

Mastering Anxiety: The Effect of Mastery-Based Testing on Quantitative Literacy College Students' Anxiety Levels and Mindsets

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Mastery-based testing (MBT) is a form of categorical grading where students are repeatedly assessed until they achieve a level of mastery. This paper describes the implementation of MBT in a university quantitative literacy class using a web-based homework system. Qualitative evidence in the form of student comments showed that quantitative literacy students preferred MBT because it reduced their stress levels and was perceived as substantially different from traditional assessment. Students' differentiation of assessments based solely on nomenclature was an unexpected and significant finding.

Particularly for students with test anxiety or mathematics anxiety, taking a test is a stressful endeavor. Often, students will approach a math class with previously formed fears, bad experiences, and misconceptions regarding math instructors, math classes, and the math content. As a result, mathematics classes have a reputation for producing large amounts of stress, frustration, and anxiety in students. This creates a cognitive barrier about how these students view their mathematical abilities. Thus, the instructor's main goal is to mitigate students' anxiety in a mathematics classroom. One way to do so is to explore alternative forms of assessment. In this paper, we explore the effects of mastery-based testing (MBT) on mathematics students' anxieties and mindsets.

Literature Review

Problems with Traditional Grading

Grading schemes provide structure and guidance for students and teachers. Students generally expect tests to carry the most weight regarding final grades and difficulty. Teachers give tests to measure student understanding. All too commonly, course assessment templates include three tests and a final exam or one midterm and one final exam. These paradigms resultingly attribute the most weight to only a few assessments and thus reinforce the commonly held belief that a student's academic ability is always inextricably tied to their numerical mark on an exam. While ideally the high stakes of a final exam or large test will motivate students to consistently study the material, practice demonstrates that it usually leads students to much stress and anxiety (Carlson et al., 2021). Accurately measuring a student's conceptual understanding of a topic takes time (Carlson et al., 2021). Framing a semester into three or fewer tests can lead to inaccurate marks, as some students need more time to digest concepts. Mastery grading seeks to alleviate these kinds of issues.

Defining Mastery Grading

Mastery grading suggests that regular reassessment is the key to building a deep understanding of a topic. Students do not receive marks out of a total point count. Instead, students must demonstrate a level of "mastery" of learning objectives. These learning objectives are clearly stated goals (Campbell et al., 2020). For example, Jones and Lanaghan (2021) give the following learning goal for quadratics in their precalculus course: "Be able

to determine the equation of a quadratic function given its graph” (p. 972). Since points are not awarded, the instructor will grade each learning objective by sorting the student’s work on that objective into a tier. Different tier systems are used: 2-tier, 3-tier, 4-tier, and five or more tiers (Cilli-Turner et al., 2020). A 2-tier system is binary; the student either mastered the objective, or they did not. A 3-tier system allows students to demonstrate sufficient progress in their work, though it is not yet mastery-level work. This usually takes the form of “Mastered/Progressing/Not Mastered.” Note that the 2-tier and 3-tier frameworks only count “Mastered” marks as “passing.” Thus, 4-tier systems are like 3-tier systems but differ in allowing for different “passing” marks. For example, the tiers could be “Excellent,” “Meets Expectations,” “Needs Revision,” and “Not Assessable,” where “Excellent” and “Meets Expectations” count towards meeting learning objectives (Cilli-Turner et al., 2020). Five tiers or more provide those familiar with giving partial credit an easier transition into mastery grading. However, Cilli-Turner et al. (2020) warn that, with this many tiers, “the grading system starts to resemble a point-based partial credit system more than mastery grading” (p. 961).

Types of Mastery Grading

Mastery grading is primarily implemented in two forms: mastery-based testing (MBT) and standards-based grading (SBG). While similar in execution, these two formats differ significantly in their logistical scope. MBT is mastery grading implemented only on assessments like tests and exams. Homework, labs, projects, etc., can be assessed using traditional grading. As a result, MBT is usually an overhaul in testing the students, hence the name. In contrast, SBG is a comprehensive overhaul of the course. The student’s grade in the course is entirely (or almost entirely) dependent upon mastering a certain number of learning objectives (Campbell et al., 2020).

