Evidence for Reformed Teaching in Undergraduate Geoscience Course Syllabi

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Earth Educators' Rendezvous 2020
Funded by NSF DUE grant #1022844 & NSF GEO #1125331

Study Motivation

- Syllabi are the initial mode of communication we use to share course norms, expectations
- Taken together, a collection of geoscience syllabi could represent our normative practices, but the degree of alignment between syllabi and classroom practices is not known.
- Explicitly stating learning objectives benefits students, helps align course goals with instruction and assessments (Wiggins & Tighe, 2005)
- Active learning and student-centered teaching lead to improved learning (Freeman et al., 2014; Gross et al., 2015), narrows achievement gap for underrepresented students (Theobald et al., 2020)

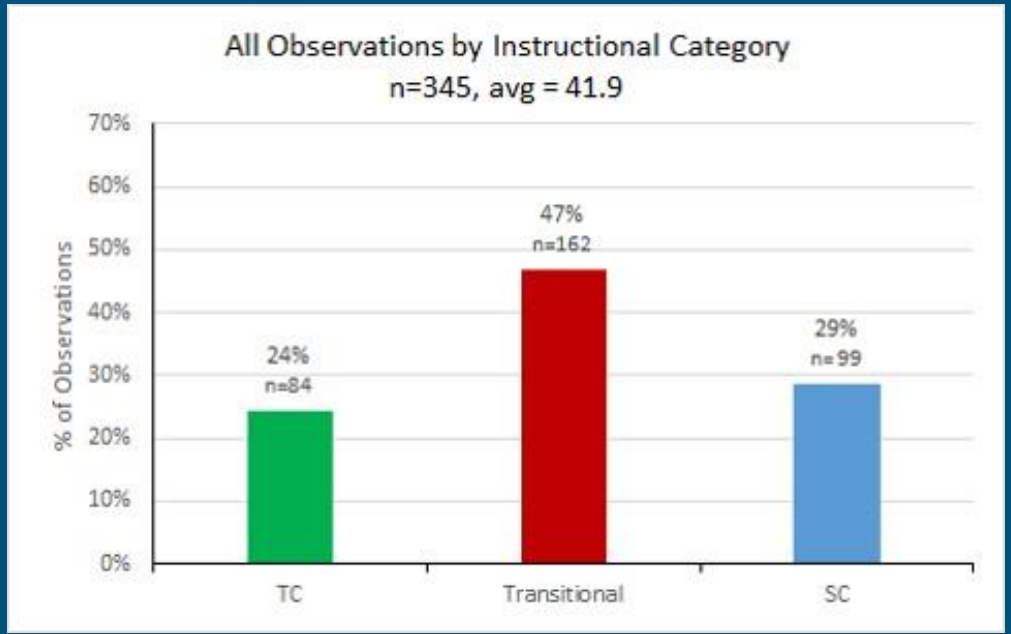
Research Questions

- Do our syllabi reflect our observed classroom practices?
- What kinds of learning objectives do we target in geoscience courses?
  - How, if at all do they differ for Student-Centered (SC) and Teacher-Centered (TC) courses?
  - How, if at all, do they differ for intro and major courses?
- What are normative assessment practices in geoscience courses?
  - How, if at all, do they differ for Student-Centered (SC) and Teacher-Centered (TC) courses?
  - How, if at all, do they differ for intro and major courses?

