Quantitative Reasoning Assessment – Detailed Findings

Fall 2014 – Spring 2015 v2

Overview

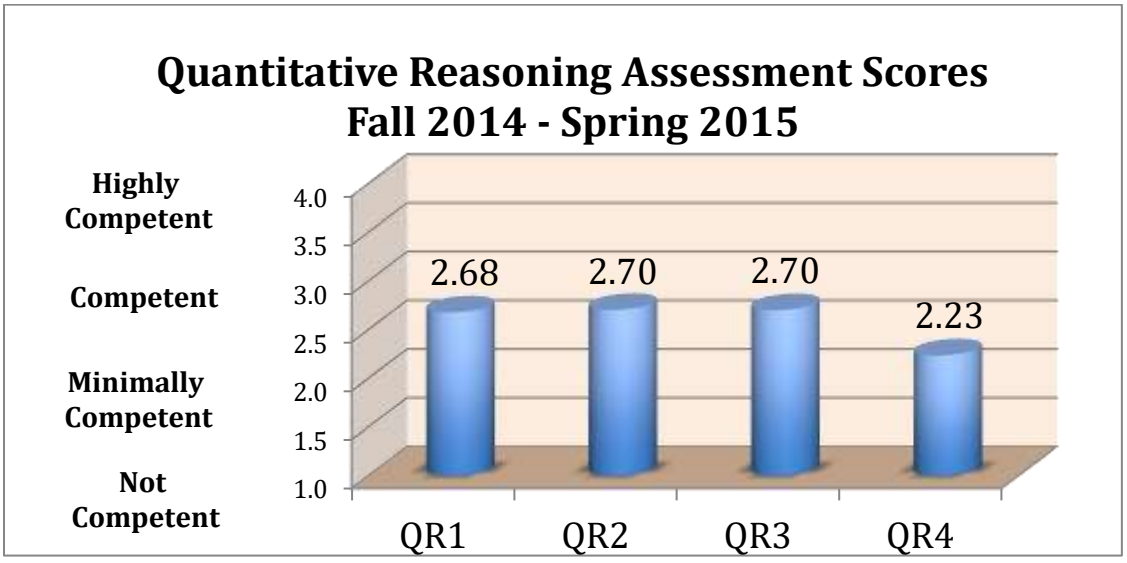
The assessment team assessed student progress towards the Quantitative Reasoning competency area during the 2014-2015 academic year. The assessment team collected quantitative and qualitative data on student learning in the initial round of data collection. The assessment team analyzed the results of the initial data collection and then conducted Faculty Focus Groups in Spring 2016 to gather additional insights and feedback from faculty. This report summarizes the results of the quantitative data on student achievement and the qualitative data generated during the Faculty Focus Groups.

Fall 2014 – Spring 2015
232 students participated in QR Assessment during Fall 2014 - 2015
6 different course subjects (ECN 101, ECN 102, MAT 137, MAT 167, PHY 121, PSY 201)
8 participating faculty members
Spring 2016
10 faculty participated in 5 Focus Groups

Quantitative Reasoning Competency

QR1 - Represent mathematical and quantitative information symbolically, graphically, numerically and verbally.
QR2 - Apply quantitative methods to investigate routine and novel problems. This includes calculations/procedure, mathematical and/or statistical modeling, prediction and evaluation.
QR3 - Interpret mathematical and quantitative information and draw logical inferences from representations such as formulas, equations, graphs, tables and schematics.
QR4 - Evaluate the results obtained from quantitative methods for accuracy and/or reasonableness.

Quantitative Results



Qualitative Results

The Assessment Team analyzed Instructor Feedback forms submitted by faculty in the 2014-2015 academic year. Faculty identified numerous areas of concern that hinder students' ability to demonstrate quantitative reasoning. These areas of concern were:

- Students difficulty with Critical Thinking
- Students difficulty with Abstract Thinking
- Students lack of confidence, and corresponding anxiety surrounding math assignments.
- Students lack of Academic Foundations in Mathematics and English

Faculty also identified numerous solutions to better support student learning, such as:

- Incorporating more Real-world Problems into the curriculum
- Utilization of Technology

Ten faculty participated in 5 focus groups in Spring 2016. The Focus Groups discussed the previously identified concerns and provided additional insights and feedback into actions that can be taken by the College.

