

Influence of Attitude towards E-Learning on Academic Achievement in Higher Education

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Abstract

The rapid advancement of digital learning technologies has transformed higher education. This study examines the relationship between attitude towards e-learning and academic achievement using a descriptive research design. Data were collected from 600 undergraduate students and analyzed using inferential statistical methods, including t-tests and Pearson correlation. Findings indicate that students with a positive attitude towards e-learning demonstrate higher academic achievement. Disciplinary differences were observed, with students in science-related programs reporting more favorable attitude compared to those in non-science programs, especially in usability and engagement, while no significant gender-based differences were found. Results further highlight that content quality and ease of platform use significantly enhance attitude towards e-learning, whereas inadequate digital infrastructure remains a persistent challenge. These findings emphasize the need for high-quality digital content, user-friendly platforms, and improved accessibility to foster inclusive and effective online learning environments. Future research should explore longitudinal trends in e-learning adaptation and examine the impact of blended learning models on students' academic achievement.

Keywords: *Attitude towards learning; Academic achievement; Digital learning; Online education; Higher education*



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INTRODUCTION

Students' attitude towards e-learning play a crucial role in shaping their academic experiences and performance, particularly in today's rapidly evolving digital learning environment. While online learning offers flexibility and accessibility, students' engagement and academic success are strongly influenced by their perceptions of e-learning platforms. Research indicates that students with a positive attitude towards e-learning tend to achieve better academic outcomes, whereas negative attitude often lead to disengagement and lower performance (Masalimova et al., 2024; Chikileva et al., 2023). Despite the growing integration of digital learning in higher education, there remains a need to understand the specific factors that shape students' attitude, especially regarding technological acceptance and usability.

The Technology Acceptance Model (TAM), developed by Davis (1989), provides a valuable framework for examining students' acceptance of e-learning technologies. TAM identifies perceived ease of use and perceived usefulness as the main determinants of technology adoption. In e-learning, perceived ease of use refers to how effortlessly students can navigate online platforms, while perceived usefulness reflects how effectively these platforms support learning outcomes (Singh et al., 2024). Studies suggest that user-friendly and beneficial platforms enhance motivation and engagement (Akpen et al., 2024), whereas technical difficulties, low digital literacy, and inadequate institutional support reduce adoption.

Students' attitude towards e-learning is shaped by various factors such as content quality, platform usability, behavioral intention, satisfaction, confidence, flexibility, and infrastructure support. These dimensions collectively influence students' willingness to engage in digital learning environments.

According to TAM, students adopt e-learning when they perceive it as both useful and easy to use (Davis, 1989). Research shows that positive attitude enhances academic performance, while negative attitude—arising from technological barriers or poor-quality content—hinder learning outcomes (Singh et al., 2024; Paul, 2025).

The quality of digital content is one of the strongest predictors of positive attitude. Well-structured courses that include interactive, multimedia-rich, and logically organized materials enhance student engagement and comprehension (El Sabagh, 2021). Courses incorporating videos, quizzes, discussion forums, and real-world applications improve satisfaction and motivation (Harris et al., 2023). Conversely, poorly designed or outdated materials, text-heavy formats, and limited interactivity discourage students from active participation (Kumar et al., 2022).

Discipline-specific preferences also shape attitude. Science and mathematics students benefit from simulations, visual models, and virtual labs, while humanities students value interactive discussions and case-based learning (Bouchrika, 2025). Thus, high-quality content tailored to diverse academic needs is essential for fostering positive attitude towards e-learning.

Ease of use is another critical determinant of engagement. When students find a platform intuitive, stable, and easy to navigate, they are more likely to develop positive perceptions (Davis, 1989; Singh et al., 2024). User interface design, accessibility of resources and system reliability contribute significantly to satisfaction (Paul, 2025). Students prefer platforms offering mobile compatibility, smooth navigation, and minimal technical barriers (Naik, 2024). In contrast, technical issues, poor interface design, or lack of optimization often create frustration and reduce motivation (Gupta, 2021; Tulsiani, 2024).

Behavioral intention, or the willingness to continue using e-learning systems, depends on prior experiences, ease of use, and perceived usefulness (El Sabagh, 2021). Students with positive experiences are more inclined to continue using online platforms (Amarneh et al., 2021). However, a lack of meaningful interaction with instructors or peers can weaken this intention (Kumar et al., 2022). Studies highlight that live sessions, timely feedback, and collaborative opportunities improve students' motivation and long-term engagement (Harris et al., 2023).

Infrastructure and institutional support also play a vital role. Limited internet access, inadequate devices, or insufficient technical assistance remain common barriers (Kumar et al., 2022). Institutions that ensure stable connectivity, provide digital tools, and offer training programs help promote equitable access and sustained participation (Paul, 2025).

