
THE MULTI-MILLION-DOLLAR INVENTORY: THE FCI USES AND APPLICATIONS

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The Force Concept Inventory (FCI), developed by Hestenes et al. (1993), is a well-known conceptual pre- and post-test used extensively in Physics Education research. It is often referred to as the "million-dollar concept inventory" due to its significant impact and the extensive years of research conducted using it. In Physics and other STEM subjects, it is crucial for students to go beyond just memorization and equation hunting. They need to grasp the underlying concepts and see the big picture. This presentation will discuss various Concept Inventories (CIs) used in STEM education. A common issue with CIs is the additional time required to complete them, which can increase student anxiety. This presentation explores different approaches to utilizing and interpreting the FCI. Key topics include identifying dominant misconceptions from pre-test results to guide teaching, calculating Hake Gain, and using Item Response Theory (IRT) for a precise mathematical definition of gain. IRT can also facilitate the implementation of Computerised Adaptive Testing (CAT), which personalizes the test to each student's ability level. I will present ongoing and preliminary work with the FCI at the Physics Departments at the University of Johannesburg and the University of Lyon. These projects include applying these methods to improve the effectiveness and efficiency of CIs. A significant benefit of using CAT is the reduction in time required for students to complete the inventory, which also helps in reducing their anxiety.

REFERENCES

Hestenes D., Wells M., & Swackhamer G. (1992). Force concept inventory. *Physics Teacher*, 30 141–158.
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