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Development and standardization of a scale for attitude towards e-learning

Puja Saini[1] & Dr. Asha Yadav[2]
[1] Department of Education, Research Scholar, Om Sterling Global University, Hisar, India,
Orcid: https://orcid.org/0000-0001-5932-6564
[2] Department of Education, Associate Professor, Om Sterling Global University, Hisar, India,
Orcid: https://orcid.org/0009-0007-7804-9305
Emails: [1] pujasaini.puja@gmail.com, [2] ashayadav@osgu.ac.in

Abstract
The increasing reliance on digital learning platforms underscores the importance of robust tools to evaluate students' attitudes toward e-learning. This study addresses the gaps in existing research by developing and standardizing a comprehensive scale to measure undergraduate students' perceptions of e-learning. It encompasses broader dimensions such as content quality, perceived ease of use, engagement, and infrastructure support (Al-Fraihat et al., 2020; Zhang et al., 2020). Employing a mixed-methods approach, the research integrates qualitative feedback from domain experts with quantitative analysis of responses from 200 undergraduate students in Haryana, India. Rigorous testing, including item analysis, split-half reliability, Cronbach's alpha ($\alpha = 0.9$) and Exploratory factor analysis (68.14% variance) confirmed the scale's high reliability and validity. The validated scale provides practical applications for educators, policymakers, and researchers aiming to enhance students' e-learning experiences. Additionally, the study offers actionable insights to optimize digital resources and overcome barriers to e-learning adoption, particularly within diverse socio-economic contexts. Future research could expand the scale's applicability to various educational levels and cultural settings, further refining and broadening its utility.
Keywords: E-learning, Scale standardization, Attitude towards e-learning, E-resources, Attitude Scale

Introduction
Attitude shapes how a person thinks, feels, or behaves towards something, influencing their responses. It can be positive, negative, or neutral, affecting how individuals react to various situations. Personal experiences, beliefs, values, and social influences all contribute to shaping attitudes and decision-making processes (Ajzen, 2001). In the context of e-learning, attitude refers to students' overall feelings, beliefs, and perceptions about using digital platforms and resources for education. This includes emotional, cognitive, and behavioral responses that shape how students engage with e-learning.

A positive attitude towards e-learning means students are more likely to adopt online tools, see them as beneficial, and stay motivated to learn (Sun *et al.*, 2021). They view e-learning as flexible, convenient, and a valuable source of information (Ameen *et al.*, 2020). Conversely, a negative attitude can lead to frustration with technology, decreased motivation, and the belief that e-learning is inferior to traditional classroom instruction (Zhang *et al.*, 2020).

Studying attitudes towards e-learning has become increasingly significant with the global shift towards digital education. The growing adoption of e-learning, highlight both its advantages and challenges. Recent studies have shown that while students appreciate the flexibility and accessibility of e-learning, issues such as limited interaction, social isolation, and technological barriers persist (Masalimova *et al.*, 2024; Sikder *et al.*, 2022). These findings underscore the importance of understanding students' attitudes to improve educational outcomes and ensure effective use of digital resources.

Evaluating factors impacting students' attitudes and addressing barriers is essential, especially in regions with varied access to digital infrastructure (Kumar, 2021). Several factors shape students' attitudes towards e-learning, including content quality, perceived usefulness, ease of use, accessibility, flexibility, engagement, interaction, and infrastructure (Venkatesh *et al.*, 2003). High-quality, well-organized materials and user-friendly, accessible platforms are vital (Al-Fraihat *et al.*, 2020). Satisfaction and confidence in students reflect their comfort with e-learning, while engagement and interaction enhance the learning experience by promoting active participation (Fredricks *et al.*, 2004). Sufficient infrastructure, such as reliable internet access, is crucial for full participation in e-learning activities (Fox *et al.*, 2021).

Despite the availability of various scales to measure attitudes towards e-learning, existing tools often focus on specific aspects such as technology acceptance or readiness, neglecting broader dimensions like engagement, motivation, and institutional support (Hung *et al.*, 2010; Kumar & Bhattacharya, 2019). Recent studies have emphasized the need for a comprehensive framework that incorporates emerging factors such as system usability, learner engagement, and the psychological impact of e-learning environments (Hu & Xiao, 2025). These elements play a crucial role in shaping the effectiveness and accessibility of digital learning platforms, ensuring a more engaging and supportive experience for learners.