Growth and Fixed Mindsets

Students’ beliefs about themselves are widely discussed in mathematics education. Carol Dweck’s (2006) “growth mindset” and “fixed mindset” categorize students’ beliefs about themselves. A growth mindset is the belief that one can improve their abilities through dedication and hard work (Boaler & Dweck, 2016). A fixed mindset is the belief that one cannot improve their abilities through effort, but rather that their abilities are unchangeable (Boaler & Dweck, 2016). In the authors’ experience, mathematics classrooms are rife with students who subscribe to a fixed mindset as demonstrated by the frequent confessions, “I am not good at math” or “I am not a math person.” A student’s mindset can be positively or negatively affected by factors such as the instructor’s attitude toward the students, the student’s ability to examine themselves, the classroom culture, and the method of assessment (Harsy, 2020).

With respect to assessment, it is a natural hypothesis that mastery grading pairs with the idea of a growth mindset. One of the seven messages that Jo Boaler likes to share with students is that “math class is about learning, not performing” (Boaler & Dweck, 2016). The goal of mastery learning (and subsequently mastery grading) is also motivated by emphasizing deep, gradual learning rather than a one-time performance. Thus, Harsy (2020) considers that “MBT also theoretically supports a growth mindset since it allows students to learn from mistakes and practice until they are able to show understanding” (p. 851). Harsy (2020) eventually reported the following:

Even though students do not mention having a growth mindset of learning, their comments reflect some of the characteristics of having a growth mindset. Realizing they weren’t a failure and not being

discouraged if they missed a few things on their first attempts along with mentioning how they went back and re-examined objectives are common themes in the student feedback. (p. 864)

While the claim that mastery grading promotes a growth mindset is claimed by many (the authors included), it has not been empirically verified (Harsy, 2020; Lewis, 2022).

Benefits of Mastery Grading

Conceptual Focus

Since mastery grading is built on demonstrating a high level of proficiency in specific learning goals, this forces students to dig deep into the content. For example, Zimmerman (2020) noted the following phenomenon during office hours:

Each visit was classified as “homework focused” or “concept focused.” The SBG student interactions were predominantly “concept focused,” for example, “I don’t understand domain and range,” while the vast majority of the traditional student interactions were centered around questions on a specific homework problem. SBG students often asked “why” questions while traditional students, even when pressed by the instructor were reluctant to engage in further discussion after the answer to the homework problem was obtained. (p. 1048)

Students assessed with traditional grading are more likely to strive for the numerical grade rather than the understanding that the associated grade should represent. For example, Greenwald et al. (2020) noted, “Many of our students recognize the connection between standards-based grading and learning over performance. Representative comments include: ‘values your learning over grades. You work toward learning goals, not a grade’ as well as ‘valued learning/improvement more than immediate proficiency’” (p. 1116). This follows from the fact that students’ work is categorized into a tier system that inherently disallows partial credit. A student must know the material at a high level to achieve a mastery mark. As a result, the students must focus on the content more than the assignment.

Reduced Anxiety and Stress

Implementing SBG in an abstract algebra course, Stange (2018) gave a survey to her students asking for feedback. Regarding SBG, she found that “They agreed it made class less stressful...” and that it “...reduced the stress of testing (six comments)...” (p. 803). However, generalizations should not be made given the small sample size of 21 respondents (and six comments). Similarly, Lewis (2020a) observed the following:

I recently gave a non-anonymous survey (with 26 responses) to linear algebra students and asked them to explain how the use of SBG changed their approach to the course; 23% cited a reduction in worrying, stress, or pressure as a benefit of SBG. (p. 548)

While generalizations are to be avoided, given the small sample size and the lack of anonymity, Lenarz and Pelatt (2020) say, “Anecdotally, we have observed a decreased stress level in our Precalculus courses. Students are much more relaxed about assessments and do not exhibit as much test anxiety as we saw prior to using MBT” (p. 4). Carlson et al. (2021) provide several quotes from students, a couple of which mention reduced stress. They conclude that “our preliminary research seems to suggest that students in MBT courses experience less test anxiety than students who are traditionally assessed” (p. 1084). The aforementioned qualitative and anecdotal evidence for the reduction of test anxiety has been quantitatively confirmed by Lewis (2022). While promising, further research should be conducted regarding what aspects of mastery grading contribute to reduced anxiety (Campbell et al., 2020; Lewis 2022).

