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The role of the pre-university life path in the performance of students who access higher education: the case study of the Master's Degree in Civil Engineering at FEUP

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This study aims to characterize the profile academical and social of the students enrolled to higher education, suggesting measures that lead to the improvement of their academic performance. It is based on the case study which covers the pre-university and first year students enrolled in the Integrated Master in Civil Engineering (MIEC), at Engineering Faculty of Porto University (FEUP) between 2015 and 2020.

Keywords: Data analysis, non-parametric tests, principal component analysis, higher education, academic performance

In Portugal, admission to public higher education is conducted through a national competition, when takes into consideration both secondary education grades and specific exams for the intended course. Each course has a pre-determined limited number of vacancies, which is called numerus clausus.

The first-year university student faces a series of challenges and new experiences, often intertwined with various factors and milestones: reaching adulthood, leaving parental home, moving to a new residence, learning different teaching methods, begin enrolled in the desired course, etc. However, in order to facilitate the integration of the new students, the Integrated Master's degree in Civil Engineering has developed and launched, in the academic year 2015/2016, a Peer Mentoring Programme, called CIVIL'in [1]. It is widely known that performance in the first year of the course, namely the number of curricular units completed, is a determining factor for success in the following years, in particular for the number of years required to complete the course. This explains the various measures implemented to support the integration of students in higher education and the growing attention with the first year students [1]. This work focuses on students enrolled in the Integrated Master in Civil Engineering (MIEC) at Engineering Faculty of Porto University (FEUP), between 2015 and 2020.

The area of civil construction is strongly connected to national economic cycles, having suffered a severe crisis in the past decade, which had repercussions on the ability to attract students to Civil Engineering courses. MIEC always filled the number of vacancies available, but the average application grades tended to decrease.

The objectives of this study are to characterize students enrolled to MIEC, to find pre-university curricular and/or social factors that influence their academic performance in the first year of the course, and to understand if there is any relevant trend during the 6-year period under analysis.
The information used in this work was provided by the course board. The variables under study are the student's entry score, the grade obtained in the high school, the rank position of MIEC option on the higher education application, the type of school attended in high school (namely public or private) and its location, the access regime, the entry stage in MIEC, the student status at FEUP, the number of course units completed in the first year and, when this number is not less than 5, the respective average classification, the number of completed curricular units in the scientific area of Mathematics (Mathematical Analysis 1 and 2 and Algebra) and average classification obtained, when the student completes at least 2 of these.
A univariate and bivariate descriptive analysis of the data set, for each of the years under study, considering the typology of the different variables, revealed that some modality and/or binary variables had relevant information content, namely to interpret the dependency relationships with the quantitative variables. The variables i) type of school attended in high school, public or private, and ii) location of usual place of residence, translated into permanence in the usual place of residence or need to reside abroad, depending on whether or not to the location belongs to the Greater Porto area, proved to be variables to be explored in more detail. Using non-parametric Wilcoxon Mann-Whitney tests, it was possible to verify that these variables are significantly influencing the students' performance in the first year of the course, measured by the number of course units completed, in general subjects and in mathematics, and by the respective average scores.
Interestingly, the variables student's entry score and grade obtained in the high school did not prove to be systematically determinants of the first year performance. In order to further explore the possible relationships between the quantitative variables in the study, a Principal Component Analysis was conducted for these variables and for each year. For the 6 years under study, the first 3 main axes were found to explain between 85% and 90% of the inertia of the point cloud. The first axis can be called "continuity of good performance", to which students who been enrolled with high grades and maintain the level in the first year contribute. The second axis that we call "in-adaptation/change of course", is associated with students who, been enrolled with high grades, completed a reduced number of course units. The third axis has different interpretations throughout the 6 years.

References

[1] Ribeiro I.M., Henriques A., Carvalho B., Guimarães A., and Sousa V. The civil'in programme - a peer mentoring programme for first-year students of civil engineering. *Engaging Engineering Education - SEFI 48TH ANNUAL CONFERENCE*, pages 416–431, 2020.