But does it last???

Sustainability of our course transformation efforts in physics

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The Courses

Two Junior-Level courses (Electricity & Magnetism and Quantum Mechanics)

Added In-Class:
- Tutorials
- Clicker questions

Added Resources:
- Research into student difficulties
- Additional homework questions

Assessed with: New conceptual assessments
The Archives

Detailed archives of each course includes:
1. Syllabus and handouts
2. Material organized by TOPIC (e.g., Gauss’ Law)
3. Material organized by COLLECTION
   - Clicker Questions / Tutorials / Student Difficulties
4. Assessments (exams, homework, conceptual assessment)
5. PDFs of all materials

This is given to the new instructor each semester
The Questions

What are student experiences in subsequent iterations of the course?

&

How do instructors use the developed materials in subsequent iterations?
Assessments

Research-based Transformations = “RES”

**Electricity & Magnetism**
First transformation: Spring 2008 (RES1)

Taught using transformed materials:
- Fall 2008 (RES2)
- Spring 2009 (RES3)
- Fall 2009 (RES4)
- Spring 2010

**Quantum Mechanics**
First transformation: Spring 2008 / Fall 2008 (RES1)

Taught using transformed materials:
- Spring 2009 (RES2)
- Fall 2009 (RES3)
- Spring 2010 (RES4)
Student learning gains remain high, and above traditionally-taught courses at CU and elsewhere.
Tutorials

Optional group work sessions, out of class, focused on conceptual understanding *(see our other poster!)*

Created optional 1-credit co-seminar courses to assist with scheduling and sustainability.
Tutorial attendance drops after the first iteration

Note: Each iteration of each course (eg., RES1) is NOT taught by the same instructor.
Student attitudes

Averaged FCQ of:
Course overall, Instructor overall, Instructor availability, Challenge, How much learned

Student rating of the courses is not consistently high.
Q13: Roughly how many hours (on average, per week) did you spend on 3310 homework?

- Minimum
- Maximum
- Average

Student attitudes

Electricity & Magnetism

Students spend more time on HW in transformed course
Student attitudes

Electricity & Magnetism

Clicker questions rated as highly useful in all courses
Faculty experience

Faculty teaching course interviewed 2-3 times:

• Beginning of semester
• End of semester
Co-teaching

The first time each new course was handed-off from the developers (RES2), it was co-taught by a Physics Education Research (PER) faculty and a non-PER faculty.

- I know my teaching has improved from having team taught with X.
- I learned how to have a more organic conversation, especially in response to a student question.
- I learned a lot about ideas for how you could have an interactive classroom. He’s always looking for something new to get them engaged.
- I moved a little in his direction, but one thing I realized is...is that even though I learn from him, I can’t imitate him.
- I learned how to integrate a concept test into lecturing.
- This process of letting (the students) stand up and say....why they voted the way they did (in clickers) was completely new to me and I really enjoy it.
- By listening in class [while the other instructor was teaching], as well as in help sessions tutorials, and other places, I’ve learned a lot about what (students) think.

Instructors learned from each other through co-teaching
Course Materials

Tutorials: Used all semesters*
Homework problems: Used extensively in all semesters*
Clicker questions: Used extensively in all semesters*
Lecture notes: Used extensively in all semesters to prepare lectures
Student difficulties Used by most, but not all, instructors
Conceptual diagnostic Given in all courses once developed

* Each instructor modified, added to, or iteratively improved the materials.

Instructors used the course materials. Most report moderate changes in pedagogical style as well.
Instructors are mixed: Some put in additional prep time and others feel that it’s similar to a traditional course. Added course structures (eg, tutorial) increase work load.
When asked whether they would use the transformed course materials if they taught the course again, all instructors indicated that **YES** they would.

Some mentioned modifications, such as modifying content coverage or changing some aspects (such as more demos).
Conclusions

• **External supports** (STF, co-teaching, co-seminar tutorials, electronic course archives) have been instrumental in institutionalizing the new course structure

• **Individual faculty** have a wide range of experience in using materials and teaching the course – overall positive

• **Longer term impacts?** It remains to be seen whether these changes to the course, and to individual faculty, are sustained.