Contribution ID: **95** Type: **Oral Presentation**

Analysing assessments in introductory physics using Semantic Gravity: Refocussing the purpose

Monday, 1 October 2018 16:00 (20 minutes)

In physics it is required from students from first year onwards to be able to apply core concepts in different contexts, ranging from commonplace to highly specialised examples. Students also need to transfer their understanding of core concepts to subsequent years of study since physics hierarchically builds on these understandings as students progress in their studies. Cumulative learning has been defined as learning that facilitates the ability to "transfer knowledge across contexts and build knowledge over time" [K. Maton, British Journal of Sociology of Education 30, 43,2009].

Cultivation of cumulative learning during first year physics modules is critical and challenging, particularly in South Africa where student cohorts have highly diverse educational backgrounds. Assessment is a key aspect of learning that influences students' approach to learning. It is therefore important to ask whether our assessment practices encourage cumulative learning.

Legitimation Code Theory (LCT), developed by Maton and co-workers, provides a framework for analysis of educational practices [K. Maton, British Journal of Sociology of Education 30, 43,2009]. The Semantics dimension is one of the tools from LCT that facilitates distinction between levels of abstraction and complexity. Abstraction (termed semantic gravity) refers to the role of context in meaning, whereas complexity (termed semantic density) is related to the degree to which meaning is condensed into words or symbols. Maton argues that cumulative learning is facilitated by exposing students to appropriate ranges of complexity and abstraction in teaching and assessments. In this paper we illustrate how semantic gravity was used to critique the quality of assessments in introductory physics on university level, and how the results were then used to inform assessment practices.

We analysed past assessments of two mainstream first year physics modules over a five year period. The results revealed large variation in the range of abstraction that was assessed over this period. It also highlights challenges with regards to cumulative learning. The study was followed up by an intervention during 2017 consisting of real time analysis of the test and exam papers, in combination with interactive internal moderation sessions. The analysis empowered both the lecturers and internal moderator by providing a practical categorisation of questions. The process guided both lecturers and students to refocus on the teaching and learning of core concepts. Analysis of grades of cohorts before and during the intervention suggests that it has improved student understanding of the core concepts and advanced cumulative learning.

This study illustrates how semantic gravity can be used to guide the moderation of assessments and support the development of more consistent assessments over consecutive years.

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No

Level for award
 (Hons, MSc,
   PhD, N/A)?

Not applicable

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Session Classification: Parallel Session 2

Track Classification: Track G - Assessment and Evaluation of Teaching and Learning in Physics