This study aims to address these gaps by developing and standardizing a scale to assess students' attitudes towards e-

learning. By incorporating a wide range of attitudinal dimensions, this scale seeks to provide a holistic understanding of students' perceptions and experiences, ultimately contributing to the improvement of e-learning practices and outcomes.

Literature review

Existing Scales Measuring Attitude Towards E-Learning

E-learning attitudes have been assessed using various scales, each contributing uniquely to the field while presenting certain limitations. The Technology Acceptance Model (TAM) developed by Davis (1989) focuses on perceived usefulness and ease of use, offering a widely recognized framework for evaluating users' acceptance of technology. Despite its extensive validation across different fields, TAM is limited to technological adoption and does not account for broader dimensions such as engagement, motivation, or institutional support. Venkatesh *et al.* (2003) expanded on TAM with the Unified Theory of Acceptance and Use of Technology (UTAUT), which incorporates factors like social influence and facilitating conditions alongside ease of use and usefulness. While more comprehensive in studying technology use, UTAUT primarily emphasizes behavioral intention and adoption, neglecting pedagogical and psychological dimensions vital for understanding attitudes toward e-learning.

Another notable tool is the E-Learning Readiness Scale (ELRS) proposed by Hung *et al.* (2010), which evaluates readiness based on technical skills, self-directed learning, and motivation. Despite being specifically designed for e-learning environments, ELRS excludes important factors such as content quality, interaction, and institutional support, limiting its utility for a holistic assessment. Kumar and Bhattacharya (2019) introduced the Students' Attitude towards E-Learning Questionnaire (SAELQ), emphasizing perceived usefulness, ease of navigation, and satisfaction with e-learning platforms. While SAELQ highlights satisfaction and usability—key aspects for acceptance of e-learning tools—it lacks consideration of motivational and emotional responses, institutional support, and socio-economic disparities in e-learning adoption.

The Test of e-Learning Related Attitudes (TeLRA) by Kisanga and Ireson (2016) examines teachers' attitudes toward e-learning in higher education settings, offering valuable insights into instructors' perceptions and readiness. However, TeLRA is designed for educators rather than students, overlooking critical factors such as engagement, infrastructure, or emotional responses. Lastly, Demirel (2022) developed the Students' Attitude Scale for Online Education, which captures positive and negative attitudes through dimensions such as confidence, satisfaction, and flexibility. Although this scale incorporates six dimensions relevant to the online learning experience, it fails to consider institutional support, cultural contexts, and e-learning's impact on motivation and engagement.

These limitations underline the need for further research to develop a more comprehensive tool for assessing students' attitudes toward e-learning, as discussed in subsequent sections.

Research Gaps in Measuring Attitudes Towards E-Learning

Existing research on attitudes toward e-learning has predominantly focused on technical aspects such as perceived ease of use, system usability, and technology adoption (Davis, 1989; Venkatesh *et al.*, 2003). While these studies have provided valuable frameworks for understanding the acceptance of digital platforms, they often neglect pedagogical and psychological dimensions such as motivation, engagement, and emotional responses (Sharma & Gupta, 2020). Additionally, most scales have been developed in high-income, technology-rich environments, limiting their applicability in regions with constrained digital infrastructure (Dhawan, 2020; Fox *et al.*, 2021). Critical factors such as institutional support, socio-economic and cultural differences, and emerging dimensions—like interactive course designs and learner engagement—remain underexplored (Masalimova *et al.*, 2024; Kumari & Jaiswal, 2025). Addressing these gaps is crucial for developing a comprehensive understanding of students' attitudes and ensuring effective global implementation of e-learning initiatives.

Unique Contributions of This Study

This study introduces a scale to assess students' attitudes toward e-learning, addressing gaps in existing tools. It evaluates dimensions such as content quality, perceived usefulness, ease of use, accessibility, behavioral intention, satisfaction, confidence, engagement, interaction, emotional response, and infrastructure support. By integrating these factors, the scale provides a holistic understanding of e-learning experiences, offering insights for enhancing digital education across diverse socio-economic and cultural contexts.

