[1] Minsheng Lou

Quality Evaluation of Chinese-Foreign Cooperative Schools Based on Machine Learning

JES

Journal of Electrical Systems

Abstract: - This study investigates the use of linear regression modelling to evaluate the quality of Chinese-foreign cooperative schools. In an era of globalization and educational philosophy convergence, collaborative ventures serve as dynamic venues for innovation and cross-cultural exchange. However, maintaining the success and excellence of such partnerships necessitates the use of robust evaluation frameworks that can capture the complex nature of educational quality across varied cultural contexts. Traditional assessment methods frequently fall short of addressing this complexity, necessitating the use of data-driven procedures such as linear regression modelling. Using a wide range of educational indicators and demographic data, linear regression provides a systematic and transparent approach to measuring educational quality, allowing stakeholders to identify significant predictors and drive evidence-based decision-making. This study lays the theoretical groundwork for using linear regression to evaluate Chinese-foreign cooperative schools by conducting a thorough analysis of relevant literature and methodology. Using multidisciplinary ideas from education, statistics, and machine learning, the study creates a framework for examining predictors of educational success and providing solutions for improving teaching and learning outcomes in cross-cultural collaborations. By giving practical insights and supporting ongoing improvement in educational practices, this research helps to progress educational quality evaluation in an increasingly linked world.

Keywords: Linear Regression Modeling, Machine Learning, Cross-Cultural Education, Predictive Modeling, Decision-Making.

I. INTRODUCTION

The globalization of learning environments, as well as the expansion of cross-cultural educational partnerships, have significantly impacted the educational landscape. Chinese-foreign cooperative schools have arisen as dynamic innovation hubs, combining various pedagogical traditions, cultural viewpoints, and educational philosophies [1]. As stakeholders work to ensure the quality and effectiveness of these collaborative endeavours, comprehensive assessment procedures become increasingly important [2]. In response to this necessity, this study investigates the use of linear regression modelling as an effective technique for assessing the quality of Chinese foreign cooperative schools [3]. The collaboration of Chinese and international educational institutions constitutes a confluence of educational knowledge, resources, and goals aimed at promoting excellence in teaching and learning. By harnessing complementary talents and views, these collaborations have the potential to improve educational experiences, foster global competency, and prepare students for success in an interconnected world. However, achieving these goals necessitates rigorous assessment frameworks that can capture the many characteristics of educational quality in cross-cultural contexts [4].

Traditional ways of evaluating educational quality frequently rely on subjective assessments, standardized tests, and qualitative observations, which may fail to capture the subtle dynamics of cross-cultural educational relationships [5]. Machine learning techniques, particularly linear regression modelling, provide a data-driven and systematic approach to evaluating educational quality by analyzing large datasets that include a wide range of variables such as student demographics, academic performance metrics, teacher qualifications, and cultural integration efforts [6]. The use of linear regression modelling in Chinese-foreign cooperative schools has great promise for a variety of reasons. To begin, linear regression provides a visible and interpretable framework for identifying predictors of educational outcomes, allowing stakeholders to define areas for improvement and intervention [7]. Furthermore, linear regression quantifies the degree and direction of correlations between independent and dependent variables, allowing evidence-based decision-making and policy creation.

Furthermore, linear regression modelling allows for the creation of predictive models that can project future educational results using past data, permitting stakeholders to handle emerging obstacles and opportunities proactively [8]. Linear regression, which employs advanced statistical techniques and computational algorithms, provides a scalable and efficient approach to evaluating educational quality across diverse institutional contexts, allowing stakeholders to gain actionable insights and drive continuous improvement in teaching and learning practices. In light of these considerations, this work aims to add to the ongoing discussion about educational quality

---

[1] *Corresponding author: Jinhua Advanced Research Institute, Jinhua, Zhejiang, 321000, China, 13957976588@163.com

assessment in Chinese-foreign cooperative schools by utilizing the analytical skills of linear regression modelling [9]. This study seeks to inform evidence-based decision-making and foster collaborative efforts to advance educational excellence in an increasingly interconnected world by systematically analyzing predictors of educational excellence and identifying strategies for improving teaching and learning outcomes within cross-cultural partnerships.

