Mathematical Models for Forecasting Students and Optimizing Workload: Higher Education's Basis for Operations Management

Dr. Albert Alipan Tayong

Majan University College, Muscat, Oman

Dr. Gulliver Maxi Roma

Majan University College, Muscat, Oman

Abstract:

In a fast-changing landscape of higher education, accurate forecasting of student enrollment per subject is of great value for efficient resource allocation and effective operations management. This paper embarks on the development of Mathematical models for forecasting students and optimizing staff workload, leveraging the computational power of Advanced MS Excel formulas/functions with Macros and Visual Basic Applications (VBA) and the data management abilities of Access Database. Through an exploratory-sequential approach coupled with data mining and linear programming, this study aims to provide Higher Education Institutions (HEIs) with a robust and adaptable forecasting tool. The research realizes the multi-faceted and dynamic nature of enrollment trends, which portrays complex patterns influenced by various factors and variables. By deriving insights from historical data, this study found that the developed Mathematical models, which involved the use of the power of Piecewise-defined Functions and Cumulative Frequencies, demonstrated a high level of accuracy in forecasting student enrolment in individual subjects for the upcoming semester. The models consistently achieved prediction accuracies around 95% - 97%, enabling Majan University College (MUC) to optimize its workload effectively and efficiently. This resulted in a more balanced allocation of resources, avoiding understaffing or overstaffing issues. By aligning staffing levels with actual forecasts, MUC benefited in terms of significant costs savings. Moreover, the study found that optimizing workload had a positive impact on the staff satisfaction by improving workload fairness and timetables. The study also found that optimizing staff workload had a significant impact on the student experience.

Additionally, the showcased models found to be scalable for different departments and numbers of current students. The study's findings have significant policy implications for HEI governance. Institutional leaders can consider adopting the Mathematical Models to improve their resource allocation efficiency.

Keywords:

Mathematical Models, Forecasting, Higher Education Institutions, Operations Management.