Objective of the Study

To develop and standardize a scale attitude towards e-learning.

To establish the norms for the categorization of students' attitude towards e-learning.

To find out the attitude of undergraduate students towards e-learning in Haryana.

Methodology

This study used a combination of qualitative and quantitative methods to develop and standardize the scale.

Qualitative Phase

Expert opinions from experienced educators in e-learning were gathered to improve the clarity and relevance of the initial items. These insights helped refine the scale, ensuring it addressed all necessary aspects of e-learning attitudes.

Quantitative Phase

The refined scale was pilot tested with 200 undergraduate students randomly selected from diverse academic disciplines across various colleges in five districts of Haryana. This representative sample ensured comprehensive data collection.

Development and Standardization of the Scale

Step 1: Generation of Initial Items:

Dimensions and Item Generation

To develop a comprehensive scale measuring students' attitudes toward e-learning, five key dimensions were identified based on an extensive review of literature and theoretical frameworks. These dimensions were selected to address diverse aspects of e-learning attitudes, ensuring a holistic evaluation of students' perceptions and experiences. The dimensions are as follows:

Content Quality & Perceived Usefulness (6 Items)

This dimension evaluates how effectively e-learning platforms support students in understanding course material, completing assignments, and achieving academic goals. Items were designed to assess content relevance, interactivity, and the perceived value of e-learning in improving academic performance.

Perceived Ease of Use, Accessibility & Flexibility (8 Items)

This dimension focuses on students' ability to navigate e-learning platforms easily and access resources conveniently. Items were formulated to measure the flexibility of e-learning systems, allowing students to learn at their own pace and location.

Behavioral Intention, Confidence & Satisfaction (8 Items)

This dimension assesses students' satisfaction with e-learning, their confidence in utilizing digital tools, and their intent to continue using these platforms. Items also evaluate students' likelihood of recommending e-learning to peers and their ability to overcome technical challenges.

Engagement, Interaction & Emotional Response (6 Items)

This dimension explores students' levels of engagement during e-learning sessions, including participation in discussions, collaborative learning, and group activities. Emotional aspects such as curiosity, reduced anxiety, and a sense of control over learning were also considered.

Infrastructure & Resources (3 Items)

This dimension examines the technical infrastructure and resources provided by e-learning platforms. Items address the reliability, availability of learning materials, and the overall ease of the e-learning experience.

In total, 33 items were initially drafted across the five dimensions, ensuring comprehensive coverage of the factors influencing e-learning attitudes. The items were designed using clear and concise language, and were structured on a 5-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree."

Strongly Disagree: 1 point
Disagree: 2 points
Neutral: 3 points
Agree: 4 points
Strongly Agree: 5 points

Step 2: Refinement of Items and Expert Review:

To ensure the scale's accuracy, ten experts with over five years of experience in education, educational psychology, educational technology, and e-learning reviewed the items. Their feedback refined the wording, clarity, and coherence of the scale, eliminating redundancy and improving precision. This rigorous process resulted in a finalized set of 31 items, each validated for relevance and comprehensibility, with two redundant items eliminated.

Step 3: Initial Testing:

The pilot study was conducted to develop and conduct initial validation of the scale with a sample of 200 undergraduate students, randomly selected from various academic disciplines across colleges in five districts of Haryana, India. The sample included participants with diverse demographic characteristics, such as gender (79 males, 121 females), location (104 from urban and 96 from rural), academic streams (113 from Arts, 87 from Science), and varying levels of familiarity with e-learning platforms. This diversity was intended to ensure comprehensive feedback on the scale items and their applicability across different contexts.

Step 4: Data Analysis:

Usage Duration: 67.74% of students had used e-learning resources for 1-3 years, 12.90% for 4 years, 13.71% for 5 years, and 5.65% for 6 years or longer.

E-learning Dependency: 22% used e-learning for 80% of their studies, over 70% for at least 50%, and less than 30% relied on e-learning for a small part of their studies.

Item Analysis:

After administering the tryout, the scale was scored using the Likert procedure. Scores from all 200 students were arranged in ascending order. The top 27% and bottom 27% were separated for item analysis. Mean and Standard Deviation values were calculated for each statement in both groups. The t-test assessed the differences between groups for all 31 items. Items with t values above 2.58 (significant at 0.01 level) were included in the final scale. All items were significant at 0.01 level.