In summary, previous research demonstrates that students' positive attitude towards e-learning emerges from the combined influence of quality content, platform usability, behavioral engagement, and institutional support. These factors collectively enhance satisfaction, engagement, and academic success in digital learning environments.

As higher education increasingly adopts blended and online models, understanding students' attitude towards e-learning becomes crucial for improving the effectiveness of digital education. By examining the relationship between attitude towards e-learning and academic achievement, this study aims to identify the key drivers of student motivation and success. Addressing barriers such as technological limitations, inadequate content, and unequal digital access will help institutions design inclusive and engaging learning experiences that promote better academic outcomes (Sikder et al., 2022).

Objectives of the Study

1. To investigate the number of years for which students have been using e-learning resources.
2. To analyze the extent to which students' studies are supported by e-learning resources.
3. To examine the types of e-learning resources commonly utilized by students.
4. To examine the relationship between students' attitude towards e-learning and their academic achievement.

5. To analyze differences in academic achievement among students with varying levels of attitude towards e-learning.
6. To explore the influence of gender on students' attitude towards e-learning (Male vs. Female).
7. To assess differences in students' attitude towards e-learning based on their educational stream (Arts vs. Science).

METHODOLOGY

The study follows a quantitative research design using a descriptive survey approach to explore students' attitude towards e-learning and their impact on academic achievement. This approach is appropriate as it enables the collection of standardized responses from a large sample, allowing for objective analysis and generalization of findings. For analyzing objectives 1, 2 and 3, data was collected through the demographic section of the Google Form.

Research Design

To achieve the research objectives (4 to 7), the following null hypotheses were formulated and tested:

- H₀₁.** There is no significant relationship between students' attitude towards e-learning and their academic achievement.
- H₀₂.** There is no significant difference in academic achievement among students with different levels of attitude towards e-learning.
- H₀₃.** There is no significant difference in students' attitude towards e-learning based on gender (male vs. female).
- H₀₄.** There is no significant difference in students' attitude towards e-learning based on their educational stream (Arts vs. Science).

Population

The target population consists of undergraduate students (2nd and 3rd year) from Arts (B.A.) and Science (B.Sc. Medical/Non-Medical) streams enrolled in government and government-aided colleges in Haryana.

Table-1: Characteristics of the Population

Characteristics	Description
Students	Undergraduate (2nd & 3rd Year)
Gender	Male, Female
College Type	Government and Government-aided Colleges
Location	5 districts of Haryana (Kurukshetra, Karnal, Kaithal, Ambala, Yamunanagar)

Sample Selection

A stratified random sampling technique was used to ensure equal representation of students across different districts, academic streams, and genders. This method minimizes selection bias and enhances the generalizability of the findings.

Table-2: District-wise Sample Distribution

District	Total Students	Arts (Male)	Arts (Female)	Science (Male)	Science (Female)
Kurukshetra	120	30	30	30	30
Karnal	120	30	30	30	30
Kaithal	120	30	30	30	30

Ambala	120	30	30	30	30
Yamunanagar	120	30	30	30	30
Total	600	150	150	150	150

Table-2 shows that from each district; 120 students were selected (60 from Arts and 60 from science). Each stream had equal representation of males and females (30 each), resulting in a final sample of 300 Arts and 300 Science students.

Variables of the Study

1. Independent Variable: Students' attitude towards e-learning (measured using a standardized attitude scale).
2. Dependent Variable: Academic achievement (measured using students' past semester exam scores).

Measurement Tools

- Attitude Towards E-Learning Scale: Developed and standardized by the researcher in 2024.
- Academic Achievement: Measured using students' final exam scores from the previous semester, as they serve as an objective indicator of academic performance.

Description of the Attitude towards E-Learning Scale

The 31-item scale consists of the following five dimensions:

1. Content Quality & Perceived Usefulness (6 items) – **Evaluates how effectively e-learning supports understanding, assignments, and academic performance.**
2. Perceived Ease of Use, Accessibility & Flexibility (8 items) – **Assesses students' ability to navigate e-learning platforms, access resources, and learn independently.**
3. Behavioral Intention, Confidence & Satisfaction (8 items) – **Measures satisfaction, confidence in digital tools, and intent to continue using e-learning.**
4. Engagement, Interaction & Emotional Response (6 items) – **Examines participation in discussions, collaborative learning, and emotional responses such as curiosity and reduced anxiety.**
5. Infrastructure & Resources (3 items) – **Evaluates the availability, reliability, and effectiveness of e-learning materials and platforms.**

The scale employs a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

Reliability & Validity

- Cronbach's Alpha: 0.88 (**indicating excellent internal consistency**).
- Split-Half Reliability Coefficient: 0.83 (**significant at the 0.01 level**).

