

**IJRAR.ORG**

**E-ISSN: 2348-1269, P-ISSN: 2349-5138**



**INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS (IJRAR) | IJRAR.ORG**

**An International Open Access, Peer-reviewed, Refereed Journal**

# **Impact of Digital Learning and OER on Student Engagement and Learning Outcomes in Higher Education – Perceptions of Students**

**B. Krishnaveni**

Lecturer in Commerce

KVR Government College for Women  
Kurnool

DOI: <https://doi.org/10.56975/ijrar.v13i2.331644>

## **Abstract**

*Digital learning and Open Educational Resources (OER) have transformed higher education by enhancing access, flexibility, and learner engagement. This study examines students' perceptions of digital learning across four key dimensions: accessibility and flexibility, learning experience and engagement, infrastructure and technical accessibility, and learning outcomes and future readiness. Using a structured questionnaire, data were collected from 200 higher education students and analyzed using descriptive statistics, correlation, and multiple regression techniques. The results indicate a generally positive perception of digital learning, with mean scores ranging from 3.78 to 4.04, reflecting agreement on the effectiveness of digital education in enhancing academic performance and future preparedness. Correlation analysis revealed strong positive relationships among all four dimensions, particularly between learning engagement and learning outcomes, highlighting the interrelated nature of digital learning components. Multiple regression analysis demonstrated that accessibility and flexibility, learning experience and engagement, and technical infrastructure significantly predict students' perceived learning outcomes and preference for digital and blended learning, with engagement emerging as the strongest predictor. Overall, the findings suggest that digital learning effectiveness is a multidimensional construct in which accessibility, engagement, infrastructure, and learning outcomes are mutually reinforcing. The study underscores the importance of enhancing interactive learning experiences and strengthening digital infrastructure to maximize the benefits of digital education in higher education institutions.*

**Key Words:** Digital learning, Learning Management System, virtual learning platforms, artificial intelligence, multimedia tools

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Vijayawada, Andhra Pradesh, India.**

## Introduction

The rapid integration of digital learning and Open Educational Resources (OER) has significantly reshaped the landscape of higher education, offering new opportunities for flexible, inclusive, and student-centred learning. Advances in information and communication technologies have enabled learners to access educational content anytime and anywhere, thereby reducing traditional barriers related to time, location, and resources. Digital learning platforms, multimedia tools, and online collaboration environments have also enhanced student engagement and promoted active learning experiences. However, the effectiveness of digital learning depends on multiple interrelated factors, including accessibility, technical infrastructure, learner engagement, and perceived learning outcomes. Understanding how these dimensions interact is essential for designing effective digital learning strategies and policies in higher education.

In this context, the present study investigates students' perceptions of digital learning and OER across key dimensions and examines the relationships among accessibility, engagement, technical readiness, and learning outcomes, providing empirical evidence to inform digital education practices and institutional decision-making.

## Literature Review

1. Kampa et al. (2026) concluded that there is a significant difference in perceived usefulness and perceived use of OER between the students of various disciplines.
2. Taha Abuali, & Abdussalam Ali Ahmed. (2025), concluded that e-learning has the potential to revolutionize education by providing greater access to quality learning. E-learning can become a transformative tool for creating an inclusive, equitable and adaptable education system in emerging economies, contributing to sustainable development and educational empowerment.
3. David Mhlanga (2024) recommended strengthening digital infrastructure and institutional capacity to support asynchronous online education. Policymakers should implement targeted measures to address the digital divide and ensure equitable access to technology and internet services. Collaboration among government, academia, and industry is essential for integrating 4IR technologies in education.
4. Siddiquillah Barikzai et al. (2024), concluded that e-learning adoption in emerging economies remains at a nascent stage, with significant potential to expand educational access amid persistent infrastructural, technological, and contextual challenges. This study provides critical insights for policymakers, educators, and technology stakeholders, underscoring the need for context-specific strategies to ensure effective and inclusive e-learning implementation. By synthesising existing knowledge and identifying research gaps, the study contributes to the literature and offers a foundation for future research and adaptive e-learning frameworks in emerging contexts.

5. Emily Costan et al. (2021) emphasized that overcoming cybersecurity risks, health challenges, skill gaps, financial barriers, stakeholder apprehension, and weak collaborative mechanisms is essential for the effective implementation of Education 4.0 in emerging economies.
6. John Fungulupembe Kalolo (2018) emphasised that the digital era has proven to transform most education processes and systems. However, there exists a challenge in how most of the developing economies benefit from the digital era while avoiding the lapses in the education system. The study suggested that any technology cannot be blindly adopted, rather should be guided by the evidence that demonstrates productive and counterproductive approaches to technology in use.

