Graph theory approach in quantitative assessment of the efficiency of microstructuring of the course of Organic chemistry

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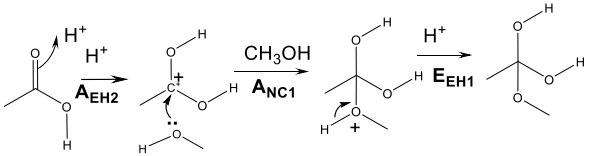
Earlier an original system of disciplinary didactic principles has been elaborated [1]. The system consists of original epystomology and didactics, moreover now we propose mathematical evaluation of the relevance of course construction based on Graph theory approach. Any of three principles proposed (structural adequacy principle, functionality principle, and mechanistic simplification principle) can be chosen for evaluation of the course relevance. The mathematic technique based on graph theory was proposed by Toldsepp [2] for macrostructuring. Here we assess the course of micro-structuring including the choice and sequence of reactions. We present course chapter as a graph in the form of the adjacency matrix. The matrix contains subcomponents which are in our case the chosen reactions. All the reactions from the chapter are formally divided into elemental stages of addition and elimination (the didactic adaptation of the reaction step by step mechanistic presentation), taking also into account the type of reagent/leaving group, the type of the atom coupling with the reagent, and finally, multiplicity of the bond.



E.g. $\mathbf{A}_{\mathbf{EH2}}$ means "Addition (**A**) of Electrophile (**E**) to Heteroatom (**H**) belonging to a double (**2**) bond"; $\mathbf{A}_{\mathbf{NC1}}$ means "Addition (**A**) of Nucleophile (**N**) to Carbon (**C**) belonging to a single (**1**) bond"; $\mathbf{E}_{\mathbf{EH1}}$ means "Elimination (**E**) of Electrophile (**E**) from Heteroatom (**H**) to leave a single (**1**) bond". The relevance of microstructuring is associated with the presence of the same elemental stages in reactions as well as with the distances between them. Mathematically it can be calculated as two indicators. The summary distance from the main diagonal of the matrix can be associated with the didactic principle of content compactness: the smaller the parameter's value, the shorter the time lags between learning different subcomponents of a teaching material. The sum of the elements on the diagonal adjacent to the main diagonal is associated with the principle of continuity of a teaching material. Supposing, every new structural element ideally ought to be built on the previous one, and then the value has to be maximal for a given matrix.

References

[1] T. Lakhvich. Khinija: prablemy vykladannia (2009) 5: 15
[2] A. Toldsepp. J. Baltic Sci. Education (2009) 8: 2