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## Education as a Complex System: Using physic methods for the analysis of students' learning behaviours in the context of programming education.

*Saturday, 3 July 2021 10:20 (20 minutes)*

As a result of the COVID19 pandemic, more higher-level education courses have moved to online channels, raising challenges in monitoring students' learning progress. Thanks to the development of learning technologies, learning behaviours can be recorded at a more fine-grain level of detail, which can then be further analysed. Inspired by approaching education as a complex system, this research aims to develop a novel approach to analyse students' learning behavioural data, utilising physical methods. First, essential learning behavioural features are extracted. Second, a range of techniques, e.g., Random Matrix Theory and Community Detection techniques, were utilised to clean the noise in the data and cluster the students into groups with similar learning behavioural characteristics. The proposed methods have been applied to datasets collected from an online learning platform in an Irish University. The datasets contain information of more than 500 students in different programming-related modules over three academic years (2018 to 2021). Results indicate the similarity and deviation of learning behaviours between student cohorts. Overall, students interacted similarly with all course resources during the semester. However, while higher-performing students seem to be more active in practical tasks, lower-performing students have been shown to have more activities with lecture notes and have lost their focus at the later phase of the semester. Additionally, the student learning behaviours in a conventional university setting tend to be significantly different to the students in a fully online setting during the pandemic. Recommendations from the work for current educational practice are made.

**Primary authors:** MAI, Tai (Dublin City University); Dr BEZBRADICA, Marija (Dublin City University); Prof. CRANE, Martin (Dublin City University)

**Presenter:** MAI, Tai (Dublin City University)

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