These results confirm the scale's strong reliability and validity in measuring students' attitude towards e-learning.

Data Collection

- Data was collected through Google Forms, ensuring efficient distribution and response gathering.
- Participants were provided with clear instructions and assured of voluntary participation and anonymity, encouraging honest responses.

Statistical Analysis

The data was analyzed using both descriptive and inferential statistical techniques:

1. Descriptive Statistics

Mean and Standard Deviation (SD) were used to summarize responses, providing insights into the general trends in students' attitude towards e-learning.

2. Inferential Statistics

- **t-tests:**
 - Used to compare gender-based and stream-based differences in attitude towards e-learning.
 - Justification: The independent samples t-test is appropriate when comparing means between two groups (e.g., male vs. female, Arts vs. Science). It determines whether differences in attitude are statistically significant.
- **Pearson's Correlation:**
 - Used to examine the relationship between students' attitude towards e-learning and their academic achievement.
 - Justification: Pearson's correlation is ideal for assessing the strength and direction of a linear relationship between two continuous variables (attitude scores and exam scores). A strong correlation would indicate that students' attitude significantly influences their academic performance.
- **ANOVA (Analysis of Variance):**
 - Used to test whether there are significant differences in students' academic achievement across different levels of attitude towards e-learning (e.g., low, moderate, high attitude groups).
 - Justification: ANOVA is suitable for comparing means across multiple groups and identifying whether attitude variations correspond to differences in academic performance.

Delimitations of the Study

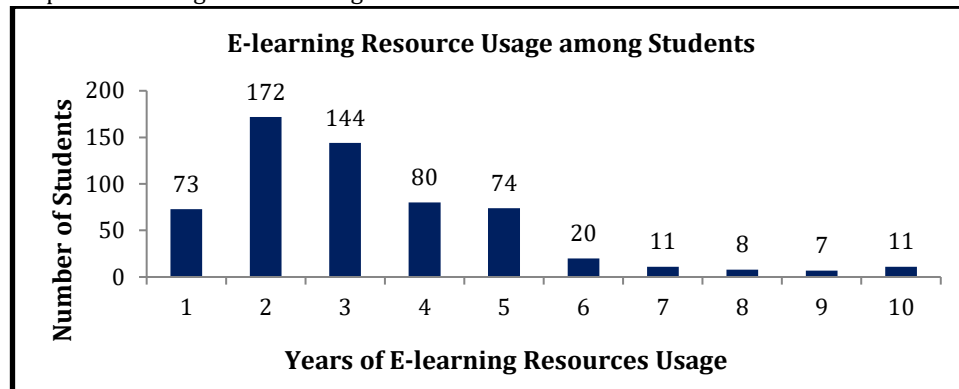
1. The study is limited to undergraduate students in Haryana, India.
2. Only 2nd and 3rd-year students from Arts (B.A.) and Science (B.Sc. Medical/Non-Medical) streams were included.
3. The Arts stream includes B.A. in Arts and Humanities, while the Science stream covers B.Sc. Medical and Non-Medical disciplines.
4. The study focuses on five districts (Kurukshetra, Karnal, Kaithal, Ambala, and Yamunanagar), limiting the generalizability to other regions.
5. Only two key variables were examined: attitude towards e-learning and academic achievement.

Descriptive Analysis

Years of Using E-Learning

The study collected data on the number of years students have been using e-learning resources. The graph-1 below presents the distribution of students based on their years of e-learning experience:

Graph-1. e-learning resources Usage

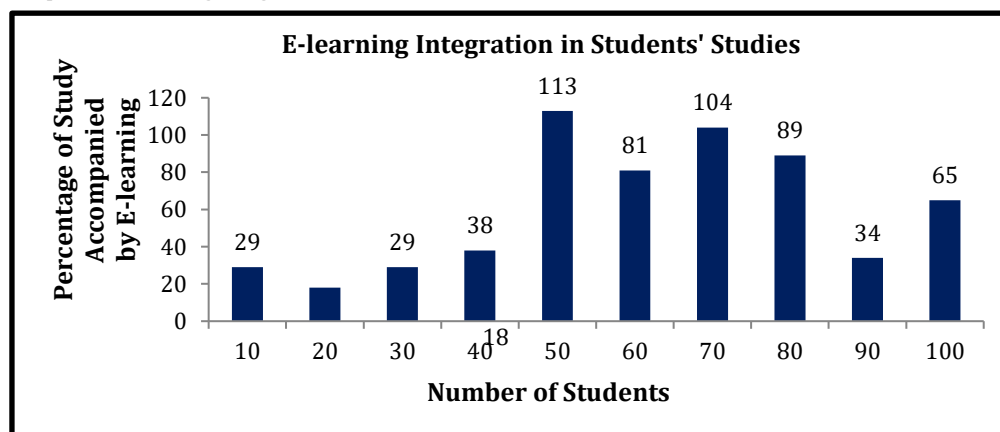


Graph-1 reveals that the majority of students have been using e-learning resources for a relatively short duration. The highest number of students (172) reported using e-learning for two years, followed by 144 students with three years of experience. This suggests that e-learning adoption among students has been more prominent in recent years, possibly due to technological advancements and the growing importance of digital learning tools.

