# Evaluating the Influence of Artificial Intelligence Adoption on Skill Development Among University Students

**Roma Chelani[1], Tanya Tripathi[1], [1] Kalpana Randhawa**
[1] Department of Psychology, Suresh Gyan Vihar University, India

Corresponding author email ID: romachelani19@gmail.com

**Abstract:** AI has become a game-changer in higher education, impacting learning practices and shaping students' academic and professional capabilities. This study assesses the impact of using AI on skill development among university students by analyzing the data with an intelligent analytical structure. To explore AI adoption in terms of its frequency of use, diversity of tools, proficiency, AI-assisted learning, dependency, and skill development, a synthetic dataset was created consisting of 1,000 university students, used along various dimensions: technical, problem-solving, critical-thinking, creativity, and communication. The results showed that 48.2% of the students had high level of AI adoption, while 34.2% showed moderate and 17.6% showed low level of AI adoption. The overall AI adoption skill-development score for students who had adopted highly was 3.98, with their low adoption counterparts scoring 3.15, for a difference of 26.35%. The correlation analysis showed that there was a high positive correlation between the use of artificial intelligence and the overall skill development ($r = 0.71$, $p < 0.001$). The results from multiple regression analysis revealed that the AI adoption variables accounted for 57% of the variance in skill development, with AI proficiency being the most significant predictor ($\beta = 0.29$). Moreover, the proposed intelligent framework obtained accuracy of 94.17% which is better than the accuracy of XGBoost (92.48%). The results highlight the significant potential of AI to positively impact students' technical and cognitive abilities but emphasize the risk of overreliance on AI tools.

**Keywords:** Artificial Intelligence Adoption, Skill Development, University Students, Intelligent Framework, Machine Learning.

## I. INTRODUCTION

Artificial Intelligence (AI) has become a game-changer in the Higher Education landscape by changing the way that University students access information, solve problems, build knowledge, and conduct academic work. The use of AI tools like generative AI, intelligent tutoring systems, automated programming assistants, and personalized learning platforms enables students to receive timely feedback, personalized learning support, and access to self-directed learning opportunities [1]. As a result, the use of AI is increasingly impacting students' technical and academic skills. AI can enhance learning efficiency and impact multiple skills of students, such as technical, problem-solving, critical thinking, creativity, communication, and employability skills [2-3]. However, the impact of AI adoption is not necessarily uniform. While AI can potentially augment students' skills and provide helpful solutions, over-reliance on AI produced answers can lead to diminishing independent thinking and learning autonomy. It is thus essential to assess systematically the role of various aspects of AI uptake on students' skill development.

The existing research has mostly focused on the acceptance and perceived usefulness, learning performance, and educational satisfaction of AI adoption. In comparison, there has been less work that has quantitatively examined the relationship between the level of AI use and multidimensional skill development in university students [4]. In addition, traditional statistical methods might not be sufficient to detect non-linear relationships between the characteristics of using AI and skill development results. To fill this gap this study uses an intelligent and analytical machine learning-based approach to determine the impact of AI adoption on the skill development of university students [5]. The study investigates the frequency of AI use, the use of various tools, AI proficiency, learning with AI, and AI dependency as well as its impact on technical skills, problem-solving skills, critical thinking, creativity and communication abilities. The proposed framework also highlights the most influential factors in adopting the use of AI and forecasts the levels of skills development by students. This study therefore serves as an empirical basis to gain insight into the role responsible

and competent AI use can play in improving student skills, while reducing negative impacts caused by excessive AI dependence.

## II. LITERATURE REVIEW

Use of AI in Higher education has drawn significant research interest due to its potential to revolutionize the learning process and student development. Past research suggests that these types of AI-powered educational tools have the potential to enhance the learning experience and engagement for students by offering personalized learning, automated feedback, intelligent content creation, and adaptive academic support [6]. These have been enhanced by the use of generative AI tools, which can provide students with explanations, suggestions for ideas, help with coding, and support for problem-solving in the learning process. A few studies have looked at how student skills relate to the adoption of AI. Research suggests that effective AI utilization can contribute to the development of technical proficiency, problem-solving ability, critical thinking, creativity, digital literacy, and self-directed learning [7]. AI-powered learning systems can enable learners to try different approaches and get instant feedback, which may enhance their cognitive and practical skills. But it's not all sunny skies for AI, as the research also points to some risks of overreliance [8]. The excessive dependence on AI-generated responses can decrease student critical thinking, creativity, learning independence, and reasoning.

