RTOP: A Method for Measuring Reformed Teaching

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What Is Reformed Teaching?

- Consistent with the nature of science inquiry
- Reflects scientific values
- Aims to counteract learning anxieties
- Extends beyond the school

(AAAS, 1989).

What Are Students Doing?

- Using data to justify positions
- Experiencing ambiguity as a result of learning
- Learning from one another

(Sawada et al., 2002).

How Do We Measure Reformed Teaching?

- Reformed Teaching Observation Protocol (RTOP) (Piburn et al., 2000)
- Assesses degree to which classroom instruction uses student-centered, engaged learning practice
- Measures extent to which instructor engages in teaching strategies that build student content knowledge in a manner consistent with reformed teaching
- Allows instructors to gain insight into their own teaching practices

History of RTOP

- Developed by Arizona Collaborative for Excellence in the Preparation of Teachers (ACEPT)
- Designed to measure the quality of instruction in college science and mathematics courses.
- Originally used in a series of summer workshops to train instructors in the use of reformed teaching strategies in classes that included preservice teachers

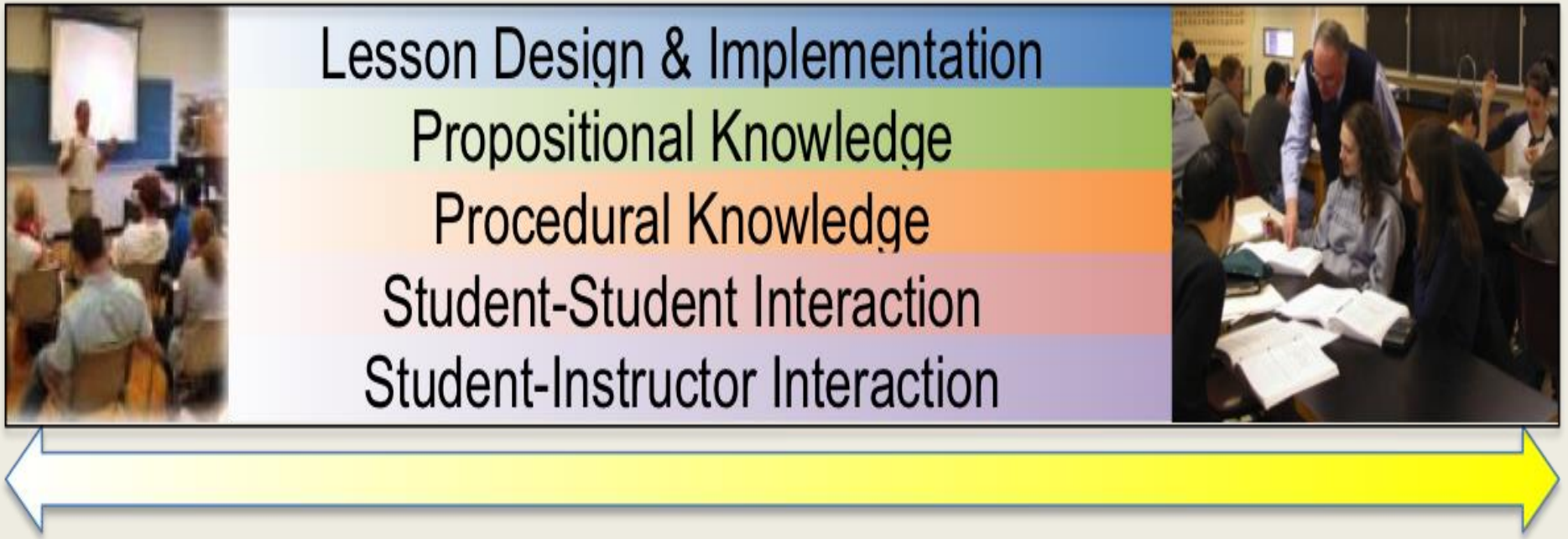
RTOP Structure and Components

- Measures the presence/absence of specific teaching strategies divided into five subscales
  - Lesson design and implementation
  - Propositional Knowledge
  - Procedural Knowledge
  - Student-teacher classroom interaction
  - Student-student classroom interaction

How Are RTOP Scores Determined?