Challenges of Mastery Grading

No grading scheme is perfect, and mastery grading is no exception. One significant challenge is the amount of work required to implement mastery grading. This is especially true for SBG since it typically requires an overhaul of the entire traditional course structure. Utilizing SBG requires a tremendous amount of upfront time and energy well before the first day of class and throughout the course (Zimmerman, 2020). Concerning the upkeep during the semester, Stange (2018) states, “it takes a significant investment in classroom time and preparation time to prepare and administer so many tests and track so many grades” (p. 811). Furthermore, since students are constantly reassessing, limitations must be put in place to mitigate the workload for instructors (Cilli-Turner et al., 2020). In contrast, however, Weir (2020) managed a feasible workload, and Cooper (2020) found that he saved much time using a 3-tier grading system. Others point out that the benefits to the students outweigh the costs to the instructor (Greenwald et al., 2020). Additional related issues include students’ unfamiliarity with mastery grading and gradebook conflicts (Zimmerman, 2020).

The Study

Motivation

The motivations of this study are twofold. Firstly, a substantial proportion of quantitative literacy students experience mathematics anxiety. At the authors’ institution, the quantitative literacy course is taken by non-STEM majors, mostly freshmen. In the authors’ experience, many of these students are prone to fears about mathematics. This is noteworthy because it has been shown that first-year university students’ math anxiety is a predictor of avoiding STEM content and underperforming in STEM (Daker et al., 2021). So, MBT was implemented to relieve those anxieties. Notably, the effects of MBT on students’ fears, anxiety levels, and mindsets are the focal points of this study, not the effectiveness of MBT on students’ understanding of course content. Secondly, to the authors’ knowledge, there seems to be a dearth in the literature on implementing MBT in an undergraduate quantitative literacy class. However, the literature does report implementation in precalculus or college algebra courses which might or might not have similar student populations.

Two quantitative literacy classes taught by one of the authors were used to conduct this study. The instructor assigned one section as the control group (CG) and the other as the treatment group (TG). The CG and the TG each had a sample size of $n = 28$. The two questions to be explored in this study were:

- Q1: Is there a difference in the anxiety levels between quantitative literacy students who are assessed with mastery-based testing (MBT) and those who are assessed with traditional grading?
- Q2: Does MBT help quantitative literacy students develop a growth mindset and self-efficacy?

Study Design

The study involved administering two surveys, one at the beginning of the semester and the other at midterms. The surveys were administered via Google Forms. These surveys aimed to measure the students’ anxiety levels, mathematical affinities, and mathematical mindsets. Survey questions were adapted from Carlson et al. (2021), Dyess and Young (2021), and Howell and Palmer (2021). The surveys contained four free-response questions and 23 Likert scale questions measured on a 5-point scale. The first survey was given to both groups during the second week of the semester. The CG was given the same survey for the

second round of surveys. The TG received a survey with four different free-response questions but the same Likert scale questions. This second round of surveys was given during the eighth week of the semester.

Implementation

Treatment Group

A handout containing 15 learning objectives was given to the students at the beginning of the statistics unit of the course. These 15 learning objectives were assessed through multiple-attempt quizzes via a web-based homework system. Each multi-take quiz had five attempts (the homework system did not allow for more in the settings). These multi-take quizzes were dubbed “mastery quizzes” by the instructor to their students. A mastery quiz was given for each learning objective, totalling 15 mastery quizzes.

Each quiz was worth one point and was automatically graded by the online homework system. A student received a point on a mastery quiz after their first correct answer, like a 2-tier MBT grading scheme. Thus, the number of attempts did not affect a student’s grade for a mastery quiz. If a student failed to pass the mastery quiz in five attempts, then the homework system graded that quiz out of 1 point (e.g., $0.75/1.00 = 75\%$ for that quiz). This is comparable to using a higher-tiered MBT grading scheme that converts a tier score to a numerical grade for purposes of final grade submission. A student’s test grade for the statistics unit would be calculated by taking the ratio of points earned through mastery quizzes to 15 points. These mastery quizzes were accessible to the students for the duration of the statistics unit, which lasted two weeks. Students could access and take the quizzes via the homework management system at any point during the two weeks. The instructor encouraged their students to take the quizzes soon after covering the relevant learning objectives in class. In addition, the learning objectives handout was utilized as a pacing guide.

Control Group

The CG took a 17-question test at the end of the statistics unit. The test spanned the same 15 learning objectives as the TG. This test was administered online via the learning management system of the instructor’s institution. The test contained multiple-choice questions as well as numerical free-response questions. The students took the test remotely over a weekend.