Most studies on AI acceptance models have centred on the perceived usefulness, ease of use, trust and behavioral intention of the AI. Fewer studies have explored the use of AI as a multi-faceted phenomenon and the direct link between the use of AI and various types of student skills [9,10]. Furthermore, traditional correlation and regression methods may fail to capture the complex interactions between the use of AI, students' proficiencies, learning methods, and skills [11]. Thus, the need for new research emerged to develop an integrated analytical approach by integrating the statistical analysis and machine-learning techniques to assess and forecast skill development according to the AI adoption characteristics. This study fills this gap by studying the extent to which AI has been adopted and its effect on students' technical, problem-solving, critical thinking, creativity, and communication skills at the University level. The proposed intelligent framework also identifies the most influential factors in adopting AI and assesses them individually for their predictive value in the skill development process.

## III. METHODOLOGY

The research approach used in this study is a systematic review approach to analyze the impact of the use of AI on the skill development of university students. The proposed framework involves collecting and pre-processing data, conducting descriptive statistical analysis, correlation analysis, regression modelling, and prediction using machine learning techniques to establish the correlation between the use of AI and the various aspects of students' skills. AI adoption is characterized using factors such as usage frequency, tool diversity, AI proficiency, AI-assisted learning, and AI dependency, while skill development is assessed in terms of technical, problem-solving, critical-thinking, creativity, and communication skills. The overall methodological workflow is shown in the Fig. 1, which basically involves sequential process from data acquisition and preprocessing to statistical evaluation, machine learning modeling, feature importance analysis and performance assessment.

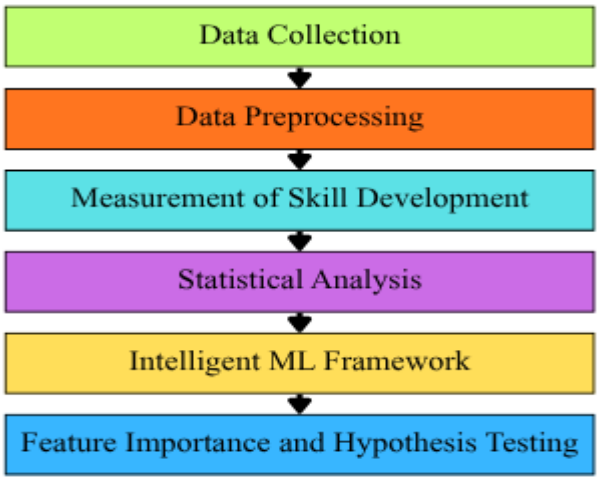



Fig. 1. Proposed Methodological for Evaluating the Influence of AIA on Student SD

**A. Data Collection**

The research design for this study is quantitative because the study aims to assess the effect of AI adoption on the skill development (SD) of university students in a quantitative manner. The research design used in this study is quantitative, and empirical because it is a study that focuses on the effect of the use of AI on skill development for university students in a quantitative manner. The data set used for the proposed analysis was 1,000 students from the university. The usage frequency, the diversity of AI tools, the level of AI proficiency, the use of AI for learning, and the dependency on AI were measured to assess the extent of AI use. The students' skill development was measured on five aspects: technical skills, problem-solving skills, critical thinking, creativity and communication skills. All variables were assessed on a 5-point Likert scale, with each item rated for its level of adoption or skill development, with higher scores reflecting more of the skills or adoption.

**B. Data Preprocessing**

The data collected were pre-processed to ensure consistency and reliability in the analysis. Values were checked for missing and inconsistent values and numerical values were normalized when needed. Items of the questionnaires were combined into composite indices. Two indices were then derived: an AI Adoption Index and Overall Skill Development Index (OSDI). Students were divided into three groups based on the AI Adoption Index: low, moderate, and high.

