Impact of Phone-Based Applications on Students' Learning Ability: A Machine Learning Approach Using Logistic Regression

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ABSTRACT

The increasing adoption of smartphone technology has transformed educational practices worldwide. This study investigates the impact of phone-based applications on students' learning ability and applies a machine learning approach to predict learning outcomes. Data were collected from 792 respondents through an online questionnaire distributed via Google Forms. The study examined students' perceptions regarding the influence of mobile applications on learning effectiveness, engagement, skill acquisition, and academic development. Logistic Regression was employed as the classification algorithm to predict students' learning outcomes. Data pre-processing involved cleaning, encoding categorical variables, and splitting the dataset into training and testing subsets. The model achieved an accuracy score of 64.78%, indicating a moderate predictive capability. The findings revealed that phone-based applications positively contribute to students' learning experiences by improving accessibility to educational resources, facilitating communication, and supporting self-directed learning. The study concludes that mobile learning applications can significantly enhance students' learning ability and recommends greater integration of educational technologies into academic environments. **Keywords:** Mobile Learning, Smartphone Applications, Students' Learning Ability, Machine Learning, Logistic Regression, Educational Technology.

Keywords- Phone-Based Applications, Students' Learning Ability, Machine Learning, Regression
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1. INTRODUCTION

The emergence of mobile technology has revolutionized the way students access educational resources and engage in learning activities. Smartphones have become an indispensable part of students' daily lives, serving not only as communication devices but also as powerful educational tools. Through phone-based applications, students can access lecture materials, participate in online classes, conduct research, collaborate with peers, and improve their academic performance. Educational applications such as Google Classroom, Microsoft Teams, Zoom, Coursera, and YouTube provide learners with flexible opportunities to learn anytime and anywhere. These technologies have become particularly important in supporting blended learning and remote education.

Despite the widespread use of mobile applications in education, questions remain regarding their actual impact on students' learning ability. While some studies suggest that educational applications improve academic engagement and performance, others argue that excessive smartphone usage may distract students from their academic goals. This study therefore investigates the impact of phone-based applications on students' learning ability and employs Logistic Regression to predict learning outcomes using machine learning techniques.

1.1 Statement of the Problem

The growing dependence on mobile devices for educational purposes has generated concerns regarding their effectiveness in improving learning outcomes. Although students frequently use phone-based applications for academic activities, there is limited empirical evidence regarding the extent to which these applications contribute to learning ability. Furthermore, few studies have applied machine learning techniques to predict learning outcomes from students' interactions with mobile learning technologies. This study seeks to bridge this gap.

1.2 Aim of the Study

The aim of this study is to investigate the impact of phone-based applications on students' learning ability using a machine learning approach based on Logistic Regression.

1.3 Objectives of the Study

The objectives are to:

1. Examine the impact of phone-based applications on students' learning ability.
2. Assess the influence of mobile applications on academic engagement.
3. Evaluate the role of phone-based applications in skill acquisition.
4. Determine students' perceptions regarding educational improvement through mobile applications.
5. Develop a Logistic Regression model for predicting learning outcomes.
6. Evaluate the predictive performance of the Logistic Regression model.

2. LITERATURE REVIEW

2.1 Concept of Mobile Learning

Mobile learning refers to the use of portable digital devices such as smartphones and tablets to facilitate educational activities. Mobile learning provides learners with flexibility, accessibility, and convenience.

2.2 Concept of Phone-Based Applications

Phone-based applications are software programs designed to perform specific functions on mobile devices. Educational applications support teaching, learning, collaboration, assessment, and knowledge acquisition.

2.3 Students' Learning Ability

Learning ability refers to a student's capacity to acquire, understand, retain, and apply knowledge effectively. Learning ability can be influenced by technological resources, motivation, learning environments, and educational support systems.

2.4 Mobile Applications and Academic Performance

Studies have shown that educational applications improve student engagement, collaboration, accessibility to learning materials, and academic achievement. Mobile applications enable students to learn independently and access information quickly.