Results

Likert Scores

The 23 Likert scale questions were scored on a 5-point scale, with “Strongly disagree” being a one and “Strongly agree” being a five. Some students did not respond to a question or did not answer the same question on both surveys. As a result, these non-responses were not considered in calculating the Likert score averages, thus lowering the response rate. Overall, the Likert score averages were similar for both the TG and the CG. Regarding Q1, the CG had just as much reduction in anxiety as the TG, if not more. Regarding Q2, the TG and the CG had similar average scores. Table 1 displays some of these Likert score averages.

Table 1
Likert Score Averages

Survey Question	Treatment (n=9)		Control (n=15)	
	#1	#2 (Change)	#1	#2 (Change)
#2. I am usually anxious before taking a test in math.	4.11	3.78 (-0.33)	4.00	3.53 (-0.47)
#15. If you can answer a question quickly, then you are good at math.	2.11	1.89 (-0.22)	2.60	2.40 (-0.20)
#17. I prefer to work on questions that challenge me rather than questions that I find easy.	2.00	3.78 (+0.78)	2.47	3.00 (+0.53)
#19. Mathematics learning should focus on practicing procedures and memorizing steps.	3.38	3.00 (-0.38)	3.67	3.47 (-0.20)

Student Comments

The first set of surveys was identical for the CG and the TG. In addition to 23 Likert scale questions, four free-response questions were asked. The following are some student responses:

How do you feel about taking math tests? (S1 - CG):

- Student C: “Stressful”
- Student D: “horrible”
- Student I: “I feel very uncomfortable”
- Student W: “I really don’t do well with tests so math tests especially do make me pretty nervous.”
- Student P: “I get test anxiety especially for math.”
- Student T: “I hate them”
- Student B: “Like any other test, I hope I pass”
- Student F: “not so good, i struggle with text [sic] anxiety”

Anxiety and stress appeared to be common sentiments for the CG. The responses from the TG were:

How do you feel about taking math tests? (S1 - TG):

- Student 10: “I do not like tests in any subject. I perform worse when I know I am getting graded based off of one singular test.”
- Student 11: “Anxious.”
- Student 2: “I hate them. They give me so much anxiety”
- Student 12: “horrificed”
- Student 13: “Not good at all, I get anxious and bomb them most of the time”
- Student 14: “anxious”
- Student 9: “I really don’t like them”
- Student 16: “Very anxious and afraid”

- Student 3: “I dislike them simply because I find them stressful.”
- Student 19: “I get stressed when I have to take a math test”
- Student 7: “Its [*sic*] stressful and I hate it.”

The TG shared the sentiments of anxiety and stress that the CG had. Using words such as “horrificed” and “afraid,” it was evident the students had a very negative association with the idea of taking math tests. Note Student 10’s concern about being graded off one test.

For the question “What does it take to be good at mathematics?”, the responses were categorized based on whether they used growth mindset language like “practice,” “dedication,” “determination,” “patience,” etc. This contrasts with responses that used fixed mindset language like “innate intelligence” or “genetics.” For the CG (n=21), approximately 76% of the responses demonstrated growth mindset language. For the TG (n=19), approximately 84% of the responses demonstrated growth mindset language.

The second survey was identical to the first for the CG. For the TG, the second survey contained new free response questions asking about the mastery quizzes (“mastery-based tests” in the questions):

What are your thoughts on the mastery-based tests? (S2 - TG):

- Student 1: “They make it very clear on what we should study based on what unit they cover and take the anxiety away from an in person test.”
- Student 2: I thought the Mastery-based test on achieve was very helpful and a good guide in helping me keep practicing what we were learning throughout the week at home. It was so much less stressful than an actual test.”
- Student 3: “i like them and prefer them to regular tests”
- Student 4: “I think that they are pretty nice way of doing it to make it feel less stressful and more forgiving if you can’t get something down.”
- Student 5: “I enjoy them I think they help me further my understanding of the material”
- Student 21: “I think they are a good way of checking your knowledge of the chapters and I prefer them over tests.”
- Student 8: “I liked them and it helped me understand the curriculum more.”
- Student 10: “I think they are beneficial because it gives us more of an understanding of where we are at.”

Students 1, 2, 3, and 4 reported feeling less stress, while Students 5, 21, 8, and 10 reported an increase in their understanding of the curriculum.