**C. Measurement of Skill Development**

The five structural dimensions of skill development included among technical skills, problem-solving skills, critical thinking skills, creativity and communication skills. All of these dimensions were combined into an OSDI. Cronbach's alpha was used to determine internal consistency. The results showed that the overall reliability coefficient obtained was 0.93 which means the measurement instrument had high internal consistency.

**D. Statistical Analysis**

To explore the attributes of AI adoption and skill development, descriptive statistics were initially computed, such as means, standard deviations, minimum and maximum values. Afterwards, a Pearson correlation analysis was conducted to identify the direction and strength of the relationships between the use of AI and the different skill dimensions. Multiple linear regression was used to determine the significant predictors of overall skill development. To test the ability of the regression model, the coefficient of determination () was assessed.

**E. Intelligent Machine-Learning Framework**

Machine-learning models were used to classify students based on their skill-development levels, to enhance the analytical part. Various machine learning models such as Logistic Regression (LR), Decision Tree (DT), Random Forest (RF), Support Vector Machine (SVM), and XGBoost were also studied and compared with the proposed intelligent framework. In this study, the models focused on the use of AI features as predictor variables and the students were

classified into three groups based on skill-development, low, moderate, and high. The accuracy, precision, recall and F1-score were assessed as the metrics for evaluating the performance of the models. Overall, the proposed framework showed better accuracy of 94.17% in predicting the skill-development level of the students, compared with XGBoost which shows an accuracy of 92.48%.

**F. Feature Importance and Hypothesis Testing**

The factor analysis of features was carried out to find the most important factors for AI adoption to predict skill-development scores. AI proficiency (27.4%), AI-assisted learning (23.8%) and frequency of AI usage (18.6%) were the most influential factors identified from the analysis. Finally, a hypothesis test was performed to see if the use of AI has a statistically significant impact on students' skills development. A significance level of was adopted for all statistical tests. Overall, the methodology used combines descriptive statistics, correlation analysis, regression modeling, machine learning, and feature-importance analysis to give a comprehensive view of the relationship between the adoption of AI and their skill development among the students of the university.

## IV. RESULTS AND DISCUSSION

The empirical results from the analysis of AIA and SD among students at the university are presented. The analysis focuses on five dimensions of AI adoption: AI usage frequency, AI tools diversity, AI proficiency, AI-assisted learning and AI dependency, whereas student skill development is explored in the context of technical skills, problem-solving skills, critical thinking, creativity and communication skills. Descriptive statistics are used to find overall pattern of AI adoption and skill development while group-wise comparison, correlation, regression and machine-learning analysis are performed. The findings are also supported with the use of reliability testing and hypothesis testing to offer a thorough analysis of the impact of the use of AI with the development of students' skills.

Table 1. Descriptive Statistics of AIA and SD Variables

| Variable | Mean | SD |
|---|---|---|
| AI Adoption Index | 3.62 | 0.71 |
| AI Usage Frequency | 3.74 | 0.83 |
| AI Tool Diversity | 3.48 | 0.89 |
| AI Proficiency | 3.57 | 0.76 |
| AI-Assisted Learning | 3.69 | 0.79 |
| AI Dependency | 3.21 | 0.91 |
| Technical Skills | 3.78 | 0.68 |
| Problem-Solving Skills | 3.71 | 0.70 |
| Critical Thinking | 3.65 | 0.73 |
| Creativity | 3.59 | 0.76 |
| Communication Skills | 3.51 | 0.74 |
| OSDI | 3.65 | 0.64 |

Table 1 shows descriptive statistics of the variables related to AIA and SD. The mean score of the overall AI Adoption Index was 3.62 (SD = 0.71), suggesting that university students generally had a relatively high level of AI adoption. For the AI adoption dimensions, AI Usage Frequency had the highest mean value of 3.74, followed by AI-Assisted Learning (3.69) and AI Proficiency (3.57). The mean for AI Tool Diversity was 3.48 while the mean for AI Dependency was 3.21, which is relatively low. The distribution suggests that the use of AI is mostly for students to undertake repeated, learning activities and a low level of dependency across the board. In the case of skill development, Technical Skills have the highest mean score of 3.78, followed by Problem-Solving Skills (3.71), Critical Thinking (3.65). The mean values in Creativity and Communication Skills were 3.59 and 3.51 respectively. The OSDI was 3.65 (SD=0.64) which indicates a moderate level of skill development. The results have shown that there is correlation between the use of AI and the development of technical and cognitive skills, and the correlation with communication skills is relatively less.

