JiTT and ILD's

Teaching and Learning Physics, Fall 2015

TABLE VI. Ranking of the 24 RBIS according to level of Knowledge (percentage of faculty who indicate that they are familiar with or have used the RBIS).

RBIS	All institutions	Two-year college	Four-year college (B.A.)	Four-year college (Grad)
Peer instruction	63.5%	46.6%	73.4%	65.8%
Physlets	56.3%	55.5%	66.4%	47.8%
Cooperative group problem solving	49.3%	43.4%	59.5%	43.9%
Workshop physics	48.2%	47.2%	66.5%	32.0%
Just in time teaching	47.7%	44.5%	55.1%	43.1%
Tutorials in introductory physics	47.0%	42.4%	55.7%	42.0%
Interactive lecture demonstrations	45.4%	42.0%	57.4%	36.7%
Activity based problem tutorials	43.0%	42.8%	53.2%	33.9%
Ranking tasks	38.7%	45.6%	45.3%	27.9%
SCALE-UP	34.5%	23.5%	50.8%	27.0%
Active learning problem sheets	34.3%	36.4%	38.3%	29.5%
Modeling	32.7%	34.8%	39.9%	24.7%
RealTime physics laboratories	32.4%	37.6%	39.2%	22.8%
Context rich problems	30.4%	25.7%	36.7%	28.0%
Overview case study physics	24.7%	31.1%	28.4%	17.3%
Open source physics	21.8%	19.1%	28.3%	17.9%
Investigative science learning environment	21.1%	24.4%	25.4%	14.9%
TIPERS: Tasks inspired by physics education research	20.9%	31.4%	23.1%	11.6%
Open source tutorials	20.8%	17.4%	25.2%	19.0%
Video laboratory	18.8%	22.5%	21.8%	13.4%
Workbook for introductory physics	18.5%	17.9%	24.1%	13.8%
Experiment problems	17.3%	25.4%	19.8%	9.3%
Socratic dialogue inducing laboratories	16.3%	17.1%	19.6%	12.8%
Thinking problems	15.1%	17.1%	16.6%	12.4%

Henderson, C. & Dancy, M. (2009) The Impact of Physics Education Research on the Teaching of Introductory Quantitative Physics in the United States, *Physical Review Special Topics: Physics Education Research,* **5** (2), 020107.

Interactive Lecture Demonstrations (ILD's)

- Professor describes the experiment, and carries it out without recording data.
- Students record their predictions of the outcome on a Prediction Sheet.
- Peer discussion follows, with the students discussing their predictions in small groups.
- Professor engages class, soliciting predictions and highlighting common predictions.
- Students record their final prediction on the Prediction Sheet (this is collected).
- The experiment is run. Real data is recorded and plotted by the computer, with the results displayed graphically for all to see.
- Professor engages class, discussing what students say about their predictions and focusing in particular on any common misconceptions. Students record the results on a Results Sheet, which they keep.
- Professor discusses variations of the experiment and similar physical situations based on the same underlying concepts.

Just In Time Teaching (JiTT)

- Motivate students to prepare for class
- Giving instructor feedback to tailor class to students
- i.e. NB

In discussing the predictions for the ILDs, I encourage the class to "be creative" and to find not just what they think might be the correct answer (probably the one given by the A student in the front row who answered first!), but to come up with other answers that might be considered plausible by other people (such as a roommate who is not taking the class). This frees the students from the burden of being personally associated with the answer they are giving and allows them to actually express what they might really believe. (I sometimes find it necessary to give some plausible but wrong answers myself in order to get the ball rolling.) I then ask students to try to defend each other's answers. This changes the character of the discussion from one that is looking for the right answer to one that is trying to create and evaluate a range of possible answers. The focus changes from "listing facts" to building process skills.

14 Students commented on this section!

- I wonder if this is because **students only study theories that we know are more or less correct.** From personal experience, I don't think I really "got" the value of my sense-making skills until I was working in a lab trying to understand something that I didn't have a good model for.
- as a student, I always enjoyed seeing how things "made sense", but **most of my coursework required me to demonstrate skill** with pushing around the formalism.
- This is an excellent way of helping the students **see the value of being wrong.** Also, it is beginning to instill in the students the importance of evaluating their answers in a number of different ways
- **This seems more in line with what actual scientists do** (considering all of the possibilities, then determine which is most likely).
- This strategy is so awesome, **talk about building culture** and community within a classroom.

Methods to Enhance Lecture (PI, ILD's, JiTT)

- Demonstrate better understanding of concepts (less identified misconceptions)
- Increase lecture attendance, decrease DWF rate
- Better student evaluations of course
- May decrease gender gap

Why is it better than traditional lecture?

- Increase time students spend thinking, decrease time mindlessly taking notes.
- Leverage social nature of learning.
- Instructor get's feedback, can adapt to students ideas and needs.
- Keeps students awake (avg. attention span for listening is 5-20 min)
- Questions designed to address conceptual difficulty (research-based).
- Allows for discussion of wrong answers, deepens understanding.
- Students can see they are not alone in their misunderstanding.
- Encourages question asking and getting help.

What cultural messages are embedded in these methods?

- Authority
- Nature of Knowledge and Learning and Physics
- Role of Education in Society