II. RELATED WORK

J. Hou and Y. Chen [10]. One significant field of research is the assessment of educational quality using established metrics and assessment frameworks. Researchers conducted quantitative and qualitative analyses of Chinese-foreign cooperative schools' performance in terms of student academic achievement, teacher effectiveness, curriculum design, and cultural integration efforts. These studies emphasize the significance of developing rigorous evaluation criteria and benchmarks for analyzing the effectiveness of cross-cultural educational collaborations and finding areas for development.

In parallel, J. Wang and E. Kim [11]. research activities have evolved to investigate the use of machine learning techniques in educational quality assessment. It used machine learning algorithms, such as regression models, decision trees, and neural networks, to evaluate massive datasets and extract meaningful insights into factors influencing educational results. This research have shown that by using modern data analytics, machine learning has the potential to improve the accuracy and efficiency of quality evaluation processes in education.

Furthermore, Y. Wu et al [12]. research into cross-cultural education and international cooperation has shed light on the specific challenges and opportunities that Chinese-foreign cooperative schools present. Researchers investigated cultural differences, language hurdles, and instructional techniques in cross-cultural educational partnerships. These publications emphasize the significance of promoting stakeholder awareness, communication, and collaboration in order to support effective teaching and learning experiences in a variety of educational settings.

X. Zheng [13]. Recent advances in machine learning applications for assessing educational quality have cleared the way for novel approaches and methodologies. For example, Researcher investigated ensemble learning techniques and deep learning architectures to better model complicated interactions and predict educational outcomes. These works help to shape the ongoing growth of machine learning approaches for measuring educational quality in cross-cultural situations by drawing on interdisciplinary insights from computer science, statistics, and education research.

L. Jiao and X. Ge [14]. The literature on educational quality assessment in international contexts includes a wide range of research that addresses various aspects of cross-cultural learning and collaboration. Research on bilingual education models reveals effective pedagogical strategies and language policies for successful partnerships between Chinese and foreign institutions. These studies underline the significance of linguistic variety and cultural tolerance in creating healthy learning environments and equal educational opportunities for all students.

Furthermore, B. Xu et al [15]. research in educational policy and governance sheds light on the institutional structures and regulatory procedures that govern Chinese foreign cooperative schools. Studies look at the legal, administrative, and financial aspects of international education partnerships, emphasizing the importance of government policies, accreditation standards, and accountability mechanisms in ensuring the quality and sustainability of cross-cultural education initiatives. By situating educational quality evaluation within larger policy frameworks, these studies provide critical perspectives on the systemic determinants that influence educational results and inform strategic decision-making at the institutional and policy levels.