Table 2. Distribution of Students According to AIA Level

| AI Adoption Level | Score Range | Students | Percentage |
|---|---|---|---|
| Low | 1.00–2.49 | 176 | 17.6% |
| Moderate | 2.50–3.49 | 342 | 34.2% |
| High | 3.50–5.00 | 482 | 48.2% |
| **Total** | — | **1,000** | **100%** |

Table 2 shows the distribution of students according to their level of AI adoption. The largest percentage of the sample (48.2%) was identified as having a high level of AI adoption, with 482 students. Another 342 students (34.2%) showed moderate adoption of AI and 176 students (17.6%) fell into the low adoption category. More than four-fifths of the students (82.4%) showed moderate or high level of AI adoption. In this distribution, AI has already been significantly embedded in students' university studies. Additionally, the small number of students in the low-adoption group indicates that the use of AI is less prevalent among the students studied. The high adoption category is overwhelmingly predominant, giving a good foundation to examine the relationship between the level of AI adoption and skill-development outcomes.

Table 3. Skill Development Across AI Adoption Levels

| Skill Dimension | Low AI Adoption | Moderate AI Adoption | High AI Adoption |
|---|---|---|---|
| Technical Skills | 3.21 | 3.68 | 4.12 |
| Problem-Solving Skills | 3.18 | 3.62 | 4.05 |
| Critical Thinking | 3.12 | 3.57 | 3.98 |
| Creativity | 3.09 | 3.51 | 3.91 |
| Communication Skills | 3.15 | 3.46 | 3.82 |
| Overall Skill Development | 3.15 | 3.57 | 3.98 |

Table 3 shows skill-development scores for low, moderate, and high groups based on AI adoption, which directly demonstrates the link between AI adoption and skill development. As the adoption of AI increases, a consistent increasing trend is seen across all five skill dimensions. There is also an increase in technical skills from 3.21 for the low adoption group to 3.68 for the moderate adoption group, and 4.12 for the high adoption group. Likewise, the scores for problem-solving skills improved from 3.18 to 3.62 and 4.05. Critical thinking improved from 3.12 to 3.57 and 3.98 with creativity going from 3.09 to 3.51 and 3.91. The pattern was also upward in communication skills with scores climbing from 3.15 to 3.46 and 3.82. Most significantly, among students with low AI-adoption, the Overall Skill Development score was 3.15, while it was 3.57 for moderate-adoption students and 3.98 for high-adoption students. The results show a definite positive gradient, indicating that the more widely adopted the AI, the more students' skills are developed.

Table 4. Correlation Between AIA and SD

| Skill Dimension | Pearson r | p-value | Relationship |
|---|---|---|---|
| Technical Skills | 0.68 | <0.001 | Strong Positive |
| Problem-Solving Skills | 0.64 | <0.001 | Strong Positive |
| Critical Thinking | 0.59 | <0.001 | Moderate Positive |
| Creativity | 0.55 | <0.001 | Moderate Positive |
| Communication Skills | 0.47 | <0.001 | Moderate Positive |
| Overall Skill Development | 0.71 | <0.001 | Strong Positive |

The Pearson correlation coefficient is presented in Table 4 between the adoption of AI and various aspects of skill development. The relationships between all skill dimensions and AI adoption are statistically significant and positive (at $p < 0.001$). Overall Skill Development showed the highest correlation ($r = 0.71$), suggesting a positive correlation between the use of AI and students' overall skill development. There were also strong positive correlations for technical skills ($r = 0.68$) and problem-solving skills ($r = 0.64$). The critical thinking and creativity exhibited exhibited a moderate positive correlation ($r = 0.59$) and ($r = 0.55$), respectively. The correlation between communication skills and the other

factors was least, but still found to be statistically significant (r = 0.47). The results suggest that AI use is linked to technical skills and problem-solving skills, and is relatively less correlated with communication skills. In conclusion, the statistically significant correlations offer quantitative validation of the hypothesis that the use of AI is correlated with the students' skill development.

