



Editorial

Special issue “Statistical methods in the economics of education”

Carmen Perez-Esparrells^{1,2,*} and Sara González-Betancor³

¹ Autonomous University of Madrid, Department of Economics and Public Finance, 28049 Madrid, Spain

² UAM-UC3M Research Institute for Higher Education and Science (INAECU), 28903 Getafe, Spain

³ University of Las Palmas de Gran Canaria, Department of Quantitative Methods in Economics and Management, Campus Universitario de Tafira, 35017, Las Palmas de Gran Canaria (Canary Islands), Spain

* **Correspondence:** Email: carmen.perezparrells@gmail.com.

This Special Issue of *AIMS Mathematics*, titled *Statistical Methods in the Economics of Education*, brings together six original research articles that demonstrate the richness and methodological diversity of quantitative approaches in educational research. The selected contributions address educational phenomena across a variety of contexts—from primary schooling to higher education and the labor market—and apply advanced statistical, computational, and spatial modeling techniques to inform evidence-based educational policy.

Collectively, these articles reflect the increasing interdisciplinarity of the economics of education, where data-driven tools such as machine learning, fuzzy evaluation systems, structural equation modeling, and spatial metrics are employed to evaluate accessibility, predict performance, assess equity, and quantitative methods of educational outcomes. The contributions in this issue can be grouped into two thematic areas: studies focused on **higher education and institutional evaluation**, and those addressing **educational accessibility, equity, and labor market outcomes**.

In the first group, **Alharbi and Allohibi** propose a novel hybrid classification algorithm aimed at predicting student academic performance in higher education contexts. The model integrates the strengths of three widely used decision-tree-based classifiers—Random Forest (RF), C4.5, and CART—into a unified hybrid structure referred to as PHC. Their results, based on a public dataset, show that the PHC model achieves the highest accuracy (92.4%) and outperforms individual classifiers, particularly in correctly identifying students at risk of underperformance.

The paper argues that combining complementary classification strategies can provide more robust predictions than single algorithms, and that such predictive systems may help academic institutions

identify students in need of support, enabling timely, data-informed interventions. The study underscores the potential of ensemble learning models in educational data mining and highlights their practical applicability for early detection and intervention strategies.

Tang, Sun, and Chen develop an integrated framework to evaluate the quality and implementation of Entrepreneurial Failure Education (EFE) in Chinese universities. Drawing on the CIPP evaluation model—which considers Context, Input, Process, and Product—they construct a multi-dimensional index system and apply both the Analytic Hierarchy Process (AHP) and Fuzzy Comprehensive Evaluation (FCE) methods. Their empirical results from five universities reveal that while the institutional and policy context is relatively strong, the input dimension—especially in terms of funding, teaching resources, and curriculum—remains notably weak. The process and outcome dimensions also reveal substantial room for improvement. The authors suggest that to improve EFE, universities should strengthen their curriculum design, enhance teacher capacity, and ensure better integration between entrepreneurial education and real-world practice. This work contributes a rigorous methodology to EFE evaluation and provides a diagnostic tool for institutional development.

Schöer and Clavel examine the role of dialogic teaching practices in shaping student performance in mathematics across different cultural contexts. Using data from the 2018 PISA assessment and through multivariate regression analysis, the authors investigate how classroom dialogue—defined as student-teacher and peer interactions that promote reasoning, questioning, and co-construction of knowledge—mediates the relationship between background factors and academic outcomes. Their analysis also explores potential gender differences and the moderating effects of country-level variables, revealing that dialogic practices are positively associated with student performance, especially among girls. However, the prevalence and effects of such practices vary substantially across national education systems. The study offers policy-relevant insights into the design of pedagogical strategies that promote equity and learning gains and provides empirical support for shifting instructional paradigms from traditional lecture-based teaching toward more interactive, student-centered models.

