Quantitative Reasoning (Q) Core Assessment

2022-2023 Academic Year

Overview of Assessment Procedure

Syllabi for all courses designated as fulfilling the Quantitative Reasoning core requirement were reviewed. All syllabi contained the MUS-approved Learning Outcomes for the course and align with the Common Course Numbering database maintained by the Office of the Commissioner of Higher Education.

The focus of this assessment was on whether each course is designed to address the MSU rationale statement for the Quantitative Reasoning (Q) category. The statement is as follows: *Quantitative Reasoning courses develop computational and analytical skills, the ability to reason about and solve real-world problems, as well as create and critically evaluate arguments supported by quantitative evidence.*

While not specifically assessed as part of this core perspective review, it is worth noting that all Q courses at MSU must also be designed and delivered in a manner to support the student attaining one MSU Core Quality standard. Specifically, all Q courses must support the MSU *Graduates are Thinkers and Problem Solvers* Core Quality, which is as follows: *Graduates reason using relevant evidence gathered through scholarly, disciplinary and interdisciplinary methods. They analyze, construct, or critique arguments taking into consideration premises, assumptions, contexts, and conclusions. Graduates will apply information literacy; the ability to skillfully consume (i.e. find, evaluate, and use) and meaningfully create information. They successfully anticipate counterarguments, but can respectfully consider, accommodate or incorporate opposing views as appropriate. Graduates independently, or collaboratively, demonstrate ethical, creative and innovative approaches to asking and answering questions, defining problems and identifying solutions, and creating knowledge or art.*

Courses Included in Year 3 Quantitative Reasoning (Q) Core Assessment

M105	Contemporary Mathematics
M121	College Algebra
M133	Geometry & Measures K-8 Teachers
M151	Precalculus
M161	Survey of Calculus
M165	Calculus for Technology I
M171	Calculus I
M181	Honors Calculus I
PHL 236	Logic
STAT 216	Introduction to Statistics

Method

Evaluators individually assessed submitted syllabi for the same ten (10) Q courses and addressed four questions as outlined in the following paragraphs. Evaluator responses were tabulated in Qualtrics.

Question 1: Does the syllabus reflect the intention of the core perspective definition?

Majority (92% Yes) summary: Evaluators concluded that most of the syllabi clearly articulate the Q core elements and intention. The comments below indicate that there is a consistency and clarity, across courses, of the learning outcomes aligning with the MSU Q Core Perspective.

Opportunities for improvement (8% No) summary: For one course an evaluator mentioned one course syllabus could benefit by having more information on how the course aligns with the Q Core Perspective included.

Comments for Question 1:

- Syllabus directly addresses how this course addresses the core perspectives.
- This course helps students learn analytical skill that underlies most of the critical reasoning ability emphasized in various courses offered by MSU.
- The current course helps build skills by teaching graduates how to prove theorems and sometimes provide counterarguments to some statements.
- Learning outcomes, "interpret and draw inferences", "explain how...", "demonstrate critical thinking...".
- The course description says things like "analyzing and communicating results" and states that students should be able to "critically read news stories based on statistical studies", "evaluate and communicate".
- The syllabus does state the Core quality and Core perspective as well as the Q learning outcomes. But in terms of specific to this course, the only thing I see in learning outcomes to support these is "explain and understand basic concepts of limits, derivatives and integrals" and "apply calculus to solve mathematical problems in engineering and physics applications".
- I think there is opportunity to add more to this syllabus. In the course outline I see things like "group portion of midterm" and "project work" these seem like they would align well with core perspective and they should be referenced in the syllabus.
- The syllabus does state the Core perspective & Core quality but in the learning outcomes I do not see this reflected. The learning outcomes are very operational instead of things like "interpret", "explain", "describe" "problem solve". The syllabus does a good job in the section "Examples of homework and exam relation to core qualities" of tying the curriculum to core.
- Content Learning outcomes bullet points start with words like "analyze, describe, explain, apply" this aligns with core perspective. Additional learning outcomes state "engage in

problem solving" "articulate and discuss mathematical ideas". Unit evaluations reference back to these additional learning outcomes as an explanation as to why they do not do traditional exams. I liked the section on "Expectations to myself".

- Syllabus is very clear and there are several places the Core perspective is reflected. Course Description, "communicating your mathematical ideas, both orally and in writing", "you cannot solve problems with understanding by observing and mimicking others doing mathematics" "the emphasis in this course will be on problem solving and reasoning with understanding rather than memorization and using equations or algorithms". Learning Outcomes, "Explain, represent, solve, construct". I like the explanation of attendance.
- The syllabus does state the Core perspective and Core quality. The learning outcomes seem very operational. There is a section explaining what students should demonstrate but those statements are not reflected with the learning outcomes, assignment descriptions or assessment descriptions. I like the section at the end about testing accommodations.
- Course description, "liberal arts students develop quantitative reasoning skills". Learning outcomes, "to develop skills to think and reason mathematically in order to function more effectively in the modern world" No mention of mental health resources or diversity statement. Under Assessment, "providing explanation or justification for a problem".
- Several learning outcomes begin with the phrase "Explain", such as "Explain the Riemann integral" which aligns with being thinkers and problem solvers. I appreciate the "about the course" section about valuing diversity, social justice, inclusion and equity.
- The Academic Integrity section is followed up by some examples of what this would constitute, I believe this is helpful for the student. No mention of mental health or diversity in syllabus.
- Core Quality and Core Perspective info covered in syllabus and provided to students.

Question 2: Do the assignment examples permit students to attain the Core Perspective learning outcomes?

Majority (92% Yes) summary: Evaluators concluded that the Q Core Perspective outcomes can be attained by students based on the exercises in the assignments in the courses. The comments below indicate that some of the assignments challenge students to apply what they have learned to real-world problems, which supports the associated Core Quality Thinker and Problem Solver.

