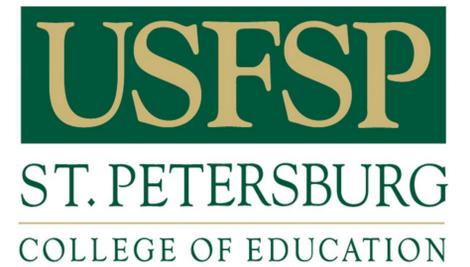


Assessing Mathematics Learning Realistically

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Introduction

A new teaching and assessment strategy called **Jam, Quest, ReQuest** was incorporated in three math classes starting in the Fall 2012 semester.

MAC1105--College Algebra
STA2023--Introductory Statistics
MGF1106--Finite Mathematics

Course content was "chunked" into two week units.

Each unit was followed by a "**Quest**", a short assessment using an open answer format.

Graded Quests were returned to students during the next class meeting, providing timely feedback for optimal learning.

"**Jams**" were student-led review and cooperative learning sessions, held in class, immediately prior to each Quest. Students reaped the benefits of highly teachable moments as they clarified the material and gained confidence. Jams contributed to a safe learning environment where questions were welcome and confusion was accepted as part of the learning process.

"**ReQuests**" were second chance assessments which students could opt to take within two weeks of the corresponding Quest. Each ReQuest covered the same key concepts as the corresponding Quest, using unique questions, not simply the "old" questions with "new" numbers.

Outside of class time, students, working alone or in groups, were encouraged to address any learning gaps identified by the Quest by seeking tutoring, working with faculty members, or using the study tools in MyMathLab and the text.

Students took ReQuests using MyMathLab in a proctored setting, the Math ReQuest Center. Paper ReQuests were available for those students who felt uncomfortable with computer based assessment. MyMathLab graded the online ReQuests automatically and provided immediate results to students and instructors.

Quest scores comprised 60% of the course grade.

Students earned the higher of the Quest and ReQuest scores.

There was no penalty for a lower score.

Impact on Learning

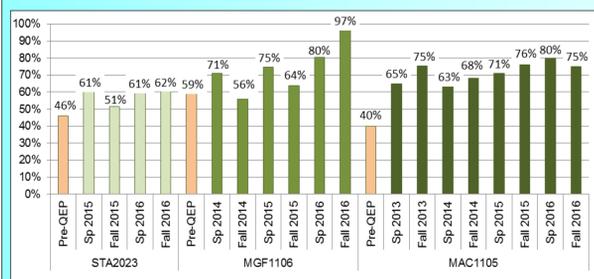
To examine the impact of taking **ReQuests**, students' grades were calculated based on only the in-class **Quest** grades, disregarding improved scores on **ReQuests**.

Outcome 1: Of the 2652 students who completed these math courses, 298 (11%) more students passed the courses because of improved scores on **ReQuests** than would have passed if **ReQuests** were not available. Sixty-nine percent of the **ReQuest** attempts resulted in improved scores over the corresponding original **Quest**.

Course	N	ReQuests (Improved Score)	Pass Rate Without ReQuests	Pass Rate ReQuests
MAC1105	1331	2106 (51%)	731 (55%)	872 (66%)
MGF1106	416	672 (67%)	263 (63%)	330 (79%)
STA2023	905	900 (72%)	536 (59%)	626 (69%)
All Students	2652	3678 (59%)	1530 (58%)	1828 (69%)

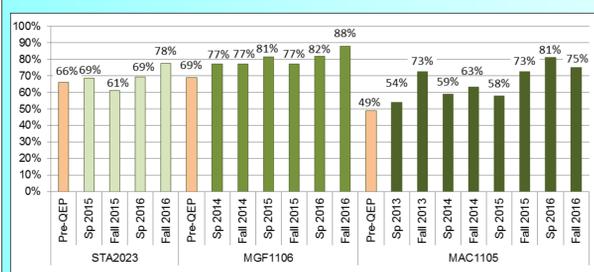
Outcome 2: Overall, 68% of the students in the three mathematics courses passed their comprehensive final exams with scores of 70% or better. Prior to **Jam, Quest, ReQuest**, only 45% of all of the students in these courses passed their final exams.