I. Critical Thinking

Faculty identified the following ways to improve students' critical thinking in mathematics:

- Reduce the number of learning outcomes listed in math courses because the curriculum is too "too packed"
- Provide more open-ended questions for students to explore solutions and provide more problem-based learning experiences
- Provide more real-world problems where students can relate the math problems to real life situations

Faculty identified types of instruction and approaches that are successful in their courses to support students' critical thinking in mathematics:

- Discussing the problem solving steps
- Using graphing calculators in class and for homework
- Group Work, including having students apply different problem-solving techniques
- Have students make presentations to their classmates

7 out of 10 faculty expressed an interest in participating in a future workshop on Critical Thinking in Mathematics.

II. Abstract Thinking

Faculty identified the following ways to improve students' abstract thinking in mathematics:

- Explain to students why they are learning algebra and how abstract thinking can apply to many areas
- Teach students the importance of not just memorizing rules

Faculty identified types of instruction and approaches that are successful in their courses to support students' critical thinking in mathematics:

- Problem solving in class followed by discussions of what they have learned and how to apply what they've learned
- Understanding vocabulary
- Having students work together, listen to students' discourse, get students who have a kernel of understanding to circulate knowledge throughout the room
- Let students make up their own problems

9 out of 10 faculty expressed an interest in participating in a future workshop on Abstract Thinking within Mathematics.

III. Real-World Problems

7 out of 10 faculty stated incorporating real-world problems into their courses is an effective strategy for teaching quantitative reasoning skills.

Faculty explained that incorporating real-world problems is effective because:

- Faculty are able to integrate topics from other disciplines which students are interested in or required to learn
- Faculty wish they had more than just word problems
- Students can be assigned Case Studies or other types of projects
    - Examples (elasticity of demand, price sensitivity, mortgages, loan payments)
- Real-world problems make the math concepts being studied more understandable, more relatable and less abstract

9 out of 10 faculty state that if the College were to develop a repository of real-world problems that can be used in your courses, they would use it.

9 out of 10 faculty said they would be willing to share their problem sets in this repository.

8 out of 10 faculty expressed an interest in participating in a future workshop on this topic.

Faculty provided suggestions on how to create/administer a repository, including:

- Creating a repository with separate folders for different courses
- Prioritizing problem sets for Mathematics courses - 085, 095, 137, 167
- In addition to the problem description, providing context to each problem, description of goals related to use of problem, where in the curriculum to implement, solutions and discussion questions.
- Editing/Versioning controls that would allow faculty to store/track original documents, documents w/ comments posted as a forum discussion, and comments

- Ability to index problems with different emphases for different types of problems

IV. Pre-Requisites

Because issues surrounding pre-requisites were brought up as a concern in some of the Instructor Feedback Forms, we asked a series of questions regarding pre-requisites to all participants of the instructor focus groups. The majority of faculty participating in the Focus Groups did not report experiencing problems with pre-requisite policies and their administration. Participants did provide suggestions for improvements in this area that include:

- Ensuring course pre-requisites are followed and not overridden
- Providing students extra help through the Academic Success Center
- Identifying/Fixing problems with the Accuplacer exam
- Ensuring students utilize the Center for Academic Transition class

V. *Faculty Concerns*

A number of faculty concerns were collected from the Instructor Feedback Forms, and all faculty participating in the focus groups were asked to rank the previously identified concerns.

The top 4 faculty concerns identified are:

1. Poor Attendance
2. Did Not Prepare for Class
3. Critical Thinking
4. Inability to apply prior learning from previous semesters

Strategies for overcoming these concerns include:

1. Poor Attendance

- Reach out to students who have missed class and use Care reports
- Offer hybrid sections for students who might not finish semester
- Permit students to attend other sections that fit their schedule
- Allow students to attend class from home with technology, including Blackboard
- Increase outreach to students having difficulty
- MAT 137 for STEM and another class for non-STEM majors/ Make course more meaningful – connect to academic program

2. Did Not Prepare for Class

- Incentivize class participation
- Ask questions at beginning of class to incentivize students to come to class prepared
- Have students come to class with two questions to ask the instructor
- Include variety of activities in class, bonus points for excellent attendance
- Remind students to have graphing calculators with them to class

3. Critical Thinking (see Section I)

4. Inability to apply prior learning from previous semesters

- Ensuring students take courses in sequence and avoid big gaps between courses
- Identifying and preventing against grade inflation

Grade Inflation

Some participating faculty brought up the issue of grade inflation as a cause that contributes to students' inability to apply prior learning from previous semesters. Overall the focus group participants were mixed with some thinking this is a problem and others not so much.

