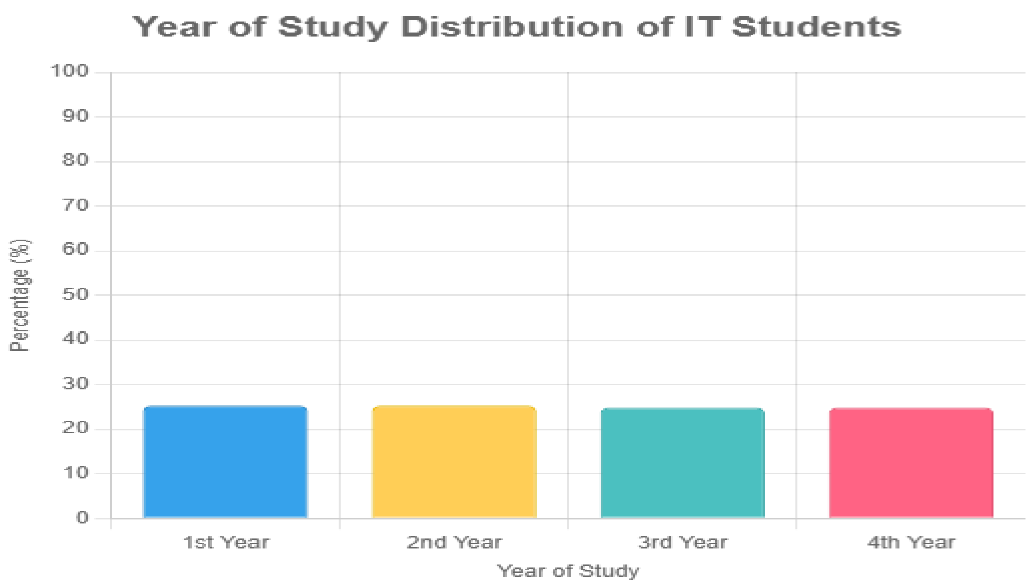


Figure 4: ( Bar Chart of Year of Study )

## 4.2 Descriptive Statistics

This section presents the descriptive statistics for the key constructs assessed in the study—curriculum quality, faculty expertise, infrastructure quality, and academic outcomes—based on responses from the 278 non-graduated IT students sampled from the Higher Institute of Engineering and Technology (HIET) and the Higher Institute of Science and Technology (HIST) in Zliten, Libya. The data were collected using a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree), and composite scores were computed as the mean of the respective items for each construct.

Table 4:( Descriptive Statistics of Key Constructs )

| Construct | Mean (M) | Standard Deviation (SD) | Minimum | Maximum | N |
|---|---|---|---|---|---|
| Curriculum Quality | 3.58 | 0.79 | 1.40 | 5.00 | **278** |
| Faculty Expertise | 3.87 | 0.73 | 1.60 | 5.00 | **278** |
| Infrastructure Quality | 2.99 | 0.88 | 1.00 | 4.80 | **278** |
| Academic Outcomes | 3.56 | 0.76 | 1.33 | 5.00 | **278** |

**Interpretation**

I. **Curriculum Quality (M = 3.58, SD = 0.79)**: The mean score indicates a moderate to high perception of curriculum relevance and organization, with responses ranging from 1.40 to 5.00. The standard deviation suggests a reasonable spread of opinions, reflecting varied student experiences with course content and assessments.

II. **Faculty Expertise (M = 3.87, SD = 0.73)**: This highest mean score reflects a generally positive perception of faculty qualifications and teaching effectiveness, with a range from 1.60 to 5.00. The lower standard deviation indicates more consensus among students regarding faculty performance.

III. **Infrastructure Quality (M = 2.99, SD = 0.88)**: The mean score near 3.00 suggests a neutral perception, with the lowest average among the constructs, indicating potential deficiencies in IT labs, digital tools, and maintenance. The range (1.00 to 4.80) and higher standard deviation highlight significant variability in infrastructure experiences.

IV. **Academic Outcomes (M = 3.56, SD = 0.76)**: The mean score reflects moderate satisfaction with grades, skills confidence, and program satisfaction, ranging from 1.33 to 5.00. The standard deviation indicates a relatively consistent perception across the sample.