Opportunities for improvement (8% Unclear) summary: Some examples in the comments point to areas for possible improvement of assignments but none were determined to be insufficient.

Comments for Question 2:

- The Quantitative reasoning Q objective of creating Thinkers and problem solvers is illustrated by the second example problem where the students are required to evaluate each other's work.
- The list of assignments is very true to the Q Core perspectives and clearly articulated.
- It might be a good idea moving forward that examples provided have an additional narrative that explains the examples in a way that a non-mathematician could understand them. Like a "Broader Impact Statement" for a grant.
- This is a very extensive list of examples that access the Q-core learning outcomes. A good model for other courses to follow.
- The first example might not seem to reflect the "Thinker and Problem Solver" criteria for Q but if you think about life skill of having to explain your solution to others or as a teacher, this is a real-world problem.
- Assignment's ask students to answer questions and then "provide a one-line rationale for each".
- Very good set of examples highlighting thinking and problem solving.
- Yes, the three problems given as examples permit students to attain core perspective learning outcomes, but I would like to see more examples.
- The homework platform they use "WebAssign", as stated in the document that precedes the syllabus "students must learn to reason using relevant evidence stated and analyze, and critique assumptions". Additionally, the final exam that was attached had two application problems that students would need to reason through. There was one problem that students were asked to "interpret the result in context".
- This is a very comprehensive and robust set of examples, I appreciate this! All questions align with core perspective in that they have students develop computational and analytical skills while also asking the why or explain questions. The Reflection Prompt is very much in line with Core perspective.
- These are two excellent examples of developing thinkers and problem solvers.
- I would like to see more examples, but these application problems do require students to be problem solvers. I especially like, "A student did the following work, but the teacher said it was incorrect".
- Every example given requires a student to "create and critically evaluate arguments supported by quantitative evidence". Best example given to showcase CORE perspective was "Describe at least one situation from the news or your own life".
- The examples given were incomplete but would require thinking and problem solving.
- There is a very brief section on assignment examples. Based off of those, although they are not complete, I would say that they foster problem solving skills.
- Clear examples of assessable items
- Multiple examples of opportunities to assess student attainment of core perspective outcomes.
- Examples assess student attainment of math knowledge consistent with Core Perspective
- Statement of assessment is included in syllabus.
- Examples of assessments linked to Core Quality and Q Core Perspective attainment.
- Could provide more information but examples are provided that demonstrate linkages.

- Very complete description of assessment items.
- Examples demonstrate to students how course material is used to address assessment projects.
- Clear linkage of assessment tools to course learning outcomes.
- Examples of assessments provided link support student attainment of Q Core Perspective.

Question 3: Highlight areas of strength in how the course supports student attainment of the core perspective.

Summary: Overall, the courses evaluated are designed in a manner that support student attainment of the Q Core Perspective.

Comments for Question 3:

- There are many examples of real-world problems and problem solving skills.
- The course includes computational and analytical skills that can and are applied to real word problems from a wide variety areas and disciplines.
- The very nature of calculus is to develop a language that always one to develop computational, graphical and analytical skills to solve problems in most any discipline.
- Students are asked to compute using various tests but furthermore they are asked to interpret their results.
- By the nature of the name of this course I think it lends itself nicely to being able to support student attainment of core perspective, I am just not seeing enough evidence.
- Given the final exam and explanation of online homework I think this course does support student attainment of core perspective while also making sure students can develop their computational skills.
- This course is always asking students to explain their knowledge, not just compute the math. This is seen heavily in the examples given and is also front facing to the student via language in the syllabus. The unit evaluations are another place that supports student attainment of core perspective because they are intended to "demonstrate how you are understanding course content and making connections across concepts investigated during each unit" the goal is to "promote your thinking about diverse approaches to the assignment and support your learning through making connections".
- This course represents "the ability to reason about and solve real-world problems" and "critically evaluate arguments supported quantitative evidence". Because this class is meant for elementary school teachers, I think it does a good job of getting the students to understand the math more comprehensively than some of the other math courses. In course description preceding syllabus, "students must be able to understand the "why" behind the mathematics".
- In the examples given I can see that the intent is for students to meet the core perspective. Additionally, the course description does a thorough job of explaining how the course has an "emphasis on building a conceptual foundation", students "work together to analyze a problem", "provide explanation and rationale for their solution process".

- Learning Outcome #1, "To develop skills to think and reason mathematically in order to function more effectively in the modern world". Under Assessment and Active Engagement this highlights different ways students will demonstrate their knowledge and ability to reason.
- This course has a greater emphasis on theory per the catalog description-this will allow the student to gain skills in the "ability to reason".
- Students attend a lab once per week where they practice with their peers in becoming thinkers and problem solvers. Written work is assigned and it is emphasized that the student will be "developing mathematical critical thinking skills".
- Good syllabus and example assignments for assessment.

Question 4: Highlight opportunities to improve how the course supports student attainment of the Core Perspective.

Summary: The comments for improvements focus mainly on more clearly connecting the course outcomes to the Q Core Perspective goals.

Comments for Question 4:

- Clearly explain in the syllabus the goals of the course.
- I would like to see the syllabus tie more into some of the language in the core perspectives in the learning outcomes section.
- I think the course itself does support the Q Core Perspective, but I do not think this is well reflected in the syllabus.
- I think this course has some great examples of the Core Perspective.
- A few more assessment examples would enhance the connections taught to students.

Other Evaluator comments not tied to Q Core Perspective:

- Not related to the core but I think this syllabus is lacking some important components about diversity, mental health, accommodations, university policy, etc.
- Course fees, for most of the Q core courses, are clearly stated in the syllabus. One course did not include this and it was noted by the evaluator.