MONTANA STATE UNIVERSITY | College of LETTERS & SCIENCE

Physics Colloquium

Friday, January 22nd
4:10 – 5:00 PM
Roberts Hall Room 101

Modernizing Formative and Research-based Assessments with Cognitive Diagnostic Models

Jayson Nissen, Ph.D.
Nissen Education Research and Design

Abstract: In physics education research, instructors and researchers often use research-based assessments (RBAs) to assess students' skills and knowledge. Our ongoing work is development of a mechanics cognitive diagnostic to test and implement effective and equitable pedagogies for physics instruction. Adaptive assessments using cognitive diagnostic models provide significant advantages over fixed-length RBAs commonly used in physics education research. As part of a broader project to develop a cognitive diagnostic assessment for introductory mechanics within an evidence-centered design framework, we identified and tested student models of four skills that cross content areas in introductory physics: apply vectors, conceptual relationships, algebra, and visualizations. We developed the student models in three steps. First, we based the model on learning objectives from instructors. Second, we coded the items on RBAs using the student models. Last, we then tested and refined this coding using a common cognitive diagnostic model, the deterministic inputs, noisy “and” gate (DINA) model. The data included 19,889 students who completed either the Force Concept Inventory, Force and Motion Conceptual Evaluation, or Energy and Momentum Conceptual Survey on the LASSO platform. Model fit was good to adequate fit for the student models with high accuracies for classifying students with many of the skills. The items from these three RBAs do not cover all the skills in enough detail, however, they will form a useful initial item bank for the development of the mechanics cognitive diagnostic that is available through the LASSO platform.

Host: Shannon Willoughby

**** Refreshments served in the Barnard Hall second floor atrium at 3:45 PM ****