Table 1: Mean, Standard Deviation, and t-values for High and Low Groups

Item no.	Item	High Group Mean	High Group SD	Low Group Mean	Low Group SD	t- value
1	E-learning helps me to understand the course material better.	4.74	0.68	2.80	1.02	11.69
2	E-learning allows me to complete assignments more efficiently.	4.61	0.74	3.04	1.12	8.65
3	E-learning helps me in improving my academic performance.	4.70	0.72	3.07	1.06	9.35
4	The e- content is more comprehensive and detailed.	4.67	0.61	2.96	1.10	9.95
5	The available e-learning materials are generally well-structured and easy to follow.	4.70	0.69	2.87	1.05	10.74
6	The available e-learning content is aligned with my learning goals.	4.54	0.75	3.06	0.94	9.08
7	The e-learning tools and platforms are user friendly.	4.72	0.66	3.00	0.95	10.95
8	I can easily access the e-learning material that I need.	4.76	0.51	2.93	0.97	12.30
9	E-learning platforms are easily accessible anytime.	4.87	0.39	3.20	1.05	10.91

10	I can access e-learning materials anywhere.	4.69	0.51	2.87	1.03	11.63
11	E-learning platforms are compatible with various internet speeds.	4.54	0.69	3.17	0.95	8.58
12	E-learning resources allow me to learn at my own pace.	4.74	0.56	3.00	1.03	10.95
13	E-learning provides me flexibility in scheduling my study time.	4.78	0.57	2.93	0.95	12.28
14	E-learning allows me to make balance between my study and other responsibilities.	4.61	0.79	3.00	0.95	9.59
15	I intend to continue using e-learning resources in the future.	4.81	0.44	3.24	1.03	10.36
16	I recommend e-learning to my peers.	4.81	0.44	3.00	1.08	11.43
17	I like to choose e-learning courses over traditional classroom courses.	4.56	0.66	2.87	1.10	9.64
18	I am confident in my ability to complete e-learning courses successfully.	4.78	0.42	3.06	0.96	12.08
19	I believe I can overcome any technical issues that arise during the use of e-learning resources.	4.56	0.63	2.83	0.91	11.44
20	I am satisfied with the interaction with other students while the use of e-learning resources.	4.69	0.61	2.80	0.94	12.40
21	E-learning provides me a satisfactory learning environment.	4.76	0.47	2.94	0.98	12.26
22	I am satisfied with the variety of learning activities in e-learning courses.	4.76	0.43	2.98	0.88	13.34
23	E-learning platforms facilitate active participation in discussions.	4.57	0.77	2.93	0.93	10.05
24	I feel engaged during e-learning sessions.	4.54	0.86	2.74	0.94	10.37
25	E-learning platforms provide opportunities for collaborative learning.	4.74	0.52	3.00	0.95	11.79
26	I am eager to learn through e-learning resources.	4.78	0.42	3.07	1.01	11.48
27	E-learning reduces my anxiety level about learning new material.	4.72	0.56	2.94	0.96	11.74
28	I feel more confident in my study when I use e-learning resources.	4.89	0.32	3.11	0.96	12.86
29	The e-learning platform provides reliable access to learning materials.	4.65	0.62	3.04	0.82	11.49
30	I feel that the technical infrastructure supports smooth e-learning experiences.	4.57	0.74	3.04	0.93	9.49
31	The resources available on e-learning platforms are sufficient for my learning needs.	4.72	0.63	2.80	0.92	12.72

Reliability and Validity Analysis

Reliability Analysis:

Reliability measures how consistently an assessment tool produces results. For this scale, reliability was established using the 'Split-Half Method,' where all items was divided into odd and even groups. Pearson Correlation was applied between the two halves, resulting in a high reliability coefficient of 0.9 ($p < 0.01$). Additionally, Cronbach's alpha was used to assess internal consistency, yielding a value of 0.9, indicating excellent reliability. Both methods confirm that the items strongly relate to each other and consistently measure the same concept. Typically, a Cronbach's Alpha above 0.7 is considered acceptable, while values over 0.9 are regarded as excellent. These high reliability measures indicate that the survey instrument used in this study is not only reliable but also strengthens the validity of the study findings.

