

Grouping Mathematical Contents Using Network Analysis Software. An Application to the Spanish Secondary Education Case

Angélica Martínez-Zarzuelo
Depto. de Didáctica de las Matemáticas,
Facultad de Educación, Universidad Complutense de Madrid, Spain
`angelica.martinez@ucm.es`

Eugenio Roanes-Lozano
Instituto de Matemática Interdisciplinar (IMI) & Depto. de Álgebra,
Facultad de Educación, Universidad Complutense de Madrid, Spain
`eroanes@mat.ucm.es`

María José Fernández-Díaz
Depto. Métodos de Investigación y Diagnóstico en Educación (MIDE),
Facultad de Educación, Universidad Complutense de Madrid, Spain
`mjfdiaz@edu.ucm.es`

Abstract

The educational laws establish an organization and a grouping of the contents of the educational system they rule. These organizations and groupings are usually designed by hand by a set of experts, and are based on their experience and criteria. As far as we know, they are not carried out using precise objective criteria and computer tools. That's why they are not usually rotund. For example, the Spanish educational law underlines that the organization proposed is only a guide, and highlights that the groups (blocks of contents) are not independent compartments. Nevertheless, curriculum developments derived from the law (textbooks, educative projects, etc.) usually just translate the suggested ways of organizing and grouping. We consider that defining precise objective criteria is key to develop alternative ways of organizing and grouping contents in a technically sound way. To achieve this, we propose to base the research in the meaningful learning theory (establishing a partial order relation among the contents, the relation: "to be a prerequisite"). We have therefore designed and implemented a proposal that has been applied to the mathematical contents of the compulsory Secondary Education (E.S.O.) of the Spanish educational system. The amount of contents considered for the four courses (814) and the number of ordered pairs in the order relation (17,669) makes it necessary to use software specialized in network analysis. Pajek and Gephi have been chosen for this task. A cluster analysis developed using these packages has determined an alternative grouping to the one proposed by the Spanish educational law.

References

1. A. MARTÍNEZ-ZARZUELO. Selección, organización y secuenciación del conocimiento matemático mediante teoría de grafos (Ph.D. Thesis) (In Spanish). Universidad Complutense de Madrid. Madrid, 2015.