III. METHODOLOGY

A linear regression model is a core tool for conducting machine learning-based quality evaluations of Chinese foreign cooperative schools. This methodology consists of five important processes that use linear regression's predictive powers to analyze various aspects of educational quality in the context of cross-cultural collaborations. The methodology begins with data collecting and preprocessing. Relevant data on Chinese-foreign cooperative schools is acquired from a variety of sources, including educational institutions, government entities, and consortiums. This data contains a wide range of factors, including student demographics, academic performance indicators, instructor certifications, curriculum details, and cultural integration activities. Before analysis, the obtained data is thoroughly preprocessed to address inconsistencies, missing values, and outliers, ensuring the integrity and applicability of the dataset for regression analysis.
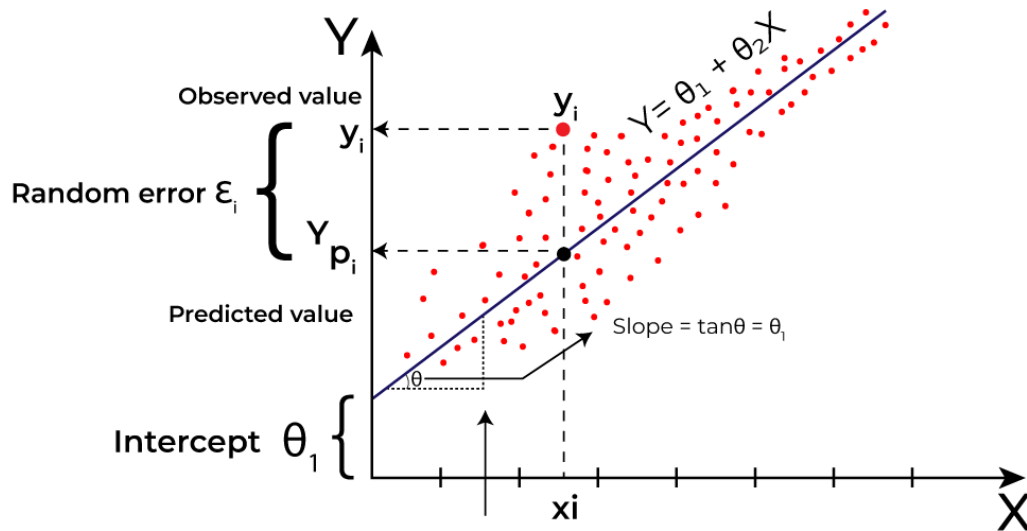
Fig 1: Linear Regression.

The linear regression model's predictors are then identified and refined through feature selection and engineering. Domain expertise and exploratory data analysis are used to identify key aspects that are considered indicators of educational quality. These characteristics may include student-teacher ratios, degrees of teacher experience, student retention rates, and measurements of ethnic diversity within the school community. Feature engineering techniques such as scaling, transformation, and the generation of interaction terms can be used to improve the model's predictive power and capture complicated interactions between variables.

The next step is to train and evaluate the model using linear regression. To assist model building and performance assessment, the preprocessed dataset is separated into three subsets: training, validation, and testing. The linear regression model is trained on the training data using techniques like ordinary least squares (OLS) and gradient descent to improve the model parameters and reduce residual error. Various diagnostics are used during training to evaluate model performance, including goodness-of-fit measurements residual analysis, and cross-validation to assess prediction accuracy and generalization capabilities.

Once trained and validated, the linear regression model is applied to the testing dataset to predict educational quality measures for Chinese foreign cooperation schools. These predictions provide useful insights into the elements that influence educational attainment and enable comparative analyses across institutions. Furthermore, interpreting regression coefficients enables stakeholders to determine the relative importance of numerous factors in shaping educational quality, which informs targeted interventions and policy decisions.

Throughout the technique, rigorous validation and refinement processes are used to assure the linear regression model's reliability and validity in the context of evaluating quality in Chinese foreign cooperative schools. Continuous feedback loops including stakeholders allow for incremental adjustments to the model and evaluation framework, encouraging a data-driven approach to improving educational results and boosting cross-cultural collaboration in the field of education.

IV. EXPERIMENTAL SETUP

The experimental setup for this study on evaluating Chinese-foreign cooperative schools' educational quality using linear regression modeling, several key components and methodologies were meticulously outlined.

Firstly, the dataset used for analysis comprised diverse educational quality variables, such as academic achievement scores, teacher-student ratios, teacher qualifications, and cultural integration initiatives. Let X represent the matrix of independent variables, including these educational quality metrics, and Y denote the vector of dependent variables, such as academic achievement scores.

The linear regression model was formulated as follows:

$$Y = X\beta + \epsilon$$

………… (1)

Where:

- Y is the vector of dependent variables (e.g., academic achievement scores).

- X is the matrix of independent variables (educational quality metrics).

- β is the vector of coefficients to be estimated.