Percentage of Study Facilitated by E-Learning

Students were asked to indicate what percentage of their studies is supported by e-learning resources. The distribution of responses is provided in the graph-2 below:

Graph-2. E-Learning integration in students' studies

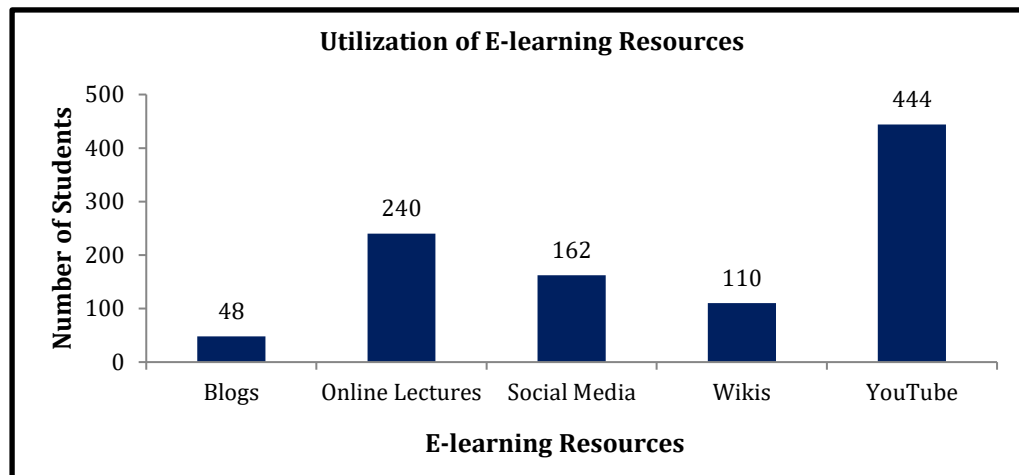


Graph-2 indicates that e-learning plays a significant role in students' academic activities. The highest number of students (113) reported that 50% of their studies are facilitated by e-learning. Additionally, a substantial number of students (104) indicated that 70% of their studies involve e-learning, highlighting a growing reliance on digital platforms. However, fewer students (65) reported using e-learning for the entirety of their studies.

Types of E-Learning Materials Used by Students

Students were also asked about the types of e-learning resources they frequently use. Students use multiple resources for their studies. The graph-3 below summarizes the responses:

Graph-3. Utilization of e-Learning resources



Graph-3 reveals a strong preference for YouTube as an e-learning resource, with 444 students using it for academic purposes. This suggests that video-based learning is widely popular among students, likely due to its accessibility and engaging content. Online lectures also emerged as a preferred resource, with 240 students relying on them for their studies.

Social media platforms (162 students) and wikis (110 students) also contribute to students' learning experiences, offering collaborative and reference-based support. However, blogs appear to be the least used resource, with only 48 students engaging with them for academic purposes. This may be due to students' preference for more interactive and multimedia-based content over text-heavy resources.

Table-3: Descriptive Analysis of Scores Obtained on Attitude towards E-learning Scale (N=600)

Dimension	Mean	SD	Skewness	Kurtosis
Content Quality & Perceived Usefulness	3.36	.738	-.060	1.106
Perceived Ease of Use, Accessibility & Flexibility	3.46	.770	-.152	.743
Behavioral Intention, Confidence & Satisfaction	3.54	.761	-.318	.561
Engagement, Interaction & Emotional Response	3.30	.710	.005	.788
Infrastructure & Resources	3.35	.767	-.311	1.072

Table-3 shows the descriptive statistics of the Attitude Towards E-learning Scale for undergraduate students (N = 600) which reveals that the mean scores for the five dimensions range from 3.30 to 3.54, indicating a generally positive attitude towards e-learning. The standard deviations falling between 0.710 and 0.770 reflect relatively low variability. This highlights that the responses are closely aligned around the mean. Skewness values for all dimensions are near zero, ranging from 0.318 to 0.005, suggesting that the data distributions are approximately symmetric. Additionally, kurtosis values range from 0.561 to 1.106, indicating slightly heavier tails compared to a normal distribution (leptokurtic). However, none of the kurtosis values are extreme, which means that the data is reasonably close to normality. As a result, the distribution can be considered normal.