Methods: RTOP as categorization tool

Reformed Teaching Observation Protocol (RTOP; Sawada et al., 2002; Budd et al., 2013)

- 25 item rubric divided into 5 subscales:
  - Lesson Design
  - Propositional Knowledge (instructor's framing of content)
  - Procedural Knowledge (what students do/use in class)
  - Student-Student Interactions
  - Student-Teacher Interactions
- Overall score from 0-100
  - 0-30: Teacher-Centered
  - 31-49: Transitional
  - 50-100: Student-Centered



Methods: Syllabus analysis

- Stratified random sample from the Teacher-Centered and Student-Centered instructional categories for intro and majors courses
  - Syllabi collection started in 2013
  - End-member categories chosen for preliminary analysis
  - 10 syllabi pulled for each category/course combination for a total of 40
- For each syllabus, coded for:
  - Learning objectives: presence/absence, level of Bloom's taxonomy for each (low/medium/high)
  - Assessment practices based on final grade categories: exams, in-class work, etc.
    - Categories generated through inductive coding
- Each author coded their set of 10 syllabi, came back together to discuss and refine.

Limitations

- Sample may not be representative of the whole geoscience education community
- RTOP
  - RTOP only considers what happens in class
  - Observed a single class period for each instructor; may not represent the whole semester of teaching practice for a course.
- Syllabus
  - Linguistic representation: assumes language meaningfully matches what's in an instructor's mind (Giere, 1999)
  - Multi-purpose: syllabus as a contract, permanent record, or a learning tool (Parkes & Harris, 2002)

Assessment Component	% Weight of Total Grade			
	TC, Intro*	SC, Intro	TC, Majors*	SC, Majors
Mastering Geology, LearnSmart or similar platform (HW)	4	0	0	0
Other	0	2	3	0
Online discussions or learning journals	0	8	0	1
Participation (e.g. clickers)	0	7	1	4
In-class activities/work	4	15	3	1
Pre-class work/quizzes	6	15	0	8
Written papers	7	6	1	15
Homework	10	4	8	11
Project or presentation	0	21	11	14
Exams	66	22	73	45

0% | 1-9.9% | 10-50% | >50%

Lab grade (if present) removed

Learning objectives: Bloom's levels

Bloom's Level	% of Learning Objectives			
	TC, Intro	SC, Intro	TC, Majors	SC, Majors
High (evaluate, create)	0	4	7	10
Medium (apply, analyze)	11	39	17	37
Low (remember, understand)	89	57	76	52
Not provided	50	0	50	20

Discussion

- Do our syllabi reflect our observed classroom practices?
  - Yes, syllabi generally reflect the instructional category determined by direct observations.
- What kinds of learning objectives do we target in geoscience courses?
  - Learning objectives are more frequently provided in SC courses (85%) over TC courses (50%)
  - High Bloom's level learning objectives are less common, ranging from 0% for TC, intro to 10% for SC, majors
  - Medium Bloom’s level learning objectives are more common in SC courses (38%) compared to TC courses (14%)

Discussion

- What are normative assessment practices in geoscience courses? (SC, TC; intro, majors)
  - Exams (summative assessments) make up a higher percentage of grades for TC courses (68.5%) compared to SC courses (33.5%)
  - Intro classes: SC classes have a higher percentage of their grade come from pre-class and in-class work, as well as projects or presentations.
  - Majors classes: SC classes have a higher percentage of their grade come from written papers and homework and a lower amount from exams.

Other observations & implications

- First opportunity to communicate with students: relational vs. transactional language
  - Relational language more common in SC courses
    - "I will not be sympathetic to someone who misses an announcement in class."
    - "If at any point during the quarter you feel you are struggling, or your grades are not what you'd like them to be, please come talk to me."
  - Fall 2020 represents an important opportunity to reflect on what is in your syllabus
- Student choice on assignments, ways to earn points - not observed for TC courses
- Syllabus as an anchor for information: be as explicit, transparent as possible
  - Syllabus can be a learning tool, as well as a contract and permanent record (Parkes & Harris, 2002)
  - 1st generation students use the syllabus to level the playing field
  - Students with disabilities or chronic illnesses may use to screen the class for unsympathetic policies (Emily, 2020)
  - Providing resources - what campus resources exist to help you?
- Consider providing tips for success - sends the message that I want you to do well!
- Office hours: what, when & where are they, plus how to set up appointments if

Questions?