

**Analysis of Digital Technology
Adoption in Higher Education: An
Integrated Approach of ML-DSS****Miss. Kirti Parmar**Assistant Professor in BCA
Smt. B. V. Dhanak College, Bagasara**Abstract**

Covid-19 Pandemic Era has given a new rise to Digital Technology; it has transformed the Perspective of Education. Learning with Digital tools has given new experiences, improved the learner's abilities and supported expansion in use of Technology among Higher Education Students. However, the Technology adoption varies among them due to lack of Digital Literacy, Technical Infrastructure, Language barrier and their Social & Economic background. The study analyses the Digital Technology adoption among higher education students using Machine Learning (ML) techniques and Decision Support System (DSS). The Analysis is based on various Machine Learning Algorithms such as Random Forest, Decision Tree, and Support Vector Machine, Artificial Neural Network (ANN) to predict the adoption level and give classification of student's engagement towards digital technology. The DSS will be helpful for administrators to design and develop strategies to boost technology adoption in education sector so the more student will be benefited with it.

Keywords: Digital Technology Adoption, Higher Education, Machine Learning, Decision Support System, Support Vector Machine, Artificial Neural Network (ANN)

1. Introduction

In higher education, digital technology has boosted the process of teaching learning in 10X speed. Many online learning platforms have been introduced after Covid-19 for students worldwide. Cloud Computing, Artificial Intelligence and Mobile Applications are introduced in modern education. Digital technology has accelerated the learning process of students in all grades; but analysis of adoption of digital technology among students is a thinkable question in many regions.

Even though the good internet connections and availabilities of Digital Technology; there are many differences found in the adoption rates of technology among students of different grades in school, higher education, colleges and universities. Understanding the differences are essential for educational institutions and administrators to improve and enhance the teaching learning process.

Integration of Machine Learning (ML) techniques and Decision Support Systems (DSS) offers the predication and analysis for understanding the technology adoption Patterns using different algorithms and can provide actionable insights for administrators.

This research studies the various factors affecting the digital technology adoption among higher education students and suggests the ML-DSS integrated framework for educational decision making.

2. Review of Literature**2.1 Theoretical foundation for Digital Technology Adoption**

The most widely cited theoretical framework for understanding technology adoption behavior is Technology Acceptance Model (TAM), introduced by Davis (1989). TAM depicts Perceived Usefulness (PU) and Perceived Ease of Use (PEoU) adoption intention and actual use

based on past history. The model has been extended into the Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh et al. (2003) for additional constructs based on TAM.

In the higher educational framework for analyzing the Pattern and behavior of students based on their past usage of technology the above models are used as a base study.

2.2 Machine Learning (ML) for Predicting Students Technology adoption

Machine Learning (ML) works with ensemble methods like Gradient Boosting, Random Forest and Supervised algorithms for predicting student's performance using digital technology, their dropout rates, engagement levels and changing patterns of learning.

ML is widely used to enhance academic and administrative functions for student performance prediction based on their historical records, attendance patterns and engagement metrics to forecast student success or failure. It is used to automate complex tasks to improve efficiency and decision-making.

2.3 Decision Support Systems in Higher Education

The DSS applications are deployed with academic planning, model-based reasoning by integrating data analysis in higher education context. It represents the analytical prediction for better decision making, improves resource allocation, and enhances policy formulation by integrating the ML models in DSS architectures.

2.4 Research Gaps

Despite the growing research on effectiveness of adoption of digital technology there are significant gaps found in analyzing and applying adoption using the Machine Learning (ML) and Decision Support System (DSS). Existing studies focuses on conventional statistical

methods to judge students by their socio-economic background, their learning abilities and so on. This research will focus on using TAM and UTAUT models for prediction of student's performance using ML techniques and algorithms. It will also indentify the critical satisfaction drivers using DSS and by integration of ML and DSS the analysis and prediction of technology adoption will be more satisfactory for the decision makers.

3. Research Objectives

- Based on the previous studies; design and develop a model for technology adoption.
- Compare and design the ML models for better prediction and strategic decision making.
- Design Decision Support System for administrators
- Understand TAM an UTAUT model analysis

4. Research Questions

RQ1: What factors significantly influence digital technology adoption among higher education students?

RQ2: Which machine learning algorithm provides the highest prediction accuracy?

RQ3: How can a DSS support educational institutions in promoting digital learning?

