Major Course Revision for MLGN593: Bonding, Structure, & Crystallography

**BACKGROUND**

*Materials Science Graduate Core program:*
- MLGN 591: Materials Thermodynamics
- MLGN 592 Advanced Materials Kinetics and Transport
- MLGN 593 Bonding, Structure, & Crystallography
- Wide variety of backgrounds
  - 1/3 Materials Science or related Degree
  - 1/3 NO Mat Sci background
- No required materials science prerequisites
- Must have enough knowledge of materials science to perform research and not embarrass themselves at conferences.

**WHAT IS CHANGING**

**Why change?**
- Large amount of material to cover
- Students struggle to master topics covered and struggle to see how different topics are connected

**Learning Outcomes:**
- Clear & concise learning outcomes defined for students
- Addition of prerequisite low-level knowledge added to prerequisite knowledge (with resources for finding answers)

**Videos & targeted readings:**
- Videos being created to cover difficult concepts
- Pre-class quizzes focusing on specific closed-end information (low-level depth of knowledge) and general curiosities about what to explore deeper
- Material in readings not repeated in class!
- More time to apply ideas in class

**Emphasis on metacognition:**
- Students often focus on mechanics of solving problem and miss the general concept.
- Additional homework added to build connections to learning objectives and major concepts.

**EXPECTED RESULTS**

**Class time:**
- Slower pace for in-class coverage of material
- Time for real examples and constructing complex ideas
- More computer simulations and visualization software
- Active participation by students in small group discussions

**Metacognition:**
- Assessments added on identifying general concepts learned and connections to learning objectives
- Assignments including descriptions of concepts with extended written portions

**Expected improvements:**
- Students able to identify why each homework is assigned and how exam problems do indeed build on homework
- Less of a “fire hose” feeling for many students

**Perspectives on Trefny Center Summer Intensive Course Revision Program:**
- The Intensive Course Revision program helped me narrow and focus my learning objectives so that they are useful for the students
- A great opportunity to work with other faculty from across campus with a range of teaching experiences
- Teaching well is never easy, but learning effective instruction techniques should make you more efficient at preparing for class.
- Well defined learning objectives help align tests and homework and gives students clear expectations, improving attitudes.

*Previous approach:*
- Just in time teaching (JITT) on readings and online quizzes
- Students with weak materials Backgrounds
- I had to cover material in readings, eliminating any possible time savings.

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