The second group of contributions focuses on **equity and accessibility in education**. **Galván-Sánchez et al.** explore the mediating role of mathematical literacy in shaping first-year academic success in Business Administration and Management degrees, with a special focus on gender-based differences. Using structural equation modeling, the authors analyze how students' mathematics background—categorized by the type of mathematics taken in upper-secondary education—and performance on university entrance exams affect academic outcomes. Their results show that mathematical literacy acts as a significant mediator between educational background and early academic performance, with differentiated effects by gender: female academic success appears more sensitive to prior mathematical preparation and entrance exam scores than that of males. The study highlights the importance of curricular alignment between secondary and tertiary education and suggests that targeted support strategies for underprepared students, specifically women, could reduce early dropout and enhance academic persistence in quantitative university programs.

Campo-Robledo, Castillo-Robayo, and da Silva Bichara analyze the returns to education across different economic sectors and vulnerable population groups in Colombia. Using data from the Great Integrated Household Survey (GEIH), they estimate conditional quantile and interquantile regressions to explore how educational attainment translates into income across the Colombian wage distribution. Their findings indicate that returns to education are highly heterogeneous, with lower returns among informal sector workers, rural populations, and historically marginalized groups. The

paper further reveals that education premiums are concentrated in the upper quantiles of the income distribution, thus failing to substantially reduce income inequality. The authors argue for a more nuanced, sector-specific approach to educational policy that not only promotes access but also addresses structural barriers to economic inclusion. This research contributes to the broader debate on education's role as a social equalizer and provides empirical evidence for policies targeting both access and relevance of educational provision.

In the last accepted paper, **Villalba, Vila, and Carot** combine statistical methods with spatial models to study the student's accessibility to schools that offer free compulsory education based on the walking distances between residences and schools within the city of Valencia. Adopting the 15-minute city model, the study uses a gravity-based accessibility metric, the Two-Step Floating Catchment Area (2SFCA), to combine the spatial distribution of the school-age population with the locations and capacity of schools. The main findings of this paper are twofold: first, the distribution of accessibility scores reflects that per capita income across the city is irrespective of the type of school and level of compulsory education considered, such as primary and secondary education; and second, for most school-age children in the city of Valencia gaining entry to a charter school is easier than gaining access to a public school. The metric appears to capture adequately the unequal spatial distribution of educational opportunities, thus offering new insights to the literature of economics of education into some of the drivers that lead to school segregation processes and their territorial establishments.

This Special Issue received a total of 28 submissions, all of which underwent a rigorous peer-review process. Each manuscript was evaluated by independent reviewers, and only those that received an explicit *accepted* recommendation from at least two referees were ultimately selected for publication. This editorial process ensured the scientific quality and thematic coherence of the final collection for this Special Issue of *AIMS Mathematics on Statistical Methods in the Economics of Education*.

As Guest Editors, we express our sincere gratitude to the authors for their valuable contributions, to the reviewers for their rigorous evaluations and insightful comments, and to the editorial team at *AIMS Mathematics* for their professional and continuous support throughout this process.

We hope that this Special Issue will serve as a reference for scholars, policymakers, and practitioners interested in applying statistical and mathematical methods to the study of educational systems, and that it will foster further research at the intersection of education, economics, and data science.

Guest Editor:

Dr. Carmen Pérez-Esparrells

Autonomous University of Madrid, Department of Economics and Public Finance, 28049 Madrid, Spain

UAM-UC3M Research Institute for Higher Education and Science (INAECU), 28903 Getafe, Spain

Email: carmen.perez@uam.es

Dr. Sara González-Betancor

University of Las Palmas de Gran Canaria, Department of Quantitative Methods in Economics and Management, Campus Universitario de Tafira, 35017, Las Palmas de Gran Canaria (Canary Islands), Spain

Email: sara.gonzalez@ulpgc.es

Conflict of interest

The authors declare no conflict of interest.



AIMS Press

© 2025 the Author(s), licensee AIMS Press. This is an open access article distributed under the terms of the Creative Commons Attribution License (<https://creativecommons.org/licenses/by/4.0>)