Using intelligent adaptive assessment models for teaching mathematics

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ABSTRACT

The utilization of CAS nowadays has been applied in a wide range of domains, including maths, to assess theoretical student knowledge or, also called, declarative knowledge. Despite this successfully utilization of CAS, assessing students using reliable and well-founded methods has still room for improvement when the knowledge being assessed is procedural. This kind of knowledge occurs when the student must solve a problem with a serial of steps involved on it to achieve a solution.

Problem solving environments are normally used for learning by practising knowledge but not for assessment. This gets even worse in complex domains where the over-specificity problem in the knowledge representation makes difficult not only to assessing students, but even the creation of a suitable model capable to be used in a learning system.

In this work we will present an adaptive and intelligent model that pursues two main goals: first, to assess students by means of well-founded assessment methodologies on domains where an evaluation is difficult to be performed using traditional CAS; and second, to allow students learning in such domains by applying a constructivist methodology (i.e. using the assessment for learning approach). The theoretical foundations that make our approach to be a valid for both, assessing and learning purposes, lie on combining Item Response Theory, a well-founded assessment theory, with Constraint-Based Modelling, a methodology developed to overcome the over-specificity problem when building learning environments and modelling student knowledge. We will discuss how to build concrete learning environments in mathematical domains that use this generic methodology and how the process of assessing students is done.

Between the currently existing systems that incorporate this methodology, it will be presented an example in the linear optimization topic, which has been applied with real students from the University of Málaga.