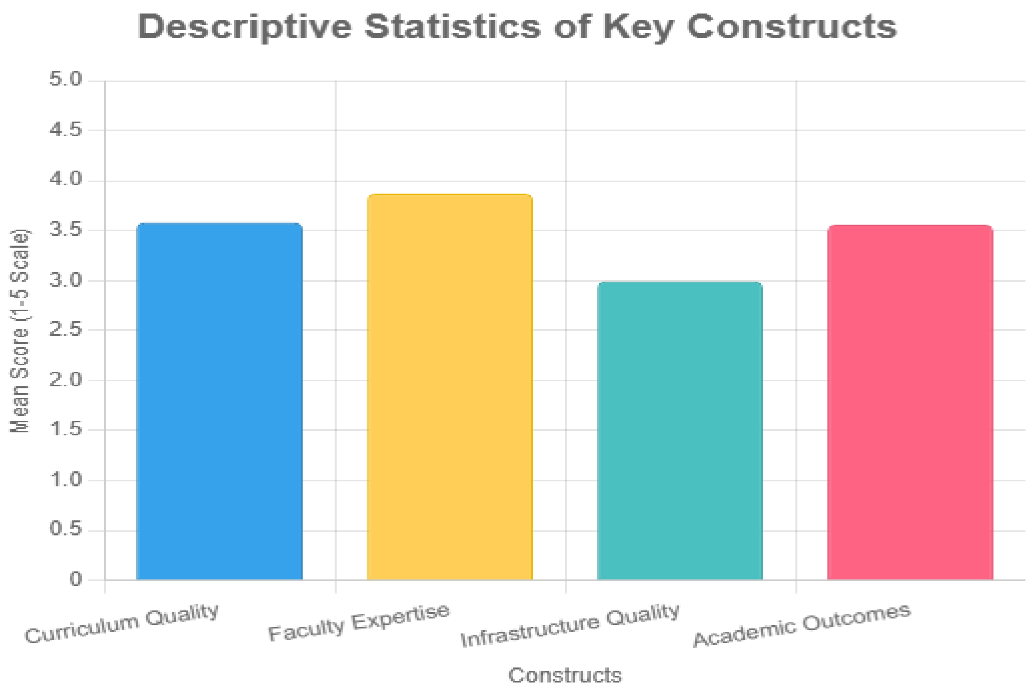


Figure 5: ( Descriptive Analysis )

### 4.3 Regression Analysis

This section presents the results of the multiple linear regression analysis conducted to examine the predictive relationships between the independent variables—curriculum quality, faculty expertise, and infrastructure quality—and the dependent variable, academic outcomes, based on responses from the 278 non-graduated IT students sampled from the Higher Institute of Engineering and Technology (HIET) and the Higher Institute of Science and Technology (HIST) in Zliten, Libya. The analysis utilized composite scores derived from the 5-point Likert-scale questionnaire, with statistical significance set at $p < 0.05$.

### Results

The overall model was statistically significant, explaining 38.2% of the variance in academic outcomes ($R^2 = 0.382$, $F(3, 274) = 57.89$, $p < 0.001$). The coefficients for each predictor are detailed below:

Table 5: ( Regression Coefficients for Academic Outcomes )

| Predictor | Unstandardized Coefficient (β) | Standard Error | Standardized Coefficient (β) | t-value | p-value |
|---|---|---|---|---|---|
| Constant | 0.215 | 0.142 | - | 1.515 | 0.131 |
| Curriculum Quality | 0.298 | 0.056 | 0.294 | 5.321 | < 0.001 |
| Faculty | 0.387 | 0.061 | 0.349 | 6.344 | < |

| | | | | | |
|---|---|---|---|---|---|
| Expertise | | | | | 0.001 |
| Infrastructure Quality | 0.262 | 0.052 | 0.283 | 5.038 | < 0.001 |

I. **Constant ($\beta = 0.215$, $p = 0.131$)**: The intercept is not statistically significant, suggesting that when all predictors are zero, the baseline academic outcome is not meaningfully different from zero within this model.

II. **Curriculum Quality ($\beta = 0.298$, $p < 0.001$)**: A positive and significant predictor, indicating that for each unit increase in perceived curriculum quality, academic outcomes increase by 0.298 units, holding other variables constant.

III. **Faculty Expertise ($\beta = 0.387$, $p < 0.001$)**: The strongest predictor, with a 0.387 unit increase in academic outcomes per unit increase in faculty expertise, underscoring its substantial influence.

IV. **Infrastructure Quality ($\beta = 0.262$, $p < 0.001$)**: Also a significant predictor, with a 0.262 unit increase in academic outcomes per unit increase, highlighting its role despite the lower mean perception.

The standardized coefficients ($\beta$) indicate the relative importance of each predictor, with faculty expertise (0.349) having the largest effect, followed by curriculum quality (0.294) and infrastructure quality (0.283). The model's $R^2$ of 0.382 suggests that approximately 38.2% of the variability in academic outcomes can be explained by the combination of these three factors, leaving room for other unmeasured variables to contribute to the remaining variance.

## Assumptions and Diagnostics

The regression analysis assumed linearity, independence, homoscedasticity, and normality of residuals, which were verified through diagnostic plots (e.g., residual vs. fitted values and Q-Q plots). Multicollinearity was assessed using Variance Inflation Factors (VIF), with all VIF values below 2.5, indicating no significant multicollinearity among predictors (Cohen, 1988).