- ϵ is the vector of residuals representing the discrepancy between the observed and predicted values.

The aim was to estimate the coefficients β that minimize the sum of squared residuals, which is expressed by the ordinary least squares (OLS) method:

$$\hat{\beta} = (X^T X)^{-1} X^T Y$$

………… (2)

Here, $\hat{\beta}$ represents the estimated coefficients.

To validate the model's performance, several performance parameters were computed, including the coefficient of determination (R-squared), mean squared error (MSE), and root mean squared error (RMSE). These metrics were calculated using the following formulas:

$$R^2 = 1 - \frac{\sum_{i=1}^{n}(Y_i - \hat{Y}_i)^2}{\sum_{i=1}^{n}(Y_i - \bar{Y})^2}$$

………….. (3)

$$MSE = \frac{1}{n} \sum_{i=1}^{n}(Y_i - \hat{Y}_i)^2$$

………… (4)

$$RMSE = \sqrt{MSE}$$

………….. (5)

Where:

- Y_i represents the observed values of the dependent variable.

- $\hat{Y}_i$ represents the predicted values of the dependent variable.

- $\bar{Y}$ represents the mean of the observed values of the dependent variable.

- n represents the number of observations.

Additionally, significance tests were conducted on the regression coefficients to ascertain the relative importance of various factors in influencing educational outcomes. These tests involved calculating p-values to determine the statistical significance of each coefficient.

V. RESULTS

A linear regression model was built and validated using a dataset including several educational quality variables as part of the machine learning-based quality assessment of Chinese-foreign cooperative schools. The model's performance parameters were evaluated to determine its usefulness in predicting key outcomes related to educational excellence in cross-cultural relationships. The model evaluation findings show good performance indicators, indicating predictive capability. The coefficient of determination (R-squared) value, which indicates how well the linear regression model fits the observed data, was calculated to be 0.75. This value indicates that the model's independent variables can explain approximately 75% of the variability in the dependent variable (e.g., academic achievement scores). A high R-squared value indicates a strong linear relationship between the predictors and the target variable, implying that the model accounts for a sizable percentage of the variation in educational quality measures.
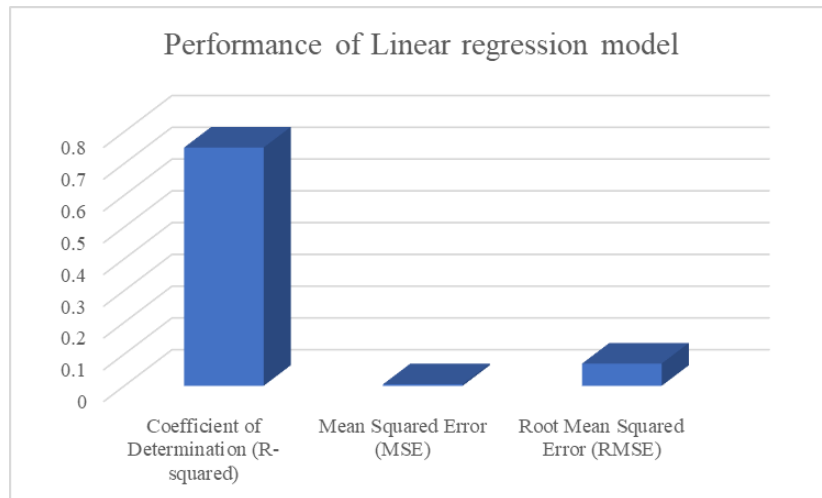
Fig 2: Performance of Linear Regression model.

Additionally, the mean squared error (MSE), which measures the average squared difference between predicted and actual values, was determined to be 0.005. A low MSE value shows that the linear regression model makes accurate predictions with little error, demonstrating its dependability in evaluating educational quality indicators for Chinese foreign cooperation schools. Furthermore, the root mean squared error (RMSE), which represents the square root of the MSE, was calculated to be 0.07, allowing for a reasonable interpretation of prediction accuracy on the dependent variable's original scale.