Validity Analysis:

Validity is often categorized into different types. Content validity ensures that the items in a measurement tool represent the content domain. Construct validity, on the other hand, assesses how well a test measures the theoretical construct it is supposed to measure.

Content Validity:

Content validity relies on ensuring that the items in a test are a comprehensive and accurate representation of the content domain. During the development of the questionnaire, technology experts and educators conducted a logical, rational analysis to determine the content validity of the items.

Construct Validity:

Construct validity means that the total scores are examined in terms of a construct. The correlation between total scores and item scores was also used for validity. This approach assumes that the total score is valid; thus, the extent to which the item correlation with the total score is indicative of construct validity. Construct validity was established through high item-total correlations ($r > 0.60$) and alignment with theoretical dimensions during expert review

Table 2 shows the correlation between total scores and item scores. To assess the validity of the items in the scale, the correlation between individual item scores and the total score was calculated. The item-total correlation was calculated using Pearson's correlation coefficient, which measures the strength and direction of the linear relationship between two variables. The correlation between each item's score and the total score (sum of all items) was analyzed to understand how individual items relate to the overall attitude score.

The analysis revealed that the values of r were above 0.30 (ranging from 0.63 to 0.78) for all items of the scale, indicating a high correlation between individual item scores and the

total score. This indicates that the item is strongly related to the total score, meaning it measures the same thing as the overall test and is valid. Correlations above 0.30 suggest a satisfactory relationship between individual items and the total score, indicating that the items are moderately associated with the construct being measured. Values exceeding 0.50 demonstrate a strong relationship, reinforcing the validity of the scale (DeVellis, R.F., 2017). High correlations indicate that the item contributes meaningfully to the scale, with moderate to strong correlations suggesting good internal consistency.

Table 2: Correlation between Total Scores and Item Scores

Item	Correlation with Total Score (r-value)	Item	Correlation with Total Score (r-value)	Item	Correlation with Total Score (r-value)
Q1	0.74	Q12	0.75	Q22	0.78
Q2	0.64	Q13	0.75	Q23	0.66
Q3	0.69	Q14	0.73	Q24	0.74
Q4	0.71	Q15	0.71	Q25	0.73
Q5	0.76	Q16	0.78	Q26	0.72
Q6	0.67	Q17	0.70	Q27	0.69
Q7	0.71	Q18	0.76	Q28	0.73
Q8	0.73	Q19	0.71	Q29	0.76
Q9	0.68	Q20	0.74	Q30	0.66
Q10	0.70	Q21	0.78	Q31	0.75
Q11	0.63				

Exploratory Factor Analysis

Exploratory Factor Analysis (EFA) is a statistical technique used to identify the underlying structure among a set of observed variables. In the context of scale development, EFA helps simplify data by grouping related items together, ensuring that the items accurately reflect the intended latent constructs.

The factor structure of the 31-item Attitude Towards E-Learning Scale was examined using Principal Component Analysis (PCA) with Promax rotation, an oblique rotation method appropriate for theoretically correlated factors. The analysis yielded a five-factor solution accounting for 68.14% of the total variance, with all items demonstrating satisfactory communalities (range = 0.58–0.81). Both Kaiser's eigenvalue >1 criterion and scree plot inspection supported the retention of five factors, confirming the multidimensional structure of the scale.

Sampling adequacy was excellent, as indicated by a Kaiser-Meyer-Olkin (KMO) value of 0.954 and a significant Bartlett's test of sphericity ($\chi^2[465] = 4671.63$, $p < 0.001$), suggesting the data were highly suitable for factor analysis.

