DQPs for Mathematics

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Lumina: Purpose and need for DQPs

Assertion 1: The call for more high quality degrees in the US must be matched by a concrete description of what each degree means (that supports assessment in terms of competencies).

Assertion 2: This concrete description will allow educators to direct their programs appropriately and will give students clear statements of outcomes the students should hope to realize.

Question: Are these assertions correct?

Some risks of generic degree qualification profiles

1. Incorporate qualifications from every type of degree. (In mathematical language, taking the "union" of desirable qualifications for each degree.) This will result in an unwieldy and unusable set of qualifications.
2. Limit to what is common to all degrees. (In mathematical language, the "intersection" of desirable qualifications for all degrees.) This will result in a lowest common denominator set of qualifications.
3. Language so specific that it makes sense for degrees in one area, but doesn't have much meaning for degrees in another area.
4. Language that is so vague that it is effectively meaningless.

Consider local and national efforts to increase rigor in K-12. They have suffered from all of these faults in some ways.

U. Oregon's outcomes for math majors (December 2008)

Liberal arts degree, not vocational.

1. Familiarity with the ideas and proficiency with the calculational techniques of calculus.
2. Awareness of the breadth of mathematics.
3. Ability to engage in the process of mathematical reasoning and proof.
4. Understanding of some area of undergraduate mathematics in depth.

(Secondary ed track different: for students who are preparing to become high school mathematics teachers, we expect to prepare them to take the licensure exam for teaching high school mathematics.)

Typical career paths for math majors include

- High school teacher.
- Actuarial work.
- Other work in finance.
- Graduate school in
  - mathematics
  - engineering
  - law
  - business
  - economics
  - medicine
  - computer science

Miscellaneous careers in corporate world involving quantitative and analytical skills, but little advanced mathematics.

Lumina DQP Summary (one to six items per category)

- **Specialized knowledge**: (E.g.: Defines/explains boundaries and major sub-fields, styles, and/or practices.)
- **Broad integrative knowledge**: (E.g.: Produces creative/ investigative/practical work using at least two fields.)
- **Analytical inquiry** (Evaluates theories and approaches within major field and at least one other academic field).
- **Use of information resources.**
- **Engaging diverse perspectives.** (Constructs alternative vision and explains how it differs from current reality.)
- **Quantitative fluency:** (E.g.: Translates verbal problems into mathematics, constructs relevant mathematical arguments.)
- **Communication fluency:** (E.g., constructs coherent arguments, uses a language other than English.)
- **Applied Learning:** (E.g.: completes substantial field based project relating to major course of study. . .).

How might this affect a typical bachelors in math?

From "Applied Learning" section: "Completes a substantial field-based project related to his or her major course of study; seeks and employs insights from others in implementing the project; evaluates a significant challenge or question faced in the project in relation to core concepts, methods or assumptions in his or her major field; and describes the effects of learning outside the classroom on his or her research or practical skills."

- Not done by vast majority of majors.
- Level of effort - full-time for at least one quarter.
- Requires 1/10 of faculty member's teaching time per year.
- Valuable: for some, not for others.
- Cost to department: roughly 15% increase in faculty.

Consideration of other items from Lumina DQP draft

Specific item discussed possible but expensive.

Other items vary. Some in line with current practicies. Some impossible. Some possible but reqire significant resources. Some reasonable requirements for masters or Ph.D. students, but not bachelors level.

Some sensible and possible for some group of majors, but not others.

If we provide a rubric that will outline mechanical ways students can demonstrate these competencies, moves more items into the practical. But unlikely to increase degree quality.

It may be possible to outline degree qualifications that are both general and appropriate to disparate types of degrees.

Questions (Karen Marrongelle)

- Are the DQP outcomes different from current "business as usual?" (Yes.) Are they more robust or useful for our students? Does this depend on what students do after their degree?
- Will DQP prompt departments to review curriculums and better prepare students? Is such prompting necessary, and if so, is this the best mechanism?
- If DQP outcomes adopted, what are benefits and drawbacks for students? Faculty?
- Can DQP help students get the best education in our programs?