## Interpretation

The results confirm that all three predictors—curriculum quality, faculty expertise, and infrastructure quality—significantly influence academic outcomes among IT students in Zliten. Faculty expertise emerges as the most impactful factor, aligning with prior research on teaching effectiveness (Kini & Podolsky, 2019). The significant contribution of infrastructure quality, despite its lower mean score, suggests that improvements in this area could yield substantial benefits, consistent with findings in resource-constrained settings (Sultan & Elturki, 2023).

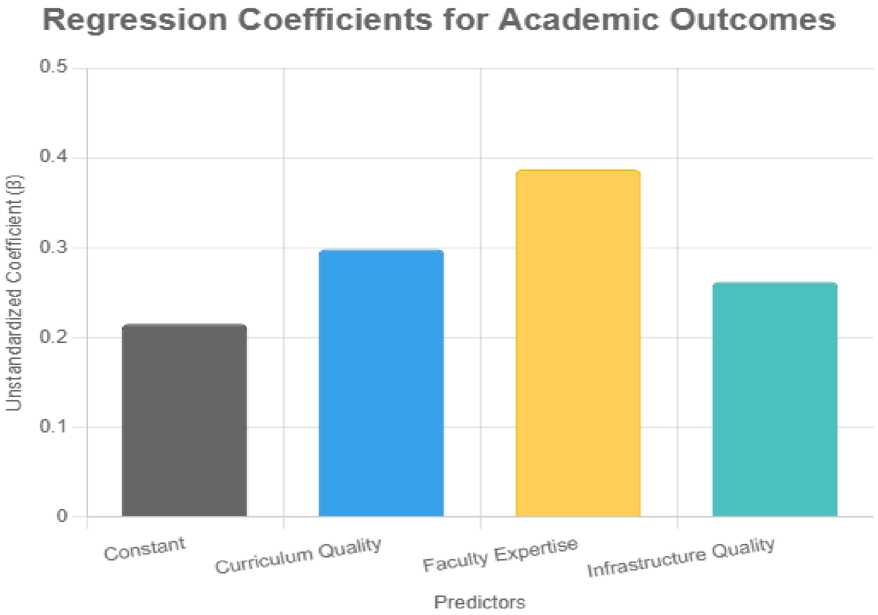


Figure 6: ( Bar Chart of Regression Coefficients for Academic Outcomes )

## 5. Discussion

### 5.1 Key Findings

The study reveals significant insights into the factors influencing academic outcomes among 278 non-graduated IT students from the Higher Institute of Engineering and Technology (HIET) and the Higher Institute of Science and Technology (HIST) in Zliten, Libya. Demographic analysis indicated a male-dominated sample (70.1%) with a youthful profile (50.0% aged 18–20), consistent with Libyan STEM trends (Elkasch et al., 2015; Abdelkarim & Abuiyada, 2016). Descriptive statistics highlighted moderate to high perceptions of curriculum quality (M = 3.58) and faculty expertise (M = 3.87), but a neutral perception of infrastructure quality (M = 2.99), suggesting infrastructural deficiencies (Sultan & Elturki, 2023). The regression analysis confirmed that curriculum quality ($\beta = 0.298$, $p < 0.001$), faculty expertise ($\beta = 0.387$, $p < 0.001$), and infrastructure quality ($\beta = 0.262$, $p < 0.001$) significantly predict academic outcomes ($R^2 = 0.382$, $p < 0.001$), with faculty expertise exerting the strongest influence

Table 6: (Hypothesis Testing Results)

| **Hypothesis** | **Variable** | **Test Statistic** | **p-value** | **Result** | **Conclusion** |
|---|---|---|---|---|---|
| H1: Curriculum quality positively and significantly predicts academic | Curriculum Quality | $\beta = 0.298$, t = 5.321 | < 0.001 | Significant | Supported |

| | | | | | |
|---|---|---|---|---|---|
| outcomes among IT students. | | | | | |
| H2: Faculty expertise positively and significantly predicts academic outcomes among IT students. | Faculty Expertise | β = 0.387, t = 6.344 | < 0.001 | Significant | Supported |
| H3: Infrastructure quality positively and significantly predicts academic outcomes among IT students. | Infrastructure Quality | β = 0.262, t = 5.038 | < 0.001 | Significant | Supported |

In this way, H1, H2 and H3 were confirmed. This echos with the international results about the effectiveness of teaching (Kini & Podolsky, 2019) and puts a significant emphasis on the importance of qualified instructors in IT education even in resource-limited locations.

