RECASTING THE PEDAGOGY OF DERIVATIONS AS LOADING OF REALITY INTO MATHEMATICS

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Derivations constitute a major component of physics education, particularly in India. They are usually taught as a string of mathematical propositions and procedures with little to no connection to the physical world (Sirnoorkar et al., 2016). This results in the whole teaching/learning process getting restricted to symbolic manipulations and mathematical operations, with the aim of arriving at an equation (Tuminaro & Redish, 2007; Walsh et al., 2007).

In an effort to improve the learning experience of derivations, specifically to present derivations as an instance of building a mathematical model, we designed and developed an interactive learning system and an associated teaching narrative. This combination presents derivations as a process of systematically loading reality into mathematical symbols, to develop an 'enactive prediction machine' (the equation; Redish & Kuo, 2015). Through this structure, we make explicit the key processes involved in mathematical modelling of a real-world process (Majumdar et al., 2014).

Providing an appreciation of the thinking process underlying derivations was one of our primary design requirements. Some of the key design features of the system are:

- Rootedness in familiar real-world contexts, with anchoring questions
- Explicit rendition of the conceptual structure and key steps in the derivation process
- Interactive visualization and manipulability
- Enactive equations

Our goal was to understand how participants' nature of learning was influenced by this new learning system and narrative. We tested the system by inviting participants with a minimal background in physics to interact with it. Results suggest that the system and associated teaching narrative provided an improvement over prior learning experiences specific to derivations. We briefly discuss the inputs we received, plausible reasons, and implications of these results.

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