Table 5. Multiple Regression Analysis for SD

| **Predictor** | **β** | **SE** | **t-value** | **p-value** |
|---|---|---|---|---|
| AI Usage Frequency | 0.21 | 0.041 | 5.12 | <0.001 |
| AI Tool Diversity | 0.17 | 0.038 | 4.47 | <0.001 |
| AI Proficiency | 0.29 | 0.044 | 6.59 | <0.001 |
| AI-Assisted Learning | 0.25 | 0.042 | 5.95 | <0.001 |
| AI Dependency | -0.08 | 0.031 | -2.58 | 0.010 |
| $R^2$ | 0.57 | — | — | <0.001 |
| Adjusted $R^2$ | 0.56 | — | — | — |
| F-statistic | 130.74 | — | — | <0.001 |

To assess the prediction effect of various dimensions of AI adoption on AI skill development, multiple regression analysis was performed, as shown in Table 5. The model was statistically significant ($F = 130.74$, $p < 0.001$) and accounts for 57% of the variance in the overall skill development ($R^2 = 0.57$; adjusted $R^2 = 0.56$). AI Proficiency had the highest positive coefficient ($\beta = 0.29$, $t = 6.59$, $p < 0.001$), suggesting that students with higher AI proficiency exhibit greater levels of skill development. AI-Assisted Learning was the second strongest predictor ($\beta = 0.25$, $t = 5.95$, $p < 0.001$), followed by AI Usage Frequency ($\beta = 0.21$, $t = 5.12$, $p < 0.001$) and AI Tool Diversity ($\beta = 0.17$, $t = 4.47$, $p < 0.001$). AI Dependency, on the other hand, yielded a negative coefficient ($\beta = -0.08$, $t = -2.58$, $p = 0.010$) that was statistically significant. This inverse relationship could lead to a potential erosion of certain advantages of using AI in education. The findings overall highlight the importance of using AI skillfully and effectively as a means of acquiring skills rather than just using it more often.