Factor Interpretation and Loadings

Table-3 presents the results of EFA. The five extracted factors aligned closely with the theoretical dimensions proposed during scale development:

1) Factor 1 (Content Quality & Perceived Usefulness) explained the largest proportion of variance (52.02%, eigenvalue = 16.127). All items loaded strongly (>0.60), with Q4 exhibiting the highest loading (0.89). This factor reflects learners' perceptions of the utility and depth of e-learning materials.
2) Factor 2 (**Perceived Ease of Use, Accessibility & Flexibility**) explained 5.56% of variance (eigenvalue = 1.725) and included eight items (Q7–Q14). Items Q7 and Q10 showed particularly robust loadings (0.88 and 0.84, respectively). While Q14 cross-loaded weakly (0.38) on Factor 4, it was retained due to its theoretical relevance to flexibility and strong primary loading (0.71).
3) Factor 3 (**Behavioral Intention, Confidence & Satisfaction**) explained (3.84% variance, eigenvalue = 1.189) included eight items (Q15–Q22) related to continued use and satisfaction. Q16 and Q21 loaded most prominently (0.91 and 0.87). Notably, Q19 loaded moderately on Factor 5 (0.42), suggesting a conceptual link between technical confidence and infrastructure quality.
4) Factor 4 (**Engagement, Interaction & Emotional Response**) explained (3.57% variance, eigenvalue = 1.106) included six items (Q23–Q28) measuring interactivity and affective responses. Q25 and Q28 demonstrated high loadings (0.93 and 0.82). The minor cross-loading of Q27 (0.39 on Factor 1) may reflect the interplay between engagement and content quality.
5) Factor 5 (**Infrastructure & Resources**) explained (3.15% variance, eigenvalue = 0.975) consisted of three items (Q29–Q31) assessing technical reliability. Q29 and Q30 loaded strongly (0.90 and 0.86), affirming the dimension's internal consistency (α = 0.807).

Although the eigenvalue of Factor 5 was slightly below the conventional cutoff (0.975 < 1.0), it was retained due to its strong theoretical relevance and robust item loadings (0.90 and 0.86). Additionally, the factor demonstrated good internal consistency (Cronbach's α = 0.807), indicating that it represents a reliable and meaningful dimension within the construct.

Inter-Factor Relationships

Moderate correlations between factors (range = 0.47–0.68) indicated that the constructs are related yet distinct. For

instance, the correlation between Factor 1 (Content Quality) and Factor 3 (Satisfaction) (r = 0.68) suggests that high-quality materials enhance user satisfaction, while preserving each factor's unique variance.

Scree Plot

The scree plot (Figure 1) provides a visual representation of the eigenvalues associated with each factor. A clear "elbow" is observed after the fifth component, supporting the retention of five factors as per the Kaiser criterion.

Figure-1

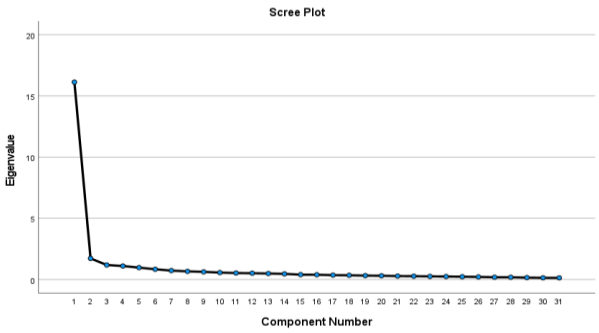

Table 3: Exploratory Factor Analysis Results for "Attitude towards E-Learning" Scale

Factor (Theoretical Dimension)	Key Items	Strongest Loadings	Eigen value	% Variance	α	Notes
Content Quality & Perceived Usefulness	Q1, Q2, Q3, Q4, Q5, Q6	Q4 (.89) Q6 (.85)	16.127	52.02%	0.87	All items loaded cleanly (> .60)
Perceived Ease of Use, Accessibility & Flexibility	Q7, Q8, Q9, Q10, Q11, Q12, Q13, Q14	Q7 (.88) Q10 (.84)	1.725	5.56%	0.91	Q14 had minor cross-loading (.38) on F4
Behavioral Intention, Confidence & Satisfaction	Q15, Q16, Q17, Q18, Q19, Q20, Q21, Q22	Q16 (.91) Q21 (.87)	1.189	3.84%	0.91	Q19 loaded on F5 (.42) but retained for theoretical relevance
Engagement, Interaction & Emotional Response	Q23, Q24, Q25, Q26, Q27, Q28	Q25 (.93) Q28 (.82)	1.106	3.57%	0.87	Q27 cross-loaded (.39) on F1
Infrastructure & Resources	Q29, Q30, Q31	Q29 (.90) Q30 (.86)	0.975	3.15%	0.80	-