## Research Gap

The literature review reveals the potential of e-learning in the development of emerging economies and also throws light on the challenges in the implementation of online education. The literature reviewed also covers the perceptions of students on online education. However, there is a paucity of empirical studies examining students' perceptions of e-learning in higher educational institutions that include undergraduate and postgraduate colleges in Kurnool town. Hence, this study is conducted as a moderate attempt to plug the gap and contribute to the extant literature.

## Objectives of the study

1. To examine the influence of accessibility, flexibility, learning engagement, and technical infrastructure on students' perceived learning outcomes and preference for digital and blended learning.
2. To analyze the interrelationships among accessibility and flexibility, learning experience and engagement, technical infrastructure, and learning outcomes in digital learning and OER contexts.

## Methodology

Data are collected from both primary and secondary sources. Secondary data are obtained from academic journals and government reports, while primary data are gathered through a structured questionnaire administered to undergraduate and postgraduate students across multiple disciplines in government and private higher education institutions. This mixed-source approach ensured a comprehensive understanding of the research context. The survey received responses from 180 students.

The study adopted a quantitative descriptive research design to examine students' perceptions of the usefulness and usability of Open Educational Resources (OER) in digital learning contexts and to analyze the factors influencing learning outcomes. The population comprised students enrolled in higher education institutions, and a structured questionnaire was used as the primary data collection instrument. The questionnaire consisted of four sections measuring Accessibility and Flexibility, Learning Experience and Engagement, Infrastructure and Technical Accessibility, and Learning Outcomes and Preference, using a five-point Likert scale ranging

from “Strongly Disagree” to “Strongly Agree.” A total of 180 valid responses were collected through an online survey.

Composite scores for each section were computed by averaging the responses to relevant items. Descriptive statistics were used to summarize students’ perceptions. Pearson correlation analysis was employed to examine the relationships among the study variables, while multiple regression analysis was conducted to assess the predictive influence of accessibility, engagement, and infrastructure on learning outcomes.

Learning Outcomes and Preference were treated as the dependent variable, while Accessibility and Flexibility, Learning Experience and Engagement, and Infrastructure and Technical Accessibility were treated as independent variables. Pearson correlation analysis was used to examine interrelationships among the study variables, and multiple regression analysis was used to determine the predictive influence of the independent variables on learning outcomes.

## Results

The results from Sections A, B, C, and D indicate a generally favourable perception of digital education among students in higher education. Section A (Accessibility and Flexibility) demonstrates that students perceive digital learning as a means to enhance accessibility, convenience, and self-paced learning, thereby facilitating better management of academic and personal commitments. This underscores the potential of digital platforms to support flexible and learner-centred educational environments.

Section B (Learning Experience and Engagement) reveals that students report positive learning experiences and higher levels of engagement through digital learning modalities, particularly due to the integration of multimedia content and interactive online learning tools. These findings suggest that digital pedagogical approaches contribute to increased student motivation and active participation in the learning process.

Section C (Infrastructure and Technical Readiness) indicates that students generally possess adequate technological infrastructure, including access to digital devices, reliable internet connectivity, and familiarity with learning management systems. Although some respondents reported technical constraints, these challenges were not perceived as major barriers to effective learning.

Section D (Learning Outcomes and Future Readiness) highlights that students perceive digital education as beneficial for improving academic performance, conceptual understanding, critical thinking abilities, and preparedness for future academic and professional requirements. Furthermore, the strong preference for blended learning approaches suggests that integrating digital and face-to-face instruction may enhance the effectiveness of higher education delivery.

Overall, the findings provide empirical evidence supporting the effectiveness of digital education in enhancing accessibility, engagement, technological readiness, and learning outcomes in higher education contexts.

## Interpretation of Mean scores

The statistical analysis indicates that students have a positive perception of the impact of digital education on learning outcomes and future preparedness. The mean scores for all statements ranged from 3.78 to 4.04, which fall within the “Agree” category. The highest mean score was recorded for the statement “Digital education prepares me better for the future” (Mean = 4.04), followed by preference for blended learning (Mean = 4.02), suggesting strong acceptance of digital education for future academic and professional readiness. The lowest mean score was observed for critical thinking and problem-solving skills (Mean = 3.78), indicating comparatively moderate perceptions regarding higher-order cognitive skill development. The overall mean score of 3.92 confirms that students generally perceive digital education as effective in enhancing academic performance and preparing them for future challenges.

