



Mathematics Courses in the
Montserrat Program at the
College of the Holy Cross

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Goals for this talk

- To discuss some experience with mathematics courses in a particular First Year Experience program
- To make contacts and (hopefully) start fruitful discussions with you about issues involved in designing and teaching courses in these programs(!)

About Holy Cross

- A highly selective undergraduate liberal arts college
- Mission – academic excellence devoted to training future leaders of highest intellectual and ethical standards; Jesuit/Catholic tradition strong and central to identity
- Student body – about 2800
- Traditionally strong science, mathematics, and pre-medical programs, but no engineering except a 3-2 dual baccalaureate option

Montserrat at Holy Cross

Overall goal: “to connect three parts of college life — learning, living, and doing”

All 1st year students take a small (enrollment 16 or 17) year-long seminar, usually (not always) taught by same professor both semesters

Seminars explore different topics (i.e. *not* based on a single core curriculum)

All aim to develop critical thinking, writing, and communication skills

Ideally *not* in student's intended major field; carries distribution credit

Montserrat design, cont.

Seminars are grouped into five continuing thematic, interdisciplinary “clusters”

Clusters (usually) have common reading(s)

Students in each cluster live together (to facilitate discussions outside of class)

Clusters sponsor activities (e.g. speakers, field trips, social events) 2 or 3 times a semester

Library staff, Chaplain's Office, Counseling Center, Residence Life staff all participate in planning and programming

Why clusters?

- 1992 – 2008: HC ran a FYP for about 1/5 of the incoming class along similar lines – results strongly positive but students in FYP tended to be isolated on campus
- In 2008 – 2009, extended to whole first-year class, but tried to keep good aspects of FYP
- Clusters: Core Human Questions (FYP), Divine, Self, Global Society, Natural World
- First two of these closest to Catholic/Jesuit aspects of mission, others look to make connections too where appropriate

A typical cluster – Natural World 2011-2012

- 2 biologists, one team-teaching with an English professor (interaction of environment and organisms as they develop, human experience of disease as interaction with the natural world)
- 2 mathematicians (me and a colleague)
- Another English professor (views of nature in literature of US westward expansion)
- A philosopher (how food we eat defines who we are and ties us to nature)

Faculty participation

- Is voluntary (so it's not always easy to staff the program)
- Math/CS department is asked to offer at least two year-long seminars virtually every year (i.e. as long as we have sufficient staff)
- To date, three different mathematicians and one computer scientist have taught seminars (in Natural World, Core Human Questions, Self clusters)

Obvious Challenges

- *Montserrat* seminars are ideally true seminars
– built around class discussion
- But leading discussions about readings (especially non-mathematical ones) is an art that I, for one, am still learning
- Teaching writing, rhetoric, and public speaking
– i.e. designing and evaluating formal writing assignments and oral presentations is another mostly unfamiliar area

A First Idea

- 2009-2010: “Identifying Patterns; Understanding Randomness” – essentially a year-long version of a “liberal arts” intro statistics class offered several times before.
- Based on Freedman, Pisani, Purves *Statistics* text (*excellent* book, by the way!)
- *Added*: cluster common reading and another book each term; more detail on many topics; used ideas from Chance project at Dartmouth; multiple writing assignments, extensive final project with oral presentation

An Unexpected Challenge

The year-long seminar format!

Just “stretching” a typical one semester “liberal arts mathematics” course over a year does not really work well (without some precautions)

Making second semester depend too strongly on first is problematic – the multiple goals of an FYE program mean specific skills/subject knowledge are often not retained as well

(My colleague Gareth Roberts had a similar experience with his Math/Music course too.)

The Next Iteration

- “Mathematics Through Time” (fall 2010)
- “Where did the pre-calculus math you learned in high school come from and what further developments have there been?”
- Focused on ideas in algebra, geometry (especially the *Pythagorean theorem*)
- A traditional, “modified Eurocentric,” account
- Looked at mathematics of Egypt, Babylonia, Greece (we read Book I of Euclid's *Elements*), discussed non-Euclidean geometry at end.

Second Semester

- “Mathematics Across Cultures” (spring 2011) addressed larger questions: To what extent have *all* human cultures done mathematics?
- Can we use an understanding of this to develop a more complete/balanced picture of the history of “mainstream” mathematics?
- Looked at some ethnomathematical work, math of Classic Maya, then China, India, Islamic civilizations, connections with Europe
- Primary texts: *The Crest of the Peacock*, *Mathematics Elsewhere*

More challenges in our program

- It's best if each seminar can make *some* contact with rest of cluster – (not really true with either course I have done – hence Environmental Math focus for next go-around in 2011-2012!)
- Should *meaningfully* incorporate common readings, outside activities (not just as “add-ons”)
- **Question:** Does this mean seminars need to be designed “from the ground up” every year?
- **If so, they take at least 2 or 3 times as much effort** as a standard first-year calculus course (in course design, prep, day-to-day work)

So why participate?

- An great opportunity to develop mentoring relationships with students
- Expands horizons and forces you to grow as a teacher (though it can be frustrating!)
- A good way to get to know faculty from other departments, and have a departmental voice present in college-wide curriculum discussions
- A chance to pass on a taste of different aspects of what mathematics is really about and why we love it!

Mathematics seminars offered

- 2009 – 2010: (*) Identifying Patterns/Understanding Randomness; plus a Core Human Questions seminar (less math)
- 2010 – 2011: (*) Mathematics Through Time/Mathematics Across Cultures; Math and Music: Structure and Form/Aesthetic Links
- 2011 – 2012: (*) Modeling the Environment/Analyzing Environmental Data; Math and Music: Structure and Form/Aesthetic Links