Table-4: Relationship between students' attitude towards e-learning and their academic achievement

Variables	N	Coefficient of Correlation (r)	Level of significance	Result
Attitude towards e-learning and Academic achievement	600	0.697	Significant at 0.01 level	Null Hypothesis Reject

Table-4 shows the correlation analysis between students' attitude towards e-learning and their academic achievement. It reveals a statistically significant positive relationship. The Pearson correlation coefficient between students' attitude towards e-learning and their academic achievement is 0.697, indicating a strong positive correlation. This means that as students' attitude towards e-learning improves, their academic achievement also tends to increase proportionally. The observed correlation is statistically significant at 0.01 level. Thus, the hypothesis H01: "There is no significant relationship between students' attitude towards e-learning and their academic achievement." is rejected.

Table-5: Academic achievement of students at different levels of attitude towards e-learning

Attitude Level	N	Mean	SD	Std. Error
Low Positive Attitude	150	55.14	8.57	.700
Moderate Positive Attitude	311	59.97	5.49	.311
High Positive Attitude	139	72.14	8.51	.722
Total	600	61.58	9.39	.383

Table-5 shows academic achievement of students at different levels of attitude towards e-learning. For this student's attitude scores have been divided in three levels that is Low, Medium and High positive attitude towards e-learning. Mean and Std. Deviation for Low Positive Attitude students (N=150) are 55.14 and 8.57 respectively. Mean and Std. Deviation for Moderate Positive Attitude students (N=311) are 59.97 and 5.49 respectively. Mean and Std. Deviation for High Positive Attitude students (N=139) are 72.14 and 8.51 respectively. The overall mean score across all groups is 61.58 with a standard deviation of 9.39. The mean scores suggest that as attitude level increase, academic achievement score also tends to rise.

One-Way ANOVA Results: Academic Achievement Based on Attitude towards E-learning

A one-way ANOVA was conducted to examine whether students' academic achievement differed based on their attitude towards e-learning. The three attitude groups were Low, Moderate, and High Positive Attitude.

Table-6: Academic Achievement Based on Attitude towards E-learning

ANOVA RESULTS					
Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	22541.138	2	11270.569	222.366	.000
Within Groups	30258.861	597	50.685		
Total	52799.998	599			

Table-6 shows that the F-value of 222.366 indicates that the differences in academic achievement across the three attitude groups are substantial compared to variations within each group. The p-value is < 0.001, the differences in academic achievement among the attitude groups are statistically significant at the 0.05 level. Since the p-value is very small, we reject the hypothesis H02 (There is no significant difference in the academic achievement of students at different levels of attitude towards e-learning). Students' attitude towards e-learning has a significant impact on their academic achievement. Higher levels of positive attitude towards e-learning are associated with significantly different academic achievement levels compared to lower attitude.

Comparison of Students' Attitude towards E-learning Based on Gender

To examine whether male and female students differ in their attitude towards e-learning, an independent sample t-test was conducted across five dimensions of the attitude scale.

Table-7: Comparison of Students' Attitude towards E-learning Based on Gender

Dimensions	Gender	N	Mean	SD	Std. Error Mean	t	Sig. (p)	Result
Content Quality & Perceived Usefulness	Male	300	19.42	4.07	0.235	1.739	0.083	Not significant
	Female	300	20.00	4.05	0.234			
Perceived Ease of Use, Accessibility & Flexibility	Male	300	27.23	5.825	0.336	0.103	0.918	Not significant
	Female	300	27.27	5.272	0.304			
Behavioral Intention, Confidence & Satisfaction	Male	300	27.81	5.303	0.306	0.143	0.886	Not significant
	Female	300	27.87	5.513	0.318			
Engagement, Interaction & Emotional Response	Male	300	19.42	3.999	0.231	0.032	0.975	Not Significant
	Female	300	19.43	3.769	0.218			
Infrastructure & Resources	Male	300	10.14	2.020	0.117	0.675	0.500	Not significant
	Female	300	10.02	2.212	0.128			
Overall Attitude Score	Male	300	104.01	17.81	1.029	0.413	0.680	Not significant
	Female	300	104.59	16.57	0.957			

Table-7 presents a gender-wise analysis of five dimensions of attitude towards e-learning. To examine whether male and female undergraduate students differ in their attitude towards various aspects of e-learning, independent samples t-tests were conducted across five key dimensions of the scale. Each group comprised 300 male and 300 female students.