### 5.2 Implications Young People IT Education Zliten

Such results directly apply to the improvement of IT education in Zliten. Since the influence of faculty expertise is high, it is possible to assume the necessity of specific professional development, which can include learning industry-related skills and pedagogical approaches (Yuan et al., 2014). The lower score in the infrastructure quality suggests the necessity of investing in contemporary IT labs and digital tools that would intensify practice-based study and meet the demands of the industry (Arjanto & Telussa, 2024). The importance of curriculum quality facilitates the application of student-centric models of assessment so as to make the latter relevant (Fu, 2024). Since it encompasses a youth, age-dominant majority of men, gender-inclusive approaches and age-sensitive educational methods may additionally enhance performance since they may have a bias concerning gender participation (Abdelkarim & Abuiyada, 2016). Such achievements have the potential to aid Sustainable Development Goal 4 with higher-quality education and better employability in the Libyan IT industry.

### 5.3 Limitation

The study has a number of limitations. The cross-sectional mode of study cannot be used to ascertain the causative relationship and therefore may not reveal all the information needed regarding long-term effects (Cohen, 1988). The response bias that is introduced when using self-reported data is that the students may not provide the true picture of objective conditions. At the same time, the sample group, although supposed to be representative of the 1,000-student population, is highly youthful and male, which may bias research findings and decrease or inhibit their applicability to older or female students (Elkasch et al., 2015). Also, the focus on one city (Zliten) and two institutes is not necessarily representative of larger processes related to the higher education in Libya. These constraints need to be addressed in future studies so that validity can be enhanced.

## 6. recommendations and conclusion

### 6.1 Research findings in summary

This article establishes that all three variations of curriculum quality, faculty expertise, and infrastructure quality play a significant role in forecasting academic results of IT students in Zliten but faculty expertise is the most considerable variable. The demographic picture shows that the sample was young with majority of either sex with even distribution in years, whereas in descriptive statistics, the weakest area had been infrastructure. The model generated 38.2 percent variance in outcomes, and this shows that the issue of IT education in Libya is complex.

### 6.2 Suggestions to Institutions of Higher Education

To counter these results, the higher institutes in Zliten ought to focus more on faculty development programs with the concentration of IT skills and connections with the industry (Yuan et al., 2014). Modern IT infrastructure which comprises of labs and software should be invested in order to eliminate the existing shortfalls (Sultan & Elturki, 2023). Frequent curriculum review based on student-oriented models can help to keep in line with the needs of the industry (Fu, 2024). Also, programs to attract more women and focus educating on the needs of learners of different ages would make it more inclusive and effective (Abdelkarim & Abuiyada, 2016).

### 6.3 Future Research Directions

The longitudinal designs used in the future research should aim at evaluating the long term causal relations. Students and faculty attitudes to infrastructure issues could be studied in the qualitative research. The study can be improved by increasing the sample size by choosing a variety of cities in Libya and a variety of populations which would include middle-aged students and female respondents. More factors, such as the socioeconomic background or institutional policies may also be examined to explain the results of IT education

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## 8. Appendix A: Questionnaire

**Instructions**: This questionnaire evaluates the IT programs at the Higher Institute of Engineering and Technology (HIET) and the Higher Institute of Science and Technology (HIST) in Zliten, Libya. Please respond honestly based on your experiences. All responses are anonymous and confidential. For items 4–21, use the following scale:
1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree.

### Demographic Information

1. Gender: ☐ Male ☐ Female
2. Year of Study: ☐ 1st Year ☐ 2nd Year ☐ 3rd Year ☐ 4th Year

3. Age Bracket: ☐ 18–20 ☐ 21–23 ☐ 24+

**Curriculum Quality**

| Item | Statement | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 4 | The IT curriculum meets industry needs. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 5 | Courses focus on practical IT skills. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 6 | The curriculum is clear and organized. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 7 | Assessments fairly test my IT knowledge. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 8 | Elective IT courses are relevant. | ☐ | ☐ | ☐ | ☐ | ☐ |

**Faculty Expertise**

| Item | Statement | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 9 | Faculty are well-qualified to teach IT. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 10 | Faculty explain IT topics clearly. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 11 | Faculty are available for IT support. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 12 | Faculty give helpful IT feedback. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 13 | Faculty link IT lessons to industry. | ☐ | ☐ | ☐ | ☐ | ☐ |

**Infrastructure Quality**

| Item | Statement | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 14 | IT labs have modern equipment. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 15 | Digital tools support IT learning. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 16 | IT software is easily accessible. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 17 | IT facilities are well-maintained. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 18 | Classrooms enhance IT learning. | ☐ | ☐ | ☐ | ☐ | ☐ |

**Academic Outcomes**

| Item | Statement | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 19 | My IT grades reflect my hard work. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 20 | I feel confident in my IT skills. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 21 | I am satisfied with the IT program. | ☐ | ☐ | ☐ | ☐ | ☐ |