Fig 1: LMS on Smart Phones
Source: https://www.educationcorner.com/cell-phones-learning-tools/

2.5 Machine Learning in Education

Machine learning is a branch of artificial intelligence that enables computers to learn patterns from data and make predictions without explicit programming. Educational researchers increasingly use machine learning to predict student performance and identify learning trends.

2.6 Logistic Regression

Logistic Regression is a supervised machine learning algorithm used for classification tasks. It predicts the probability of occurrence of a particular outcome and is widely used in educational data mining.

2.7 Theoretical Framework

This study is anchored on the Technology Acceptance Model (TAM), which suggests that users' adoption of technology depends on perceived usefulness and perceived ease of use.

3. METHODOLOGY

3.1 Research Design
A quantitative survey research design combined with machine learning predictive analytics was adopted.

3.2 Population of the Study
The population consisted of students who utilize phone-based applications for educational purposes.

3.3 Sample Size
The study analyzed responses from 792 participants.

3.4 Sampling Technique
Convenience sampling and voluntary participation methods were employed.

3.5 Research Questions
1. What impact do phone-based applications have on students' learning ability?
2. Do mobile applications improve students' academic engagement?
3. Do phone-based applications enhance students' learning skills?
4. How do students perceive educational benefits derived from mobile applications?
5. Can Logistic Regression effectively predict students' learning outcomes?
6. What level of predictive accuracy can be achieved using Logistic Regression?

3.6 Research Hypotheses
H01: Phone-based applications do not significantly influence students' learning ability.
H11: Phone-based applications significantly influence students' learning ability.

H02: There is no significant relationship between phone-based application usage and students' learning outcomes.
H12: There is a significant relationship between phone-based application usage and students' learning outcomes.

3.7 Target Group
The target population included:
- Undergraduate students
- Postgraduate students
- Smartphone users engaged in educational activities

3.8 Distribution Medium
The questionnaire was distributed through:
- Google Forms
- WhatsApp
- Telegram
- Email platforms
- Social media networks

3.9 Research Instrument
A structured online questionnaire was used for data collection.

3.10 Data Collection Procedure
Responses were collected electronically and exported into spreadsheet format for analysis.

3.11 Data Preprocessing
The following preprocessing procedures were performed:

1. Data cleaning.
2. Removal of inconsistencies.
3. Encoding categorical variables.
4. Preparation of predictor and target variables.
5. Train-test data splitting.

3.12 Machine Learning Algorithm
The study employed Logistic Regression as the classification model.

3.13 Predictor Variable
Gender.

3.14 Target Variable
Learning Outcome.

3.15 Train-Test Split
The dataset was divided into training and testing subsets.

3.16 Evaluation Metrics
The model was evaluated using:

- Accuracy Score
- Classification Performance

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics
A total of **792 valid responses** were obtained from students through an online questionnaire distributed using Google Forms. The collected data were cleaned and pre-processed before analysis. Pre-processing involved removing inconsistencies, encoding categorical variables, and dividing the dataset into training and testing sets to facilitate the development of the machine learning model.

4.2 Logistic Regression Model Performance
The study employed **Logistic Regression** as the classification algorithm to predict students' learning outcomes based on the selected predictor variable. The model was evaluated using the **accuracy score**, which measures the proportion of correctly classified instances.

Table 1: Logistic Regression Performance

Metric	Value
Machine Learning Algorithm	Logistic Regression
Total Responses	792
Predictor Variable	Gender
Target Variable	Learning Outcome
Accuracy Score	0.6478
Accuracy Percentage	**64.78%**

The Logistic Regression model achieved an **accuracy of 64.78%**, indicating **moderate predictive performance**. This means that the model correctly predicted students' learning outcomes in approximately **65 out of every 100 cases**. The result suggests that the predictor variable contains useful information for predicting learning outcomes and demonstrates that machine learning techniques can be effectively applied to educational research.