Dimension-wise Interpretation:

- **Content Quality and Perceived Usefulness:** Female students reported a slightly higher average score (M = 20.00, SD = 4.05) compared to male students (M = 19.42, SD = 4.07). However, the difference was not statistically significant, $t = 1.739$, $p = .083$. This indicating no meaningful difference between genders in their perception of content quality and usefulness.
- **Perceived Ease of Use, Accessibility, and Flexibility:** Both groups had nearly identical scores—males (M = 27.23, SD = 5.83) and females (M = 27.27, SD = 5.27). The t-test result, $t = 0.103$, $p = .918$, confirmed no significant difference, further supported the absence of a gender-based difference.
- **Behavioral Intention, Confidence, and Satisfaction:** Male students (M = 27.81, SD = 5.30) and female students (M = 27.87, SD = 5.51) showed almost the same levels of confidence and satisfaction with e-learning. The t-test result, $t = 0.143$, $p = .886$, indicated no significant difference.
- **Engagement, Interaction, and Emotional Response:** The average scores for males (M = 19.42, SD = 4.00) and females (M = 19.43, SD = 3.77) were nearly identical. The statistical test, $t = 0.032$, $p = .975$, showed no significant difference.
- **Infrastructure and Resources:** Males had a slightly higher average score (M = 10.14, SD = 2.02) compared to females (M = 10.02, SD = 2.21), but this small difference was not significant, $t = 0.675$, $p = .500$.
- **Overall Attitude Score:** Male students (M = 104.01, SD = 17.81) and female students (M = 104.59, SD = 16.57) showed almost the same levels attitude towards e-learning. The t-test result, $t = 0.413$, $p = .680$, indicated no significant difference.

Across all five dimensions of e-learning attitude, there were no statistically significant differences. All p-values were well above the standard threshold of 0.05. These results suggest that male and female undergraduate students hold similar attitude towards e-learning across all key dimensions.

Therefore, the null hypothesis H_{03} was accepted. The analysis suggests that gender does not play a significant role in shaping students' attitude towards e-learning in this study. Both male and female students show similar attitude regarding all dimensions of the scale. The overall attitude scores reinforce this equality.

Comparison of Students' Attitude towards E-learning Based on Academic Stream

To examine whether students from different academic streams (Arts and Science) differ in their attitude towards e-learning, an independent samples t-test was conducted across five dimensions of the attitude scale.

Table-8: Comparison of Students' Attitude towards E-learning Based on Academic Stream

Dimensions	Stream	N	Mean	SD	Std. Error Mean	t	Sig. (p)	Result
Content Quality & Perceived Usefulness	Arts	300	19.33	4.426	0.256	2.327	0.020	Significant
	Science	300	20.10	3.641	0.210			
Perceived Ease of Use, Accessibility & Flexibility	Arts	300	26.68	6.346	0.366	2.512	0.012	Significant
	Science	300	27.82	4.561	0.263			
Behavioral Intention, Confidence & Satisfaction	Arts	300	27.29	5.883	0.340	2.496	0.013	Significant
	Science	300	28.39	4.828	0.279			
Engagement, Interaction & Emotional Response	Arts	300	19.06	4.140	0.239	2.269	0.024	Significant
	Science	300	19.78	3.578	0.207			
Infrastructure & Resources	Arts	300	9.87	2.440	0.141	2.498	0.013	Significant
	Science	300	10.30	1.712	0.099			
Overall Attitude Score	Arts	300	102.23	19.595	1.131	2.973	0.003	Significant
	Science	300	106.38	14.126	0.816			

Table-8 reveals the analysis of the five dimensions of e-learning attitude stream wise. To explore attitude towards e-learning, independent samples t-tests were conducted across five key dimensions of the scale. Each group included 300 Science and 300 Arts undergraduate students.

- Content Quality and Perceived Usefulness: Science students reported a slightly higher average score ($M = 20.10$, $SD = 3.641$) compared to Arts students ($M = 19.33$, $SD = 4.426$). The difference was statistically significant, $t = 2.327$, $p = .020$, indicating difference between science and arts students' attitude towards content quality and usefulness.
- Perceived Ease of Use, Accessibility & Flexibility: Science students ($M = 27.82$, $SD = 4.561$) scored significantly higher than Arts students ($M = 26.68$, $SD = 6.346$), indicating they found e-learning platforms easier to use and more accessible ($t = 2.512$, $p = 0.012$), indicating difference between science and arts students' attitude towards perceived ease of use, accessibility & flexibility. The difference was statistically significant.
- Behavioral Intention, Confidence & Satisfaction: Science students ($M = 28.39$, $SD = 4.828$) reported significantly higher levels of behavioral intention, confidence, and satisfaction in e-learning compared to Arts students ($M = 27.29$, $SD = 5.883$) ($t = 2.496$, $p = 0.013$), indicating

difference between science and arts students' attitude towards behavioral intention, confidence & satisfaction. The difference was statistically significant.