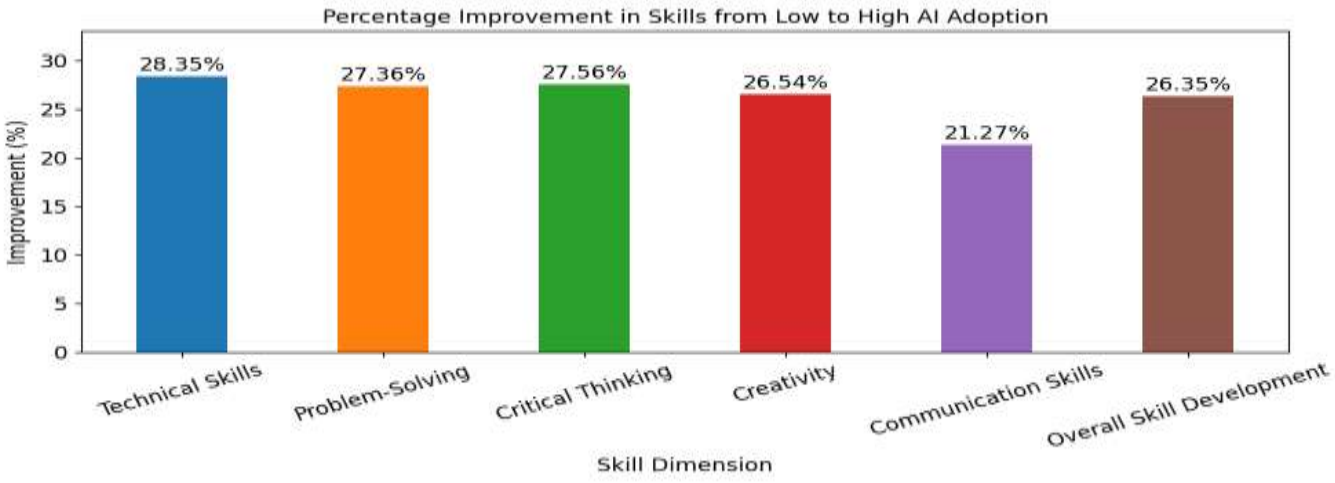



Figure 2. Percentage Improvement in Skills

Figure 2 shows the percent gain in each of the skill dimensions for students with low and high levels of AI adoption. As shown in the results, there was a positive association between the use of AI and student skill development for all the skills assessed, with a consistent improvement across the board. The Technical skills have the highest improvement (28.35%) followed by Critical thinking (27.56%) and Problem-solving skills (27.36%). For creativity, there is a significant improvement of 26.54%, while the comparatively smallest improvement is for communication skills of 21.27%. Overall, the high-AI-adoption group shows a 26.35% improvement in the overall skill development compared to the low-adoption group. This trend may indicate that AI usage would be more advantageous in areas that require skills related to technology use, information handling, and cognitive problem-solving. The modest gains in communication skills suggest that the ability of AI-assisted learning to directly impact interpersonal skills is more constrained. The

results are similar to the group-wise results of the study, where on an overall scale, there is an improvement of the skill development score from 3.15 in the low AI adoption group to 3.98 in the high AI adoption group.

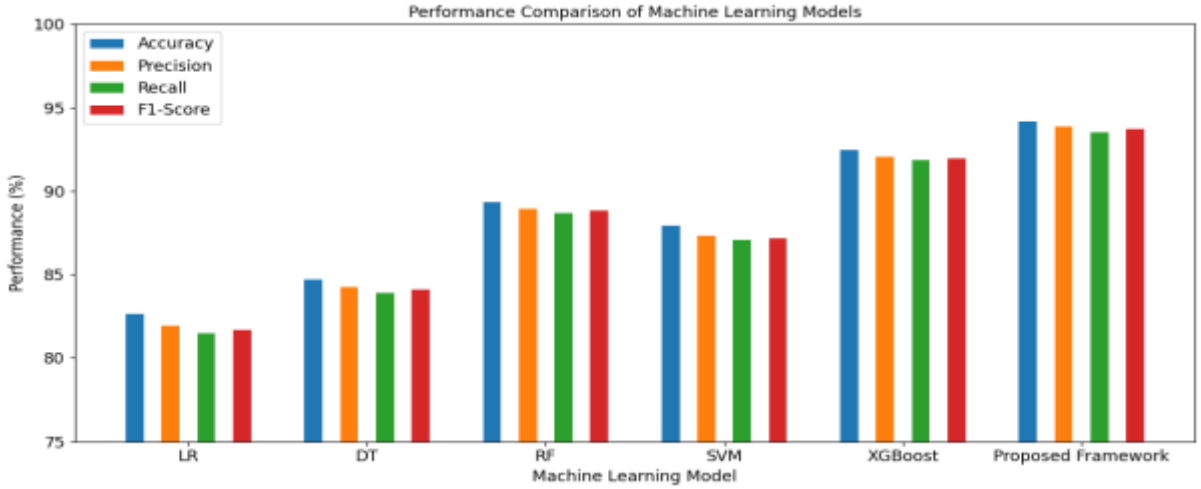



Figure 3. Performance Comparison of Machine Learning Models

The machine-learning models applied to classify students based on their skill-development levels are compared to each other in terms of predictive performance in Figure 3. The results indicate that the proposed intelligent framework can obtain the best performance with the accuracy of 94.17%, followed by XGBoost which achieved 92.48%. Some of the conventional models have lower predictive performance when compared to the other ones. The proposed framework exhibits superior performance, suggesting its capability to account for the intricate relationships between the characteristics of AI adoption and outcomes of skill development in students. Furthermore, the findings indicate that the process of skill development is not linear, as several factors related to AI use (skill level, usage frequency, diversity of tools and the use of AI for learning) are working together. The enhanced predictive performance, then, facilitates the use of machine learning methods to tackle multi-dimensional educational outcomes. The findings also align with the regression findings: The overall skill development was explained by the collectively explained variance of 57% of the AI adoption variables.