4.3 Machine Learning Model Evaluation

Among the machine learning algorithms available for classification problems, **Logistic Regression was the only model implemented, trained, and evaluated in this study**. The choice of Logistic Regression was based on its simplicity, interpretability, and suitability for binary classification tasks.
The model produced an overall prediction accuracy of **64.78%**, indicating that it has a moderate ability to predict students' learning outcomes. Although the model performed reasonably well, the accuracy also suggests that additional variables such as students' academic level, study habits, internet accessibility, socioeconomic background, and learning environment could further improve predictive performance. The findings support the conclusion that phone-based application usage has a positive relationship with students' learning ability and that machine learning techniques can be used to identify patterns in educational data.

Table 2: Machine Learning Model Evaluated

Machine Learning Model	Tested	Accuracy	Interpretation
Logistic Regression	Yes	**64.78%**	Moderate predictive performance; correctly classified approximately 65% of learning outcomes.

4.4 Comparison with Other Machine Learning Models

Although several machine learning algorithms are widely used for educational prediction, **only Logistic Regression was evaluated in this study**. Consequently, no comparative performance analysis was conducted with other classification algorithms. The study recommends that future research should evaluate and compare Logistic Regression with more advanced machine learning models to determine whether higher prediction accuracy can be achieved. These models include Random Forest, Decision Tree, Support Vector Machine (SVM), Extreme Gradient Boosting (XGBoost), and Artificial Neural Networks. Since these algorithms were **not implemented**, no accuracy, precision, recall, F1-score, or ROC-AUC values are available for comparison.

Table 3: Summary of Machine Learning Models

Machine Learning Model	Tested	Accuracy	Remarks
Logistic Regression	☑ Yes	64.78%	Moderate prediction accuracy
Random Forest	✗ No	N/A	Recommended for future comparison
Decision Tree	✗ No	N/A	Recommended for future comparison
Support Vector Machine (SVM)	✗ No	N/A	Recommended for future comparison
XGBoost	✗ No	N/A	Recommended for future comparison
Artificial Neural Network	✗ No	N/A	Recommended for future comparison

5. DISCUSSION OF FINDINGS

The findings of this study indicate that phone-based applications positively influence students' learning ability by improving access to educational resources, enhancing communication with lecturers and peers, and supporting flexible, self-directed learning. These findings are consistent with previous studies that reported positive effects of mobile learning technologies on academic engagement and performance. The Logistic Regression model achieved an accuracy of **64.78%**, demonstrating a moderate level of predictive performance. This indicates that the model was able to correctly classify students' learning outcomes in approximately two-thirds of the observations. While the model provides a useful baseline for prediction, its performance also suggests that learning outcomes are influenced by additional factors that were not included in the present study.

Furthermore, because Logistic Regression was the only algorithm evaluated, it is not possible to determine whether it is the most suitable predictive model for this dataset. Future research should compare its performance with other machine learning algorithms such as Random Forest, Decision Tree, Support Vector Machine (SVM), XGBoost, and Artificial Neural Networks using additional evaluation metrics, including precision, recall, F1-score, and ROC-AUC. Such comparisons may identify models capable of achieving higher predictive accuracy and improving educational decision-making. This version is suitable for inclusion in your dissertation and provides a complete **Chapter Four** with logical section numbering, tables, and an academically appropriate discussion based on the actual findings of your study.

6. CONCLUSION

The study concludes that phone-based applications positively impact students' learning ability. The Logistic Regression model successfully predicted learning outcomes with an accuracy of 64.78%, demonstrating that machine learning can be effectively applied in educational research.

7. RECOMMENDATIONS

What follows are recommendations based on findings from the research

1. Educational institutions should encourage the adoption of educational mobile applications.
2. Lecturers should integrate mobile learning technologies into teaching practices.
3. Students should be trained on effective utilization of educational applications.
4. Universities should improve internet accessibility to support mobile learning.
5. Future studies should include additional variables such as age, academic level, GPA, study habits, internet quality, and learning environment.

6. Researchers should compare Logistic Regression with Random Forest, Decision Trees, Support Vector Machines, XGBoost, and Neural Networks to improve predictive performance.

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