The EFA revealed a robust five-factor structure underpinning attitudes toward e-learning, aligning with theoretical expectations. High factor loadings (>0.50) and reliability coefficients for all factors (α > 0.80) underscore the scale's psychometric strength. While minor cross-loadings emerged (e.g., Q19 on Factor 5), these likely reflect natural intersections between constructs—such as the role of technical confidence in infrastructure satisfaction—rather than measurement error. Future research should validate this structure using CFA with larger samples to assess its stability across diverse populations.

Reliability and Item Retention

All subscales exhibited high internal consistency (α = 0.807–0.912), supporting their reliability. Although some items showed cross-loadings (e.g., Q14, Q19, and Q27), none were removed due to:

1) Theoretical coherence: Each item contributed meaningfully to its primary factor's construct.
2) Statistical adequacy: Primary loadings exceeded 0.50, and deletion would not improve reliability.
3) Content validity: Expert review confirmed all items were essential for comprehensive measurement.

Norms and Interpretation of Attitude Scale

The norms for the present study were developed using percentile scores. The raw scores collected were converted into percentiles. Scores above the 75th percentile (135-155) represent a high attitude, those below the 25th percentile (31-106) a low attitude, and those between the 25th and 75th percentiles (107-134) constitute a moderate attitude. Table 4 shows the norms for interpreting the Attitude towards e-learning Scale.

Table 4: Establishment of Norms for the Interpretation of Attitude Levels

Range of Scores	Interpretation
Above 75th Percentile (135-155)	High Positive Attitude towards e-learning
Between 25th & 75th Percentile (107-134)	Moderate Positive Attitude towards e-learning
Below 25th Percentile (31-106)	Low positive Attitude towards e-learning

Analysis of Attitude of Undergraduate Students towards e-learning in Haryana

The investigator administered the Attitude towards e-learning scale to measure the attitudes of 200 undergraduate students

from Haryana. Table-5 summarizes the number, percentages, and interpretations of undergraduate students' attitudes towards e-learning. Based on the responses, students were categorized into three groups according to the norms of the scale.

Table 5: Attitude of Undergraduate Students towards e-learning in Haryana.

Number of students	Percentage	Interpretation
50	25%	High Positive Attitude towards e-learning
102	51%	Moderate Positive Attitude towards e-learning
48	24%	low Positive Attitude towards e-learning

Discussion

The present study examined undergraduate students' attitudes toward e-learning in Haryana, revealing a spectrum of responses: 51% demonstrated moderate positive attitudes, 25% high positive, and 24% low positive. These findings align with global trends, where e-learning acceptance remains mixed due to infrastructural, pedagogical, and psychological barriers (Ameen *et al.*, 2020; Kumar, 2021).

Moderate Positive Attitude: Opportunities for Intervention

The majority of students (51%) exhibited moderate positivity, acknowledging e-learning's benefits while facing challenges like technological difficulties and limited peer interaction. This aligns with Venkatesh *et al.*'s (2003) Unified Theory of Acceptance and Use of Technology (UTAUT), which posits that perceived ease of use and social influence shape technology adoption. However, the findings of this study extend this model by highlighting context-specific barriers—such as content quality and digital literacy—that are critical in Indian settings (Kumar & Bhattacharya, 2019).

Targeted interventions, such as structured peer-collaboration tools (Fredricks *et al.*, 2004) and simplified platform navigation (Al-Fraihat *et al.*, 2020), could bridge this gap. For instance, integrating discussion forums or virtual study groups may mitigate isolation, a known deterrent in e-learning (Masalimova *et al.*, 2024).

High Positive Attitude: Leveraging Enthusiasm

Students with high positivity (25%) valued e-learning's flexibility and accessibility, echoing Davis's (1989) Technology Acceptance Model (TAM), where perceived usefulness drives adoption. These students' enthusiasm could be harnessed to pilot advanced e-learning features (e.g., gamification; Dichev & Dicheva, 2017) or peer-mentoring programs to support less confident learners (Kumari & Jaiswal, 2025).