Some participating faculty proposed grade inflation could be alleviated by requiring a minimum passing grade for Common Final Examinations, or weighing common final examination grades heavily within overall course grades. The majority of participating faculty, however, were not in favor of using a cutoff grade on a common exam as a requirement for successful completion of a course.

VI. Personal Attributes

8 out of 10 faculty referenced students' lack of confidence and/or math anxiety as a serious impediment to their success in their course.

Faculty report that students' lack of confidence can be hard to identify, specifically when low confidence is linked to behaviors like not preparing for class or poor attendance

.

Participating faculty identified numerous techniques they use to help students overcome their lack of confidence or anxiety. These included:

- Incorporating growth mindset topics that address the brain, learning, math anxiety, confidence into QR courses
- Addressing and confronting math anxiety early in the semester
- Discussing and reflecting upon the sizeable progression of skills gained over a semester through knowledge checks and retesting early concepts
- Practicing in small groups with one strong student in each group
- Providing students' incentives to go to the ASC for tutoring
- Meeting with students one-on-one to address specific concerns of students
- Providing collaborative learning that provides incentive if all students learn a concept, like a pizza party, so students help each other
- Congratulate students on successes, consistent positive feedback in an honest way, show them how they've learned and succeeded in math

VII. Lack of academic foundation in math and English.

7 out of 10 faculty report that there appears to be a relationship between student English skills and their success in mathematics.

However, while faculty observe a relationship, it is unclear overall the impact. For instance, some faculty state ESL students may be at a disadvantage, but those who work hard took longer but still did well.

Participating faculty describe students lack of foundation in English affecting their math skills by:

- Students who have difficult with reading comprehension or difficulty with language don't get as much out of class discussions or small group discussions and are less likely to discuss their thoughts, less engaged
- Students have difficult with real-world applications because they don't grasp the problem context

Faculty report addressing these challenges through:

- Assigning short writing assignments to 085 class
- Assisting students in interpreting the problem and the answer as well
- Utilizing myMathLab which makes the gap of interpreting smaller
- Encouraging students to use ASC
- Incorporate short or informal writing activities into your classes or assignments
    - Providing open-ended questions that must be answered in complete sentences
    - Integrating real life situations

VII. Use of Technology

Faculty were provided a checklist of popular Online Learning Tools and Technology Learning Aids that were identified from the previous instructors. The most popular tools identified from Focus Group participants were:

- Graphing Calculator
- Khan Academy
- MyMathLab

Participating faculty identified numerous benefits with multiple online learning tools and technology aids. Faculty expressed that more resources and options for students are better, and expressed support for more Open Education Resources (OER).

Participating faculty described best practices and techniques they found helpful for using myMathLab. These included:

- Discussing with students mymathlab capabilities how we use them
- Making sure students are shown the learning aids
- Removing content that is inappropriate
- Providing faculty development on how to effectively use mymathlab
- Making tech-based projects a requirement for the course in the course syllabi

Faculty provided general suggestions for ways the College can better support the use of online learning platforms. These included:

- Install graphing calculator emulator on all workstations for all classrooms on campus
- Install mathtype software to create math tests
- Provide more professional development within departments
- Give students presentations for student on why they should learn these new technologies
- Give students problems in Microsoft Excel that they can work on at home

VIII. Conclusion

Participating faculty were polled on whether they thought the IDS 105: College Success course should be required for all students.

6 out of 10 faculty were in support of this requirement. While some suggested that they would support such a requirement if there were a way for students who are already well prepared for college to merit an exemption (including students who already have a degree at the Associate level or higher).