The correlation analysis reveals a strong positive relationship among all four sections, indicating that students’ perceptions across different dimensions of digital learning and OER are highly interrelated.

Section A (Accessibility and Flexibility) shows a strong positive correlation with Section B (Learning Experience and Engagement) ( $r = 0.829$ ) and Section D (Learning Outcomes and Preference) ( $r = 0.815$ ), suggesting that improved accessibility and flexibility significantly enhance engagement and perceived learning outcomes. Section B demonstrates the strongest correlation with Section D ( $r = 0.862$ ), indicating that higher engagement in digital learning environments is strongly associated with better learning outcomes and a preference for blended learning. Section C (Infrastructure and Technical Accessibility) also shows moderate-to-strong correlations with other sections ( $r = 0.705$ – $0.763$ ), suggesting that adequate technical infrastructure is important for facilitating accessibility, engagement, and learning outcomes.

Overall, the results confirm that digital learning effectiveness is a multidimensional construct where accessibility, engagement, infrastructure, and learning outcomes are mutually reinforcing.

The multiple regression analysis revealed that accessibility and flexibility (Section A), learning experience and engagement (Section B), and infrastructure and technical accessibility (Section C) significantly predict students’ learning outcomes and preference for digital learning (Section D). The model was statistically significant ( $F = 210.4$ ,  $p < 0.001$ ) and explained 78.2% of the variance in learning outcomes ( $R^2 = 0.782$ ). Among the predictors, learning experience and engagement ( $\beta = 0.509$ ,  $p < 0.001$ ) emerged as the strongest predictor, followed by accessibility and flexibility ( $\beta = 0.246$ ,  $p < 0.001$ ) and infrastructure and technical accessibility ( $\beta = 0.140$ ,  $p = 0.018$ ). These findings indicate that while technical infrastructure is important, students’ engagement and interactive learning experiences play a more critical role in enhancing perceived learning outcomes in digital learning environments.

## Discussion

The study findings indicate a generally favourable perception of digital education among higher education students across dimensions of accessibility, engagement, infrastructure, and learning outcomes. Students perceived digital learning as flexible, convenient, and supportive of self-paced study, reinforcing the relevance of learner-centred digital pedagogies. The high overall mean score (3.92) reflects strong acceptance of digital education, with future preparedness and preference for blended learning receiving the highest ratings, highlighting students' recognition of digital learning as essential for academic and professional readiness. However, relatively lower perceptions regarding critical thinking development suggest the need for improved instructional design to foster higher-order cognitive skills.

Correlation analysis revealed strong positive relationships among all dimensions, confirming that accessibility, engagement, infrastructure, and learning outcomes are interdependent components of effective digital learning. The strongest association between engagement and learning outcomes underscores the importance of interactive and multimedia-driven pedagogical approaches. Multiple regression results further demonstrated that engagement is the most significant predictor of learning outcomes, followed by accessibility and infrastructure, explaining 78.2% of the variance. This indicates that while technical infrastructure is necessary, pedagogical engagement plays a more critical role in enhancing learning outcomes.

Overall, the findings suggest that digital education can significantly enhance higher education delivery when supported by engaging pedagogy, adequate infrastructure, and blended learning models, with important implications for institutional strategies and policy frameworks.

## Limitations and Scope for Further Research

This study relied on self-reported data from selected higher education institutions, which may limit the generalizability of the findings. The cross-sectional design restricts causal interpretation, and only student perspectives were considered. Future research should use longitudinal and mixed-method approaches, include multiple stakeholder groups, and expand regional coverage. Incorporating objective academic performance indicators would further strengthen evidence on the effectiveness of digital education and Education 4.0 implementation.

## Conclusion

This study demonstrates that students in higher education hold favourable perceptions of digital education in terms of accessibility, engagement, infrastructure readiness, and learning outcomes. The findings confirm that digital learning, particularly when integrated with blended approaches, enhances academic performance and future preparedness. Engagement emerged as the strongest predictor of learning outcomes, highlighting the importance of interactive pedagogical practices. Overall, the study underscores the need for sustained institutional and policy support to strengthen digital education implementation in emerging economies.

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