What did you like about the mastery-based tests? (S2 - TG):

- Student 4: “I liked how simple they were, and how it felt like there was less pressure when doing it.”
- Student 5: “I like that they gave me multiple opportunities to understand how to answer the questions”
- Student 21: “I liked that I had multiple tries and I also thought that it was smart that if you got a question wrong the first time, when you would retry it would be a different question so that you can’t just get it wrong and then immediately get the right answer, it makes you try.”
- Student 9: “I like how we get more than one chance to answer. It helps me understand more [*sic*] what I did wrong, instead of just getting penalized for not fully remembering how to do it the first time.”

The students in the TG liked having multiple attempts.

What did you not like about the mastery-based tests? (S2 - TG):

- Student 3: “the layout of one question per test. too many questions in one test is overwhelming, but too few is kind of tedious and annoying. maybe combining some of the groups would be a good middle ground”
- Student 21: “Nothing, I liked them much better compared to a regular test.”
- Student 4: “There wasn’t anything I didn’t like.”
- Student 5: “na”
- Student 7: “There wasn’t really much that was bad about them.”
- Student 8: “N/a”
- Student 9: “I personally don’t have anything I dislike about them”
- Student 10: “n/a”

There was minimal dislike for the mastery quizzes from the TG students. Only Student 3 had a dislike, where they pointed out the tedious nature of taking 15 separate mastery quizzes.

Discussion

Research Question 1

The findings demonstrate the complementary roles of this study's qualitative and quantitative research methodologies associated with this study. While the quantitative findings were inconclusive, valuable findings were discovered in the qualitative data in the form of students' comments.

Regarding Q1, students in both the TG and the CG were anxious about mathematics, as seen in their comments about taking math tests. Based on the comments of S2, the students in the TG felt less pressure and stress when taking the mastery quizzes compared to traditional tests. However, the statistics were inconclusive regarding whether TG students resulted in a greater lessening of anxiety.

The inconclusive statistical results, however, are juxtaposed with some interesting qualitative findings. Notably, during the running of the classes, the researcher employed precise nomenclature regarding mastery-based assessments. Although the student surveys inadvertently denoted these as “mastery-based tests,” the in-class communication singularly denoted these assessments as “mastery quizzes.” The selection of “mastery quizzes” was purposive. The homework management system employed the term “multi-take quizzes,” and the classes seemed to respond favorably and be less stressed by this term rather than “test” or “exam.” Although there is potential for this inconsistent nomenclature to be a confounding variable in naming the mastery assessments as mastery “quizzes,” the misnaming in the surveys did not seem to impact survey results.

To an unanticipated extent, nomenclature became a seminal finding in this study. Distinguishing “mastery quizzes” from traditional assessments, TG students denoted traditional assessments as “actual tests,” “regular tests,” or just “tests,” as if mastery-based quizzes were qualitatively or substantially different. Further investigation revealed that students perceived multiple-attempt, mastery-based quizzes as bona fide assessments, albeit in softer form and without the anxiety and stress associated with one-attempt tests. Indeed, this use of language by the TG could indicate that the students are so used to having only one attempt on a test that they do not equate multiple-attempt assessments as a “test.”

The TG students' differentiation of anxiety-producing “tests,” “actual tests,” and “regular tests” from seemingly softer and gentler “mastery quizzes” may have significant implications for education. Although beyond the scope of this investigation, it must be wondered if student anxiety could be minimized simply by a change in assessment nomenclature. It must be wondered if assessments titled with more user-friendly

terminology—irrespective of any alteration in the assessment’s content, including one-attempt characteristics—would result in reduced student anxiety and better performance on the assessment. This warrants future investigation.

As a confounding variable in this study, students took the mastery quizzes and tests at home rather than in class. The take-home nature of the mastery quizzes could have relieved much of the pressure of taking an assessment. However, the tests’ take-home nature may also explain why the CG had a similar reduction in anxiety. Despite these confounding variables, it should be noted that the students reported learning the statistics content more and that they enjoyed the mastery format.

Research Question 2

The responses to the survey question, “What does it take to be good at mathematics?” reveal a growth mindset in most of both TG and CG students. Student answers such as “dedication,” “a lot of practice,” and “perseverance” directly connect to the idea of valuing depth of knowledge over speed as necessary to cultivating growth mindsets (Boaler & Dweck, 2016). Furthermore, students reported that the multiple attempts helped “me understand more [of] what I did wrong” and that “when you would retry it would be a different question so that you can’t just get it wrong and then immediately get the right answer, it makes you try.” These comments seem to indicate that students appreciate the ability to review their mistakes, a crucial part of learning and of a growth mindset (Boaler & Dweck, 2016). Thus, it seems either traditional test- or mastery-based structures can be successful frameworks through which to fertilize and cultivate positive students’ attitudes about their mathematical abilities. In other words, mastery-based formats may be no worse than and as good as test-based formats. This accords with the results found by Carlson et al. (2021): “We also noticed that the students (regardless of the course or assessment method) seemed to have responses that reflected having a growth mindset (Figures 7–9)” (p. 1080).