- Engagement, Interaction & Emotional Response: Science students ($M = 19.78$, $SD = 3.578$) had significantly higher engagement and emotional response than Arts students ($M = 19.06$, $SD = 4.140$). The difference was statistically significant, ($t = 2.269$, $p = 0.024$), indicating difference between science and arts students' attitude towards engagement, interaction & emotional response.
- Infrastructure & Resources: Science students ($M = 10.30$, $SD = 1.712$) scored slightly higher than Arts students ($M = 9.87$, $SD = 2.440$), this difference was statistically significant ($t = 2.498$, $p = 0.013$), indicating difference between science and arts students' attitude towards infrastructure & resources.
- Overall Attitude Score: The overall attitude score towards e-learning was significantly more positive among Science students than Arts students. Science students scored higher ($M = 106.38$, $SD = 14.126$) than Arts students ($M = 102.23$, $SD = 19.595$). The difference was statistically significant ($t = 2.973$, $p = .003$). This indicates that, on average, students from science backgrounds hold more favorable attitude towards e-learning, possibly due to more exposure to technology and higher alignment of e-learning features with their academic needs.

All comparisons between Science and Arts students were statistically significant ($p < .05$). Science students scored higher across all factors and overall attitude, suggesting a more positive attitude towards e-learning. Hence, null hypothesis (H_{04}) was rejected.

DISCUSSION

Discussion on the Relationship between Students' Attitude towards E-Learning and Academic Achievement

The findings reveal a statistically significant positive correlation between students' attitude towards e-learning and their academic achievement. This result aligns with existing research demonstrating that a positive attitude towards e-learning enhances academic performance. For instance, Gurlek Kısacık et al. (2023) reported that students with a favorable attitude towards e-learning attained better academic outcomes during the COVID-19 pandemic. Similarly, Prakasha et al. (2022) found that motivation and engagement mediated the relationship between e-learning attitude and academic success.

Despite these findings, the relationship between e-learning attitude and academic achievement is not universally consistent. Ullah et al. (2017) found no significant correlation between e-learning attitude and academic performance among undergraduates, suggesting that external factors such as institutional support and technological infrastructure could moderate this relationship. Alsahou et al. (2022) similarly noted that even students with a positive attitude towards e-learning encountered academic challenges due to inadequate internet access and limited institutional resources. Additionally, Kumar and Pandey (2024) argued that barriers such as lack of teacher interaction and technical difficulties can hinder the potential benefits of a positive attitude towards e-learning, reinforcing the notion that systemic issues must be addressed to optimize digital learning outcomes.

This correlation is further influenced by students' self-regulation and prior e-learning experience. Uyar (2023) found that previous experience with digital learning environments enhances both attitude and academic performance. Berico and Traverro (2023) observed that despite a positive e-learning attitude, students with poor problem-solving skills struggled academically. Moreover, Kaur (2024) suggested that strong study habits are associated with a favorable attitude towards e-learning, implying that self-discipline plays a critical role in e-learning success.

An alternative explanation is the possibility of reverse causality—higher academic achievement may foster a more positive attitude towards e-learning. Additionally, factors such as socio-economic background, institutional support, and digital literacy levels could influence this relationship (Kumar et al., 2022). Sabah (2013) advocated for blended learning models that integrate digital and face-to-face instruction, a sentiment echoed by Rhema and Miliszewska (2014), who found that access to technology significantly shapes both e-learning attitude and academic outcomes.

Broadbent and Poon (2015) identified self-regulated learning strategies—such as time management, goal setting, and proactive engagement—as key mediators of the relationship between e-learning attitude and performance. Liaw (2021) further argued that students who find e-learning useful and enjoyable are more likely to engage actively with digital resources, participate in discussions, and complete assignments on time, all of which contribute to higher academic achievement.

Students with a moderate attitude towards e-learning exhibited intermediate academic performance, reflecting the variability in their e-learning experiences. Kumar and Pandey (2024) identified technical barriers such as connectivity issues and limited teacher interaction as key challenges for students who are neither fully resistant nor fully enthusiastic about e-learning. Alsahou et al. (2022) similarly noted that systemic factors, such as inconsistent internet access and inadequate institutional support, contribute to the mixed academic outcomes of this group.

Students with a low positive attitude towards e-learning demonstrated the poorest academic performance, underscoring the risks of disengagement in digital learning environments. Berico and Traverro (2023) found that resistance to e-learning tools and poor problem-solving abilities correlated with lower academic achievement. Moreover, the high standard deviation in this group suggests significant variability, with some students struggling due to infrastructural challenges (Kaur, 2024) while others lacked intrinsic motivation (Uyar, 2023). These findings support Ullah et al.'s (2017) conclusion that a negative attitude towards e-learning can undermine academic outcomes, even in technologically well-equipped settings.