Percentage of Students Passing Final Exams



Outcome 3: Students' success rates increased from 45% prior to implementation to above 75% following implementation.

Percentage of Students Passing Courses



Impact On Math Anxiety

Outcome 4: During the course of the semester in which the course was taken, 54% of the students reported increases in positive affect related to math, 53% of the students reported decreases in negative affect related to math, and 56% of the students reported decreases in total math anxiety.

More students agreed with all positive affect related items (e.g., I find math interesting; I think I will use math in the future; I would like to take more math classes; Math is one of my favorite subjects) at the end of the course than did at the beginning.

More students disagreed with all negative affect related items (e.g., I get uptight during math tests; I worry about my ability to solve math problems; Mathematics makes me feel nervous) at the end of the course than did at the beginning.

Course	N	Increase in Positive Affect	Decrease in Negative Affect	Decrease in Total Math Anxiety
MAC1105	426	211 (50%)	235 (55%)	232 (54%)
MGF1106	254	182 (72%)	167 (66%)	185 (73%)
STA2023	357	169 (47%)	152 (43%)	165 (46%)
All Students	1037	562 (54%)	554 (53%)	582 (56%)

The Math Anxiety Survey-Revised (MAS-R) by Bai, Pan, Wang, and Frey (2009) is a bi-dimensional instrument with high reliability and construct validity, assessing both positive affect and negative affect related to math.

Math Anxiety Survey-Revised (MAS-R) (Bai, Wang, Pan, & Frey, 2009)

Please respond to each statement using this scale:
1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

1. I find math interesting.
2. I get uptight during math tests.
3. I think that I will use math in the future.
4. My mind goes blank and I am unable to think clearly when doing my math test.
5. Math relates to my life.
6. I worry about my ability to solve math problems.
7. I get a sinking feeling when I try to do math problems.
8. I find math challenging.
9. Mathematics makes me feel nervous.
10. I would like to take more math classes.
11. Mathematics makes me feel uneasy.
12. Math is one of my favorite subjects.
13. I enjoy learning with mathematics.
14. Mathematics makes me feel confused.

Implications

1. This strategy seems to have a positive impact on student learning and affect related to math:

- ✓ My math anxiety was much higher before I took this class. I feel fairly confident in math now. Thanks so much!
- ✓ Examples on the board, Jam sessions are great!
- ✓ As a student who has struggled with math though most of his college career I found the Quests and Jam method helped me achieve more confidence in this subject and eliminated a very big part of my math anxiety.
- ✓ The Jams before the Quests really helped.

2. Considerable professional development is needed for faculty to implement this strategy well:

- ✓ Growth mindset
- ✓ Mastery versus performance goals
- ✓ Fostering risk taking in class
- ✓ Active learning
- ✓ Philosophy of homework and assessment
- ✓ Using assessment to support learning
- ✓ Teaching students how to learn from their mistakes
- ✓ Addressing the elephant in the room (math anxiety)

3. Use of the online learning platform is important.

4. Prompt, positive and encouraging frequent feedback fosters students self-efficacy.

5. Within the context provided by the Jam, Quest, ReQuest instructional strategy, positive affect related to math was positively correlated with and predictive of students' final course scores. (Gibson-Dee, 2016)

6. Classroom attitudes (including the class average positive and negative affect related math anxiety, hopes, and expectations) had a significant impact on students' overall math anxiety as well as the positive and negative affect subscores at the end of the course. (Gibson-Dee, 2016)

References

- Bai, H., Wang, L., Pan, W., & Frey, M. (2009). Measuring mathematics anxiety: Psychometric analysis of a bidimensional affective scale. *Journal of Instructional Psychology*, 36, 185-193.
- Gibson-Dee, K. (2016). *Hope, expectation, math anxiety, and achievement in college algebra students: Examining an instructional strategy using multi-level modeling*. (Doctoral dissertation). Retrieved from ProQuest Dissertations Publishing. (10195611).