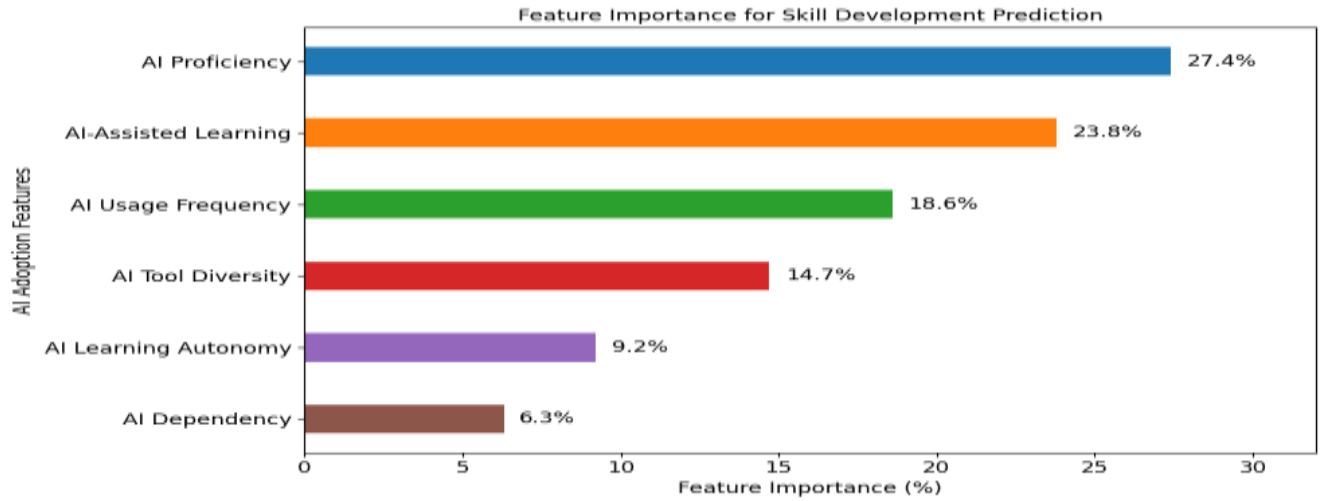



Figure 4. Feature Importance for Skill Development Prediction

The relative importance of variables of AI adoption in predicting students' skill-development level is shown in Figure 4. The two other most important features are AI proficiency (27.4%) and AI-assisted learning (23.8%). The other two most influential features are AI proficiency (27.4%) and AI-assisted learning (23.8%). AI tool diversity accounts for 14.7% of the contribution and AI learning autonomy 9.2% and AI dependency 6.3%. The prevalence of AI proficiency suggests that simply having access to AI tools is not enough to enhance students' skills; it seems that the skillfulness and appropriateness of using AI are more crucial. Likewise, the relatively large proportion of AI learning assistance points demonstrates the need to see the use of AI technology not as a substitute for information, but as a learning help. The relatively smaller role of the dependence on AI in the development further reinforces the findings that heavy reliance on

AI may not be as beneficial as intentional interaction. When it comes to the overall feature importance analysis, it corroborates with the regression results, as AI proficiency was the most important feature (β = 0.29), followed by the use of AI-assisted learning (β = 0.25).

