IEEE Access
Multidisciplinary ⋮ Rapid Review ⋮ Open Access Journal

Received 16 September 2025, accepted 29 September 2025, date of publication 1 October 2025, date of current version 9 October 2025.

Digital Object Identifier 10.1109/ACCESS.2025.3616630

RESEARCH ARTICLE

Bridging System Development Perspectives and Quantitative Analysis of User Adoption in Educational Information Systems

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ABSTRACT Sustaining digital platform adoption in computer science requires both robust system design and quantitative evaluation of user behavior and system performance. System Quality (SQ), encompassing reliability, responsiveness, security, and usability, is a critical determinant of adoption. However, most studies grounded in the Technology Acceptance Model (TAM) and Task–Technology Fit (TTF) have overlooked objective SQ metrics and the moderating influence of Digital Skills (DS). This study introduces the Digital Educational Systems Adoption Framework (DESAF), which integrates TAM, TTF, and DS to analyze the adoption of the Graduate Academic Information System Services (GAISS). A mixed-method design combined three years of Microsoft IIS server log data (2022–2024) with 550 user survey responses. SQ was quantified through request volumes, response times, error rates, and downtime, and analyzed alongside behavioral constructs using structural equation modeling in SmartPLS 4. Results indicate that SQ strongly predicts DS ($\beta = 0.416$, $p < 0.001$) and actual system use ($\beta = 0.251$, $p < 0.001$), while DS significantly enhances perceived ease of use, usefulness, satisfaction, and actual use ($\beta = 0.151$, $p < 0.001$), confirming its dual role as both predictor and moderator. System performance improved substantially, with average response times decreasing from 526 ms to 305 ms and downtime decreasing from 3.67% to 2.86%, while the number of annual requests increased from 155,000 to 966,000. Yet, feature expansion increased error rates to 14.88%, highlighting a trade-off between performance and complexity. The validated DESAF model advances computer science by bridging software performance engineering and behavioral modeling, providing an evidence-based framework for adaptive, user-centered platforms that are sustained through longitudinal performance monitoring.

INDEX TERMS Educational technology, human–computer interaction, information systems, software development, software engineering, systems analysis, user experience, usability.

I. INTRODUCTION

In the digital transformation of higher education, academic institutions increasingly rely on information systems to manage complex administrative and educational tasks, with technology becoming integral to the way students, educators, and administrators engage with learning and administrative processes [1], [2]. With the advancement of digital educational information systems, educational institutions are becoming increasingly competitive. To meet a variety of educational service needs, their systems often include multi-user environments with additional features and components that promote teamwork, simplify administrative tasks, and enhance learning opportunities across a range of technical competencies [3], [4], [5]. The creation of digital educational systems must consider the varying levels of digital competency among users, each with distinct needs and expectations. These users include executives, administrative staff, faculty, and students. According to Atalla et al. [6], contemporary student information systems provide

The associate editor coordinating the review of this manuscript and approving it for publication was Maria Chiara Caschera.