Discussion of Gender Differences in Attitude towards E-Learning

The study found no significant gender-based differences in students' overall attitude towards e-learning, supporting recent research that suggests such disparities are narrowing (Prakasha et al., 2022; Masalimova et al., 2024). Equal access to digital tools and increased technological literacy, especially during the COVID-19 pandemic have likely contributed to this convergence (Alsahou et al., 2022; Harris et al., 2023).

While male students were traditionally assumed to be more comfortable with technology, current findings show that female students are equally confident and engaged. Notably, female students rated Content Quality and Perceived Usefulness slightly higher, reflecting structured learning habits and a preference for well-organized digital content (Uyar, 2023; Alsahou et al., 2022).

These results suggest that e-learning platforms do not require gender-specific customization. Instead, institutions should prioritize inclusive design, high-quality instruction, and robust support systems for all learners (Akpen et al., 2024; Kumar & Pandey, 2024).

Discussion of Stream-Based Differences in Attitude towards E-Learning

The study revealed significant differences across all dimensions of e-learning attitude, with Science students consistently showing more favorable responses than their Arts counterparts. This trend is attributed to Science students' greater exposure to technology-rich curricula, digital tools, and simulation-based learning environments (Prakasha et al., 2022; Kumar & Pandey, 2024; Akpen et al., 2024). Their higher scores in areas such as Content Quality, Ease of Use, Engagement, and Infrastructure reflect stronger digital fluency and institutional support (Kumar et al., 2022; Chikileva et al., 2023; Naik, 2024).

Arts students, by contrast, may face challenges due to less frequent interaction with digital platforms and a preference for reflective, dialogue-driven learning styles (El-Sabagh, 2021). The findings underscore that e-learning is not experienced uniformly across disciplines. To ensure equitable engagement, institutions should adopt stream-sensitive strategies that address the distinct pedagogical needs of Arts students while maintaining robust digital support for all learners (Masalimova et al., 2024; Bouchrika, 2025; Amarneh et al., 2021).

CONCLUSION

This study highlights a strong positive relationship between students' attitude towards e-learning and their academic achievement. Students with a high positive attitude of e-learning tend to perform better academically, confirming that attitude, engagement, and digital readiness play a crucial role in learning outcomes.

The findings indicate that Science students exhibit a significantly more positive attitude towards e-learning than Arts students. Gender-based differences were minimal, with female students rating content quality and usefulness slightly higher than their male counterparts.

These insights emphasize the importance of institutional support in fostering an effective e-learning environment. Enhancing digital infrastructure, promoting interactive learning strategies, and ensuring equitable access to technology can bridge existing gaps. Moreover, self-regulated learning skills and faculty training in digital pedagogy must be prioritized to maximize student success in online education.

Future research should explore longitudinal studies on e-learning adaptation, investigate the role of socio-economic factors in e-learning attitude, and assess blended learning models that integrate digital and traditional instruction. Understanding how different instructional strategies impact student engagement across disciplines will further strengthen e-learning frameworks.

PRACTICAL IMPLICATIONS

The findings of this study provide several practical implications for enhancing e-learning engagement among undergraduate students. The results indicate that content quality, ease of use, behavioral intention, and infrastructure significantly impact students' attitude towards e-learning. These insights can guide policymakers, educators, and institutions in developing effective strategies to improve e-learning experiences and outcomes.

Firstly, the strong influence of content quality suggests that educational institutions should prioritize high-quality, well-structured, and engaging digital learning materials. Course designers should ensure that e-learning content is interactive, relevant, and aligned with students' academic and career aspirations. Providing multimedia-rich resources, real-life case studies, and gamified learning experiences can further enhance student engagement and motivation.

Secondly, the role of ease of use highlights the necessity of user-friendly e-learning platforms. Institutions should invest in intuitive and accessible learning management systems (LMS) with minimal technical barriers. Offering technical support and training programs can further empower students to navigate e-learning environments efficiently, reducing frustration and dropout rates.

Thirdly, the study underscores the importance of behavioral intention in shaping students' attitude towards e-learning. Awareness campaigns, peer mentoring programs, and faculty encouragement can play a pivotal role in fostering a positive attitude towards online education. Additionally, integrating blended learning models can help ease the transition to fully online environments while maintaining student engagement.

Lastly, the significance of infrastructure support indicates that institutions must address digital accessibility challenges. Reliable internet connectivity, availability of digital devices, and institutional support for marginalized student groups are essential for bridging the digital divide. Universities and

policymakers should collaborate to ensure equitable access to e-learning resources, particularly for students from rural or underprivileged backgrounds.

Overall, the study highlights the multifaceted nature of e-learning attitude and the need for a holistic approach in improving online education. By focusing on content quality, platform usability, behavioral encouragement, and infrastructure support, educational stakeholders can create an inclusive and motivating e-learning environment that enhances academic achievement and student satisfaction.

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