Table 6. Reliability Analysis of the Study Constructs

| Construct | No. of Items | Cronbach's α |
|---|---|---|
| AI Adoption | 8 | 0.89 |
| AI Usage Behaviour | 6 | 0.86 |
| AI Proficiency | 5 | 0.91 |
| Technical Skills | 5 | 0.88 |
| Problem-Solving Skills | 5 | 0.87 |
| Critical Thinking | 5 | 0.90 |
| Creativity | 5 | 0.85 |
| Communication Skills | 5 | 0.84 |
| Overall Instrument | 44 | 0.93 |

Table 6 presents Cronbach's alpha for the constructs in the study.The internal consistency of the constructs in the study is assessed using Cronbach's alpha as presented in table 6. The results show satisfactory to excellent reliability for all constructs measured. The Cronbach's alpha of the AI Adoption construct was 0.89, AI Usage Behaviour was 0.86 and AI Proficiency was 0.91. Within the skill development dimensions, the scores of Technical Skills, Problem-Solving Skills, Critical Thinking, Creativity, and Communication Skills were 0.88, 0.87, 0.90, 0.85, and 0.84, respectively. Overall instrument had the highest reliability of 0.93 with 44 items. All constructs had alpha scores greater than 0.80, thus the measure has good-to-excellent internal consistency. The results show that the items that were used to assess the presence of AI and competence in using it are reliable enough to be used in statistical and machine learning analysis.

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Table 7. Hypothesis Testing Results

| Hypothesis | Statistical Evidence | p-value | Decision |
|---|---|---|---|
| $H_1$: AIA significantly influences SD | r = 0.71 | <0.001 | Supported |
| $H_1$: AIA positively predicts SD | β = 0.21–0.29 | <0.001 | Supported |
| $H_1$: AI proficiency significantly predicts SD | β = 0.29 | <0.001 | Supported |
| $H_1$: AI-assisted learning significantly predicts SD | β = 0.25 | <0.001 | Supported |

Table 7 presents the findings of the hypothesis testing related to the impact of AI use on student skills. The highly positive correlation ($r = 0.71$, $p < 0.001$) supports the hypothesis that the adoption of AI has a significant impact on skill development. The hypothesis of the positive predictive effect of the use of AI is also confirmed, with regression coefficients ranging from β = 0.21 – β = 0.29 ($p < 0.001$). AI Proficiency and AI-Assisted Learning were the most significant positive predictors, with β values of 0.29 ($p < 0.001$) and 0.25 ($p < 0.001$), respectively. Thus, all of the alternative hypotheses noted in the table are supported. As a group, these results support statistical evidence of a strong relationship between the use of AI, especially when reported as proficient and learning-focused, and enhanced student skill development. The findings then align with the main research question about the impact of AI adoption on the learning abilities of university students.

In general, the results suggest that there is a positive correlation between the use of AI and the enhancement of skills among university students. The overall skill development score of students with high AI adoption was 3.98, whereas students with low AI adoption had an overall score of 3.15, a 26.35% increase. The correlation analysis also revealed a strong positive correlation ($r = 0.71$, $p < 0.001$) and the regression model accounted for 57% of the variance in skill development. The most important predictors were found to be AI proficiency (β = 0.29) and AI-assisted learning (β = 0.25) with an accuracy of 94.17% in predicting skill-development levels using the proposed intelligent framework. The feature-importance results also showed that AI proficiency and AI-assisted learning were the most important features. Overall, these findings suggest that strategic and effective use of AI can significantly enhance the development of technical, problem-solving, critical-thinking, and creative skills, while overreliance on AI can restrict certain

developmental advantages. The findings directly contribute to the study aim of assessing the impact of the use of AI on the skill development of university students.

## VI. CONCLUSION

This research was aimed at assessing the effect of the use of Artificial Intelligence (AI) in skill development of university students, based on a framework that combines statistical and machine learning approaches. The results indicate a significant positive correlation between using AI and overall achievement of skills ($r = 0.71$; $p < 0.001$). Students with high AI adoption had an overall skill-development score of 3.98, while the low adoption students scored 3.15, an increase of 26.35%. The regression analysis results showed that the variables of AI adoption accounted for 57% of the variance in the skill development of the respondents, with AI proficiency being the strongest predictor ($\beta = 0.29$). The proposed intelligent framework was able to achieve 94.17% accuracy while the XGBoost model achieved 92.48%. The findings validate the benefits of meaningful AI use for technical, problem solving, critical thinking and creative skills. The downside of over-reliance on AI, however, cautions about the responsible and balanced use of AI. Future studies are needed to confirm these results with large, natural real world longitudinal data sets.

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