- Characterizes classrooms on a spectrum from traditional lecture to reformed, student-driven, active learning
- Consists of 25 questions on five sub-scales that use a Likert scale from 0-4 (no occurrence to maximal occurrence)
- Classroom can be characterized on a scale from 0 to 100, where 0 indicates traditional, lecture-based and 100 indicates a reformed, student-driven class

Interpreting an RTOP Score



Traditional lecture (RTOP score: 0-29)

Active Lecture (RTOP score: 30-49)

Active Learning (RTOP score: 50+)

Subscale 1 - Lesson Design and Implementation: What the teacher intended to do

- Examines design and application of lesson to determine if it is sufficient to support student understanding
  - Organization
  - Acknowledgement of student preconceptions/everyday experiences
  - Allowances for informal exploration of topic
  - Opportunities for students to work together in groups (social construction of knowledge)

Subscale 1 Items (Piburn et al., 2000)

1. *Instructional strategies and activities respected students' prior knowledge and the preconceptions inherent therein.*
2. *The lesson was designed to engage students as members of a learning community.*
3. *In this lesson, student exploration preceded formal presentation.*
4. *This lesson encouraged students to seek and value alternative modes of investigation or of problem solving.*
5. *The focus and direction of the lesson was often determined by ideas originating with students.*

Subscale 2 - Propositional Pedagogic Knowledge: What the teacher knows, and how well they are able to organize and present material in a learner-oriented setting

- Character of the content the instructor teaches and their command of the material
  - assess the instructor's knowledge of material under discussion
  - explore how lesson incorporates ways for students to represent abstract concepts (e.g., graphs, equations)
  - identify how new knowledge is integrated with other disciplines and real world applications.

Subscale 2 Items (Piburn et al., 2000)

1. *The lesson involved fundamental concepts of the subject.*
2. *The lesson promoted strongly coherent conceptual understanding.*
3. *The teacher had a solid grasp of the subject matter content inherent in the lesson.*
4. *Elements of abstraction (i.e., symbolic representations, theory building) were encouraged when it was important to do so.*
5. *Connections with other content disciplines and/or real world phenomena were explored and valued.*

Subscale 3 - Procedural Pedagogic Knowledge: What the students did

- Examines the scientific ways of knowing and if students are engaged in this process in the classroom
  - Predicting
  - Estimating
  - Hypothesizing
  - Negotiating ideas

Subscale 3 Items (Piburn et al., 2000)

1. *Students used a variety of means (models, drawings, graphs, symbols, concrete materials, manipulatives, etc.) to represent phenomena.*
2. *Students made predictions, estimations, and/or hypotheses (PEH) and devised means for testing them.*
3. *Students were actively engaged in thought-provoking activity that often involved the critical assessment of procedures.*
4. *Students were reflective about their learning.*
5. *Intellectual rigor, constructive criticism, and the challenging of ideas were valued.*

Subscale 4 - Student-Student Interaction

- Evaluates the number and type of interactions among students and how the instructor facilitates such interactions
  - actively communicating with one another
  - explaining their own ideas
  - evaluating the ideas of others

Subscale 4 Items (Piburn et al., 2000)

1. *Students were involved in the communication of their ideas to others using a variety of means and media.*
2. *The teacher's questions triggered divergent modes of thinking.*
3. *There was a high proportion of student talk and a significant amount of it occurred between and among students.*
4. *Student questions and comments often determined the focus and direction of classroom discourse.*
5. *There was a climate of respect for what others had to say.*

Subscale 5 - Student-Instructor Interaction

- Addresses the culture of respect and comfort in the classroom as supported by both learners and teacher
  - students feel comfortable asking questions
  - teacher demonstrates patience
  - teacher listens to students
  - teacher provides wait time

Subscale 5 Items (Piburn et al., 2000)

1. *Active participation of students was encouraged and valued.*
2. *Students were encouraged to generate conjectures, (or) alternative solutions, and/or different ways of interpreting evidence.*
3. *In general the teacher was patient with the students.*
4. *The teacher acted as a resource person, working to support and enhance student investigations.*
5. *The metaphor "teacher as listener" was very characteristic of this classroom.*

Undergraduate Geosciences RTOP Scores

	Lesson Design & Implementation	Propositional Knowledge	Procedural Knowledge	Student-Student Interaction	Student-Instructor Interaction	Total
Average	6.7	15.1	5.3	6.5	7.8	41.0
Range	1-18	9-20	0-16	0-19	1-19	
(n=120)	(SERC, 2014).					

Limitations of RTOP

- Deals with only a single class period. Variation in the class throughout the term is not evaluated.
- Components performed outside of class are not specifically evaluated (labs, problem sets, homework, field trips)
- Does not incorporate out-of-class student-student or student-instructor conversations.
- Does not address the out-of-class quality of grading or ungraded feedback of assignments by the instructor.

References

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Science Education Resource Center at Carleton College (2014). *Understanding and improving our teaching using the reformed teaching observation protocol (RTOP).* Retrieved from http://serc.carleton.edu/52104