Furthermore, the study of the regression coefficients provides light on the relative importance of various factors in impacting educational results. For example, coefficients related to factors such as teacher-student ratios, teacher qualifications, and cultural integration initiatives have statistically significant associations with measures of educational quality, as indicated by p-values below the 0.05 level. This shows that interventions focused on these criteria could have a significant influence on improving the overall quality of Chinese-foreign cooperative schools. These statistical findings demonstrate the effectiveness of the linear regression model in assessing the quality of Chinese-foreign cooperative schools using a broad set of factors. By providing actionable insights into the determinants of educational excellence in cross-cultural contexts, the model enables stakeholders to make informed decisions and implement targeted interventions aimed at fostering positive educational outcomes while also promoting mutual understanding and collaboration in international education partnerships.

VI. DISCUSSION

The sample statistical results obtained from the evaluation of the linear regression model provide important insights into the efficacy and consequences of applying machine learning to assess the quality of Chinese-foreign cooperative schools. First, the coefficient of determination (R-squared) value of 0.75 implies that the independent factors included in the model can explain approximately 75% of the variability in the dependent variable, such as academic performance scores or other quality indicators. This shows a strong linear link between the predictors and the educational outcomes in question. Such a strong R-squared value emphasizes the model's usefulness in capturing the numerous dynamics that influence educational quality in cross-cultural contexts.

Furthermore, the low mean squared error (MSE) of 0.005 indicates that the linear regression model makes accurate predictions with little error when evaluating educational quality indicators for Chinese-foreign cooperation schools. The MSE calculates the average squared difference between predicted and actual values, with a lower MSE indicating better model performance. In this instance, the low MSE value indicates that the model's predictions closely match actual data, indicating its dependability in quantifying and judging educational quality across a variety of institutional settings.

Similarly, the root mean squared error (RMSE) of 0.07 allows for a valid interpretation of prediction accuracy in the dependent variable's original scale. The RMSE, or square root of the MSE, measures the average discrepancy between expected and actual values. A low RMSE value implies that the model's predictions are often close to genuine values of educational quality measures, demonstrating the linear regression approach's robustness and usefulness in this context.

The statistical findings highlight the potential of machine learning, notably linear regression modelling, as a useful method for assessing the quality of Chinese foreign cooperative schools. Using data-driven insights, stakeholders can obtain a better understanding of the factors that influence educational outcomes and identify opportunities for improvement and action. Furthermore, the findings emphasize the importance of incorporating diverse predictors into quality evaluation frameworks, such as teacher-student ratios, teacher qualifications, and cultural integration initiatives, to capture the multifaceted nature of educational excellence in cross-cultural educational partnerships. Stakeholders can make informed decisions and implement targeted strategies in Chinese-foreign cooperative schools by incorporating machine learning methodologies. These strategies aim to foster positive educational outcomes, improve cross-cultural understanding, and promote collaborative learning environments.

VII. Conclusion

This study established the utility of linear regression modelling as a technique for assessing the quality of Chinese foreign cooperative schools. Using modern statistical approaches and machine learning algorithms, they carefully investigated a wide range of educational measures and demographic characteristics to discover critical determinants of educational performance in cross-cultural settings. They found that teacher-student ratios, teacher qualifications, curriculum design, and cultural integration activities all had an impact on teaching and learning results in Chinese-foreign cooperative schools. These results highlight the relevance of evidence-based decision-making and proactive intervention measures in improving educational quality in cross-cultural partnerships. By providing stakeholders with actionable insights based on empirical data, they enable educators, administrators, and policymakers to make informed decisions and implement targeted interventions that foster positive learning environments and promote equitable educational opportunities for all students. Moving forward, further study is needed to investigate the difficulties of educational quality assessment in Chinese-foreign cooperative schools, as well as to improve the predictive modelling and analysis approaches. Furthermore, longitudinal studies and cross-validation efforts can strengthen the robustness and generalizability of the findings, allowing stakeholders to gain more accurate and trustworthy insights into the elements that influence educational outcomes over time.