5. Research Methodology

5.1 Research Design

This study focuses on designing a prototype for Machine Learning (ML) and DSS integrated model. It adopts a quantitative, cross-sectional research design. An Applied and comparative research can also be used for understanding the usage of digital technology among various regions of higher education students.

5.2 Data Collection methods and Variables

Primary data collected based on the structured digital questionnaire using Google Forms. The questionnaire is distributed in 3 sections- Academic and Socio-Economic background, Technology usage and technical tools availability, gender and literacy check.

Secondary data collected from Research Papers. Government reports, UGC/AICTE reports, Digital India Statistics. Independent variables used are – Internet availability, Family Income, Educational Background, Gender, and Location (urban/rural).

5.3 Population and Sample Size

The study focused on Higher Education student's technology adoption analysis; therefore, targeted age group is 18-21 years, where stratified sampling techniques used for the sample size of 200-500 students from different region of urban and rural sector from higher education.

5.4 Conceptual Framework

The conceptual framework is designed to understand the student's characteristics -> Factors of accessing Digital technology -> students technical literacy level -> Technology Adoption -> prediction based on Machine Learning techniques -> designing Decision Support System.

6. Machine Learning Algorithms

- **Random Forest, Logical Regression, Support Vector Machine (SVM)**

Random Forest is an ensemble learning method used to construct various decision trees which enhances the predication accuracy. Logical regression is used for binary classification and identifying the influential factors. SVM evaluated the multiclass problem and employed

one – vs – rest strategy for comparative evaluation.

- **Model Evaluation Metrics**

Accuracy, precision, F1-Score and recall are the evaluative matrices for Machine Learning Algorithms and techniques.

7. Decision Support System Prototype

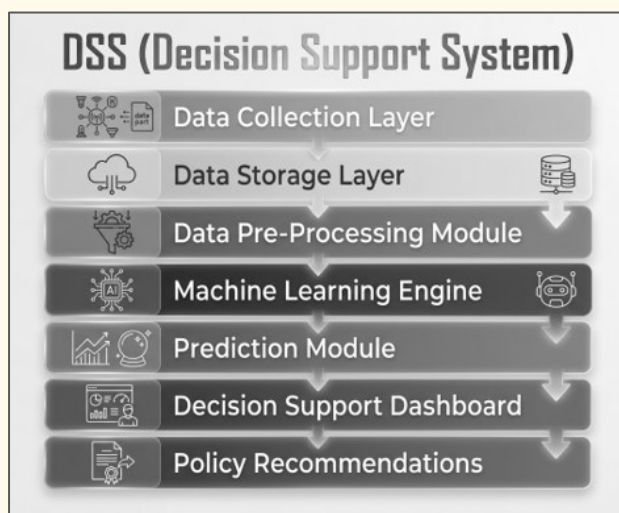


Figure 1.0: Decision Support System for Higher Education System

This Prototype is designed for understanding and suggesting the student readiness for adopting technology, allocation of resources, to monitor digital inclusion and institutional performance reporting.

8. Results and Analysis

Descriptive Analysis shows that among the surveyed students – 90% students owned smart phones, 75% had access to personal computers, 82% students are using online platforms for study regularly, 62% has high digital literacy levels, 32% are not having sufficient technology due to socio-economic barriers.

Machine Learning result shows that Random Forest model achieved the highest prediction accuracy and demonstrated superior performance in indentifying technology adoption.

DSS suggested the effective adoption of technology users and students at risk of low technology adoption. This can give the overall planned structure for decision makers and administrators.

9. Recommendation and Conclusions

The findings suggest that the digital literacy and internet accessibility are critical determinants of technology adoption among higher education students. Study suggests that ML-driven analysis of digital technology adoption among 500 higher education students in India yielding several key insights. Institutional support, digital literacy, perceived usefulness, and peer influence constitute the remaining top-five determinants. Significant adoption disparities exist across disciplines, geographic origins, and years of study, pointing to the need for targeted rather than uniform institutional interventions. ML-DSS significantly improves administrative decision-making, Predictive analytics helps identify at-risk students; Resource allocation becomes more efficient, Data-driven planning improves institutional performance.

For administrators and policymakers, this research offers three primary actionable recommendations.

- Infrastructure investment particularly for rural-origin students.
- Institutional support structures — including technical helpdesks, digital literacy programmer, and faculty development Programs has to be regulated to improve the technical knowledge.
- Peer-led technology promotion initiatives should be formalized.

Future Research may incorporate the Explainable Artificial Intelligence (XAI) along with ML-DSS integration and a deep learning methodology has to be incorporated.

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