Quantitative and Scientific Literacies: Collaborations Driving General Education Curricular Reform

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\textbf{National Numeracy Network}
East Lansing, Michigan
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Show of Hands!!!

- Does your institution offer a Quantitative Literacy (QL) course?
- Do you teach a QL course?
- Do QL (or mathematics) and science faculty collaborate on curricular development and assessment?
General Education at MSU concentrated in

- three sets of *Integrative Studies* course requirements
  - Science
  - Arts and Humanities
  - Social Science

- Writing

- Quantitative Literacy/Mathematics requirement
Institutional Landscape

- The University mathematics graduation requirement may be met via two courses from Mathematics or Statistics including two newly created QL courses (MTH 101 and 102)

- Students no longer place into developmental mathematics
Big Bureaucracy and Big Numbers

- Changes to graduation requirements and QL courses are recent, build on over ten years of work, and needed buy-in at many levels.

- QL courses are taken almost exclusively by non-STEM majors
  - N=1200 in MTH 101
  - N=1000 in MTH 102
Opportunities for Collaboration

- The majority of non-STEM students enroll in both QL (MTH 101) and Integrative Studies in Science courses (ISB and ISP)

- Integrative Science redesign informed and affected by reform in quantitative graduation requirement and development of QL-focused courses
CISGS Vision for Change

CISGS 300 (3 cr.)
- Scientific Literacy
- Quantitative Literacy

CISGS 200 (3 cr.)
- Scientific Literacy
- Information Literacy

CISGS 300 Learning Outcomes
(In Development)

CISGS 200 Learning Outcomes
(In Development)

CISGS Lab (2 cr.)
- Scientific Literacy
- Quantitative Literacy
  - MTH 101 Pre Requisite
- Information Literacy

CISGS Lab Goals
- Engage in Scientific Practice
- Capture Raw Data
- Conduct Data Analysis
- Effective Communication
CISGS Faculty Survey
Scientific Literacy?
(n=36   Response Rate=68%)

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<tr>
<th>Knowledge</th>
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Partnership in Action

- Bring cross disciplinary faculty teams together
- Collaboratively identify essential student outcomes
- Consensus on skills, context, and language
- Collaboratively embed assessment across disciplines
Examples Include

- New topics in MTH 101 this semester
- Excel
- Visual Representation of Data
- Dimensional Analysis

- Common assessment topics in Final Exams
- Common pre/post survey (SALG)
Assessment Efforts in Science

- To what ends?
  - Modify QL courses, and/or demonstrate their efficacy in improving lab outcomes
  - Better understand transfer across courses and semesters

- Current efforts (Fall 2018)
  - Four ISB/ISP lab programs will have a common embedded assessment in the final exam (n=1700+ students)
  - Four lecture courses will have common embedded assessments (n=600+ students)
Assessment—Looking Ahead

- General education science courses can be vehicles for improving QL (Follette et al., 2015)
  - To what extent are they doing that?
  - QuaRCS

- How are students' QL and SL manifesting in upper-level courses in the major?
  - Collaboration with departments like Journalism, Communication, and Advertising, among others

- Opportunities for more interdisciplinary research that accounts for research from psychology and the decision sciences (e.g., Kahan, Peters, Dawson, & Slovic, 2017)
Partnership Discussion

- In one sentence, describe the goal(s) of your QL course.
- Do QL (or mathematics) and science faculty collaborate on introductory courses?
- Who is driving the reform? Department? Dean? Provost?
- How are faculty incentivized to participate? Course release? Time buy out? Summer salary? Part of their job description?
- Do you have concrete deliverables in a concrete timeline?
Assessment Discussion

- Do you or colleagues assess students' QL or SL outside of routine course assessments?
- What ideas do you have for accounting (in assessments) for the complexity of QL and SL "in the wild"?
- What would an ideal assessment plan look like at an institution where QL and SL are major goals of undergraduate education?
Common Intellectual Experience (CIE)

Pilot (AY 17-18)

- Student Success Initiative
- First-Semester Cohort Experience
- Collaboratively develop and deliver required Science and Math classes
- Common Theme - Social Justice
- “Can it be expanded?!?!?”
- Full First-Year
- Other Integrative Studies Centers
- First Year Writing
- Cocurricular experiences
- Neighborhood Success Centers
- Graduate Student Mentors
- E-portfolios
Common Intellectual Experience (CIE) Success to Report

CIE students had a .40 higher average MTH 101 grade, despite having a lower MSU math placement score.

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<td>Average Math Placement Score</td>
<td>9.5</td>
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<td>Average Math 101 Grade</td>
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Data Analysis Conducted by Dr. Justin Bruner (ISS / APUE)
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