Low Positive Attitude: Addressing Systemic Barriers

The 24% with low positivity reported frustration with technology and perceived e-learning as inferior to traditional classrooms. This resonates with Sharma and Gupta's (2020) findings on psychological barriers (e.g., low self-efficacy) and infrastructural inequities (Fox *et al.*, 2021). In Haryana, where internet reliability varies, such attitudes may reflect broader digital divides (Kumar, 2021). Institutional investments in digital literacy workshops (Hung *et al.*, 2010) and subsidized internet access (Sikder *et al.*, 2022) are critical to inclusivity.

Conclusion

This study successfully developed and validated a scale to assess undergraduate students' attitudes toward e-learning in Haryana, India. The scale's multidimensional approach, incorporating content quality, perceived usefulness, engagement, and infrastructure support, represents a significant advancement over existing tools like TAM (Davis, 1989) and UTAUT (Venkatesh *et al.*, 2003). Rigorous psychometric testing, including exploratory factor analysis (68.14% variance), all items demonstrating satisfactory communalities (range = 0.58–0.81), split-half reliability & Cronbach's α (0.9), confirms its robustness as a measurement instrument.

The findings related to attitude towards e-learning reveal that while a majority (51%) of students demonstrates moderate positive attitudes, significant barriers persist - particularly regarding technological infrastructure, digital literacy, and engagement opportunities. These results align with global research (Kumar, 2021; Ameen *et al.*, 2020) while highlighting region-specific challenges that demand targeted interventions. The results underscore the need for institutional investments in digital resources and pedagogical strategies to enhance e-learning adoption. By addressing these challenges, educators and policymakers can foster more equitable and effective digital learning environments.

Future Implications

1) Broader Application of the Scale: The standardized scale developed in this study can be adapted and applied to various educational contexts, both in India and globally. Future research can explore how the scale developed in this study performs in different cultural, socio-economic, or institutional settings, providing comparative insights across diverse student populations.
2) Policy and Infrastructure Development: Findings from this study can guide policymakers in improving technology access, particularly in regions with limited access to technology. Future research can focus on identifying specific infrastructural improvements that can bridge the digital divide and ensure equitable access to e-learning resources.
3) Longitudinal Studies: Future research could explore how students' attitude towards e-learning evolves over time, especially as technology continues to advance. Conducting longitudinal studies can help track changes in student engagement, satisfaction, and motivation as new digital tools and e-learning platforms are introduced.
4) Impact on Different Academic Levels: While this study focuses on higher education, future research can expand to investigate how students' attitude towards e-learning varies at different educational levels such as secondary and postgraduate. This could help educators tailor e-learning environments for younger or more advanced students.
5) Integration with Other Learning Modalities: Future studies could explore how students' attitude towards blended learning (combining online and in-person

learning) differs from purely e-learning models. Understanding the attitude can help institutions design more flexible and inclusive learning systems.

6) Technological Training Programs: Based on the findings, future research could develop and test digital literacy training programs designed to improve students' confidence and satisfaction with e-learning platforms. Digital literacy training programs can aim to reduce technological anxiety and enhance the overall learning experience.
7) Assessment of Long-term Academic Performance: Future studies could investigate the long-term impact of positive attitudes towards e-learning on students' academic achievement, beyond short-term gains. This could involve tracking performance metrics over multiple semesters or academic years.

Limitations

1) Sample Limitations: The study sample is limited to undergraduate students from Haryana, which may not represent other regions or educational levels. Future research should include a more diverse sample to generalize findings.
2) Self-Reported Data: Reliance on self-reported data may introduce bias, as responses can be influenced by the current state of mind or external factors. Future studies could include observational or longitudinal data to complement self-reports.
3) Technological Familiarity: Variations in students' familiarity with technology could affect their responses, potentially skewing the results. Ensuring uniform exposure to e-learning tools before data collection could mitigate this issue.
4) Scope for Instrument Refinement: While the scale demonstrated strong reliability, some questionnaire items exhibited minor conceptual overlaps, suggesting room for refinement. A larger validation study with an expanded sample could help refine the scale. Additionally, employing advanced statistical techniques like Confirmatory Factor Analysis (CFA) in future iterations would further validate the scale's structural integrity.

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