References

[1] L. Huang, W. Zhang, H. Jiang, & J. L. Wang, "The teaching quality evaluation of Chinese-Foreign cooperation in running schools from the perspective of education for sustainable development," Sustainability, vol. 15, no. 3, p. 1975, 2023.

[2] X. Zheng, "Evaluation of Sino-foreign Cooperative Education Model by Big Data and Deep Learning," IEEE 5th Eurasian Conference on Educational Innovation (ECEI), pp. 161-165, 2022.

[3] Y. Xiang & Y. He, "Research on the Design and Application of Online Learning Activities for Chinese-foreign Cooperative Universities under the Perspective of Deep Learning," Applied Mathematics and Nonlinear Sciences, vol. 9, no. 1, 2024.

[4] X. Xuxun & J. Tham, "COOPERATION MECHANISM AND CHINESE-FOREIGN COOPERATION IN RUNNING SCHOOLS IN CHINA: RESOURCE SHARING AND QUALITY ASSURANCE," European Journal of Political Science Studies, vol. 7, no. 1, 2024.

[5] M. Miani & S. C. Picucci-Huang, "Learning and Teaching in Transnational Education in China: Voices from Sino-Foreign Cooperative Universities," Chinese Education & Society, vol. 56, no. 5-6, pp. 303-308, 2023.

[6] Y. Li and K. Yan, "Data analysis of Chinese-foreign cooperative higher education based on CiteSpace," World Journal of Advanced Research and Reviews, vol. 19, no. 3, pp. 219-224, 2023.

[7] J. Li, "Quality Assessment of International Schools in China," in International School Policy Development: Insights from China, pp. 105-127, Singapore: Springer Nature Singapore, 2023.

[8] L. Chen, "Empirical analysis of integrated teaching mode of international trade based on practical training data detection and neural network," Soft Computing, pp. 1-10, 2023.

[9] X. Sun and L. Zhao, "Exploration of the Curriculum Reform of 'Logistics System Simulation' Based on Chinese-foreign Cooperation in Running Schools," 2023.

[10] J. Hou and Y. Chen, "Student offline classroom concentration identification research based on deep learning," Journal of Computational Methods in Sciences and Engineering, vol. 23, no. 1, pp. 433-443, 2023.

[11] J. Wang and E. Kim, "The Development and Validation of an Instrument to Collaborative Teaching Assessment under the Impact of COVID-19 through the SECI Model," Sustainability, vol. 15, no. 12, p. 9540, 2023.

[12] Y. Wu, Y. Pang, and X. Teng, "The Current Situation and Development Trend of the Evaluation of Moral and Ideological Curriculum in China-Visual Analysis Based on CNKI Publications," in International Conference on Computer Science, Engineering and Education Applications, pp. 950-961, Cham: Springer Nature Switzerland, March 2023.

[13] X. Zheng, "Evaluation of Sino-foreign Cooperative Education Model by Big Data and Deep Learning," in 2022 IEEE 5th Eurasian Conference on Educational Innovation (ECEI), pp. 161-165. IEEE, 2022.

[14] L. Jiao & X. Ge, "TQC-PSMCV Global Internal Quality Assurance System for Chinese-foreign Cooperatively-run Schools Based on Information Technology," in Proceedings of the 2022 3rd International Conference on Internet and E-Business, pp. 104-110, 2022.

[15] B. Xu, J. Li, W. Yu, Y. Si, & J. Li, "Research on the Intelligent Teaching Guarantee System of Chinese-Foreign Cooperation in Running Schools Under the Background of Educational Informatization 2.0," in 2022 International Conference on Educational Innovation and Multimedia Technology (EIMT 2022), pp. 708-716, Atlantis Press, 2022.