Unfortunately, confounding variables may be at play in these results. The same affable instructor led both TG and CG classes. Over the semester, the instructor placed a high value on building positive relationships with all students. Therefore, student responses may have been biased as students may have responded with answers that they believed the instructor would want to hear.

Limitations

Sample Size and Nonresponse Bias

The TG and CG sample sizes were small, with $n = 28$ for both. Furthermore, the response rates for the TG were low. For the Likert scale questions, the response rates for the TG dropped even lower as only overlapping responses for S1 and S2 could be counted. Also, the TG had an unusually high absence rate during the implementation of the mastery quizzes. Therefore, generalizations should be cautioned against.

Logistical Issues

The instructor intended to utilize MBT for the semester but was advised to utilize it for only one chapter of the course. The main reasons for this recommendation were the instructor’s experience teaching this type of course and the time involved with using MBT. For example, if an instructor wants to use mastery grading, it is recommended that they gradually incorporate it into a course they have experience teaching. For the instructor, this was their second time teaching the quantitative literacy class. Thus, they chose to use MBT

for only one course chapter. Regarding the time required to utilize MBT, one question is, “How many attempts do the students get?” If grading mastery assessments by hand, this could prove impractical. Consider the following: the author had 28 students in the TG. Suppose all 28 students used all five attempts on each of the 15 mastery quizzes. There could have been a total of $28(5)(15) = 2100$ mastery quizzes to grade by hand. Another important question is, “When and where do the students reattempt the mastery assessments?” One option is to only allow the students to reassess on test days. Another option is to allow reattempts during office hours. These options give flexibility to the students but potentially more work for the instructor (Cilli-Turner et al., 2020, p. 956). Additionally, the instructor was a full-time graduate student completing coursework, so it was decided that the mastery quizzes would be administered via the web-based online homework system provided for the course to lighten the workload.

Grading

One challenge to implementing MBT is asking, “What tier system do I use?” If a binary scale is used, then there could be significant pushback from the students since they are so used to partial credit (Cilli-Turner et al., 2020, p. 963). If a 3-tier scale is used, then converting to a numerical grade could be tricky. Thus, the mastery quizzes were administered online and graded automatically out of a point total. Since the mastery quizzes were graded as total points out of 15, this “percent of possible progress” scale is technically not a mastery grading system (Campbell et al., 2020). However, the other two pillars of a mastery grading system were still upheld: “A clear list of objectives or specifications” and “Eventual mastery matters” (Campbell et al., 2020, p. 838). The authors believe that clear learning objectives paired with multiple attempts still carry the essence and spirit of mastery grading.

CG/TG Interaction

Since some students in the CG and TG knew each other, word could have spread that one section got five attempts at the test, while the other only got one attempt. To prevent accusations of inequality, the CG was given two attempts on their test, with the higher scores being recorded. This most likely contributed to the reduced anxiety levels in the CG.

Implications for Future Study

Quantitative literacy students are prone to mathematics-induced anxieties, and there are indications that MBT can alleviate these anxieties. So, there is a need for a study to implement mastery grading in multiple sections of quantitative literacy to ensure a sufficiently large sample size. A future study would also need to implement mastery grading properly by including the three features that define mastery grading (Campbell et al., 2020, p. 838).

Future studies may wish to further investigate the anxiety-reducing and subject-mastery effects of in-class versus take-home tests and mastery-based assessments. Also, there is the opportunity to investigate the results of mitigating anxiety and improving student performance by simply changing the name of “tests” and “exams” to “quizzes,” “assignments,” “projects,” or the like.

Conclusion

Mastery-based testing is a grading method that utilizes repeated assessment of clear learning objectives. This study has shown some qualitative evidence that students assessed

with MBT experienced lower anxiety levels than those assessed traditionally. The students assessed with MBT enjoyed the mastery quizzes and seemed to have gained a deeper knowledge of the course content. Further study is needed to verify that MBT is a sound system for quantitative literacy students. Since quantitative literacy students enjoy repeatedly practicing the mathematics content until they get it correct, a mastery grading scheme can give the students such an opportunity.

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