Abstract

This thesis focuses on the prediction of academic success and item analysis of chemistry knowledge tests used in the admission procedure at the Faculty of Science, Charles University between 2016 and 2019.

The first part of the thesis focuses on the possibilities of academic success prediction (earning a bachelor's degree within 4 years) based on various factors: (i) success rate in the admission procedure, (ii) study index (modified average of marks), (iii) success rate in each part of admission procedure, (iv) passing exams in selected mandatory subjects for students of Chemistry study programme, eventually (v) based on obtained marks in selected subjects (as in (iv)). Furthermore, a prediction of entering Year 2 was also completed for three of these factors (i, iii and iv). The sample consists of 1,780 applicants for Chemistry study programmes. The results of the analysis proved a medium effect on success in the admission procedure on entering Year 2 (d = 0.52) and a large effect on academic success (d = 0.67). By additional comparison of predictive ability of knowledge tests (Maths, Biology, Chemistry) we proved that the Chemistry test has a greater prediction ability compared to the others – low effect on entering Year (d = 0.22), but medium on academic success (d = 0.40). Additionally, we proved a low/medium effect of success in the admission procedure on study index (N = 109; ρ = -0.38; p =0.000). Moreover, the correlation analysis of the predictive ability of selected mandatory subjects in the Chemistry study programme showed Organic Chemistry I (b) as a subject with the highest predictive ability (ρ = -0.777), whereas Inorganic Chemistry I (b) as a subject with the lowest effect on academic success (ρ = -0.327).

The second part of this thesis is dedicated to item analysis of the Chemistry test used in the admission procedure between 2016 and 2019. For each test item, the difficulty and discrimination were calculated and the attractivity and suitability of construction of each distractor in was evaluated. The qualities of each item were compared with other items within a test and also within the topics of the items. Moreover, the reliability of each test was calculated using Cronbach alpha. For 5 out of 8 tests, the reliability exceeded the recommended level of 0.70. By applying a new system of evaluation (1 point for each item), the reliability of only 1 of the 8 tests would remain below 0.70. To sum up the results, the item analysis revealed 17 difficult items, 25 too simple items, 96 items with at least one implausible distractor and 34 distractors with negative discrimination (thus decreasing the efficiency of candidate selection). The 17 difficult items belong in 9 chapters of Chemistry: ideal gas law, pH calculation, electron configuration, ion product, electrolysis, organic chemistry reactions, isometry and constitution of compounds, organic compounds classification and enzymes. Moreover, 15 chapters included tasks with low item discrimination (e. g. chemical equilibrium, trends in the Periodic Table, biochemical reactions,…) Additionally, items which were too easy/difficult or those with either

implausible distractors or distractors with negative discrimination are provided with a hypothesis explaining the qualities of the task. Additionally, for part of the test items, an adjustment of tasks is proposed to improve its parameters before including the item in other knowledge tests. Based on the obtained data, proposals to the authors of Chemistry knowledge tests are listed in the conclusions of this work.

Key words

Analysis, Entrance examination, Education, Result, Chemistry