

Implementation and Impact of Mastery Grading on Student Learning and Affect on Pre-Service Teachers in a Science Teaching Methods Course

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Received: September 2, 2026

Accepted: October 19, 2026

Online Published: October 27, 2026

doi:10.5430/irhe.v11n2p1

URL: <https://doi.org/10.5430/irhe.v11n2p1>

Abstract

Traditional grading practices in the U.S. K-12 and post-secondary system often blend academic mastery with non-cognitive behaviors like attendance, participation, and timeliness, creating a lack of alignment with standards-based accountability metrics. Alternative systems like Mastery Grading (MG) promotes a learner-centered paradigm focused purely on skill and content proficiency and multiple opportunities for success. However, MG implementation remains inconsistent across all levels, and its use in pre-service teacher preparation courses has not been explored deeply. This study investigates the perceptions and attitudes of pre-service teachers (PSTs) toward an alternative evaluation framework like MG. Data was collected by embedding an active MG system into an upper-level science teaching methods course, allowing future educators to experience the model. Participants reveal that they recognize the mental health benefits, acquisition of understanding at deeper levels, and increased student effort and agency offered by MG. However, although they understood the system and its makeup as they experienced it, the PSTs respondents indicate some conflict as to whether to still reward more subjective components like student effort and behavior. This research addresses a gap in teacher preparation by examining how firsthand experiential exposure to alternative grading system like MG shapes future educators' pedagogical beliefs and their ultimate willingness to adopt learner-centered assessment practices.

Keywords: mastery grading, alternative grading system, assessment, pre-service teachers, teaching methods

1. Introduction

In the United States K-12 education system, there is a spectrum of grading practices (Brookhart, 1994; Schneider and Hutt, 2014; Feldman, 2023, Anderson, 2018). A common and historically used practice is a combination of percentages (out of 100) correlated to a letter grade (A, B, C, etc.). Many US universities follow similar formats with grading and evaluation (Rojstaczer and Healy, 2012; Kleinman, Leidman and Longcore, 2018). This traditional system combines students' performance on exams, quizzes, and projects with their behavior (attendance, attitude, class participation, in-class behavior) as well as considering their performance on homework (graded and ungraded) or extra credit. The inclusion of these non-academic and non-cognitive behaviors seem to be at direct odds with demonstrating mastery of subject matter and meeting standards as well as with standardized testing, a high-stakes mode of accountability to the student and the teacher, but which is designed to measure students' academic skills and content understanding (mastery) (Brookhart et al, 2016; Lange, 2021; McMurtrie, 2022).

Alternative systems such as Mastery Grading (MG) or Standards-Based Grading (SBG) are accepted and even favored grading system in the restructuring of education (Malan, 2000), in many places in the USA and internationally at the K-12 and post-secondary level. These systems promote a change from a teacher-centered paradigm to a learner-centered one, from a system of numbers, sums, weights, and averages to one that is more conforming to real-life – competencies based on knowledge and understanding, skills, and affective behaviors (Tam, 2014). Campbell et al (2020) define MG/SBG to include three distinct features: 1) A clear list of objectives and standards, with the course letter grade based on how many of these standards a student has mastered by the end of the course, 2) Student work is evaluated for mastery of the standards, using a rubric, with feedback provided to the student, and 3) Students have multiple opportunities to demonstrate mastery of each standard, and are not penalized for not mastering a standard on a single attempt.

When implementing and utilizing MG/SBG, curriculum is designed to produce alignment of course content, activities, and assessments. It emphasizes a learning-based approach and evaluation method focused on what a student knows and can do, which they obtain through the learning experience and opportunities throughout the course, not the accumulation of points and partial credit (Weir, 2020; Dunlosky et al, 2013).

The essence of MG/SBG is based on demonstrating proficiency, or mastery, on a list of learning outcomes. Each assignment is aligned to assess one or more of these outcomes. Thus, the goal of MG/SBG is to communicate to all parties what the student knows and/or can do (O’Conner, 2018). A final letter grade is based on how many and how well the outcomes were mastered. Recent research suggests that when “grade books” (or LMS) transparently display students’ current understanding, students have a better understanding of their knowledge and skills and can continue to improve them (Guskey, 2020; Noschese, 2011; O’Connor, Jung, and Reeves, 2018).

There does not appear to be a precise national count of how many U.S. school districts use standards-based or other alternative grading systems, and major education data sets do not appear to comprehensively track this information. It may seem that the practice is widespread but still in a minority of districts, concentrated in certain states rather than being a universal practice (Link and Guskey, 2022). The practice is also inconsistent due to factors like what defines standards-based grading, uneven guidance, and explanation of criteria for evaluation. This leads teachers to abandon alternative grading due to a heightened level of uncertainty, confusion, and frustration.

In the past two decades, teachers’ beliefs about classroom assessment have shifted. This, while state and local grading policies have remained largely unchanged, intensifying tensions between evolving teacher thinking and static policy. In the same period, an examination of scholarship tied to pre-service teachers’ interaction and attitudes toward grading and alternative grading is present. Simon, Chitpin, and Yahya (2010) found that pre-service teachers tended to prioritize assessment for classroom management, motivation, and social justice, even over actual measured learning. Their reasoning reflected an implicit mix of measurement concerns (fairness, multiple opportunities), psychological ideas (motivation, group work), and social theory (equity, accommodation). When pre-service teachers were making assessment decisions, they were already weighing issues like behavior, fairness, and inclusion as heavily as pure evidence of mastery.

Scarlett (2018) found that working with two sections of pre-service teachers in an undergraduate course in assessment, that conversations about grades and grading were not dominated by reference to student learning outcomes. Scarlett’s question of how a standards-based grading system influence students’ approach to learning and course goals revealed that students were receptive to this alternative system, which echo the findings of Hany, Proctor, Wollenweber, and Al-Batanieh (2016). Student perceptions were mostly positive, with a better sense of control over grades due to more opportunities for improvement and not letting one bad test score impact the grade. However, there was concern about the standards themselves, viewing the standards set by an individual teacher or professor as too subjective.

A large sample (248) of Canadian pre-service teachers were surveyed about assessment and grading practices using two established metrics (TAG and TCOA) in a study done by Rasooli, DeLuca, and Cheng (2022). These candidates formed an approach to grading in terms of consequence of the grade (such as how it will impact a student). PSTs expressed a more holistic view of assessment and that students should have more and varied assessments, but also that student engagement factors like class participation, attendance, and homework completion should be factored in. Interestingly there was disagreement with assigning a grade only based on a student’s most recent performance.

Dueck, Diaz, Goegan, and Daniels (2022) learned from their study with PSTs that grade focus comes from parents and upper administrators, and not the teachers themselves. The PSTs expressed that they wanted to see less focus on grades, citing mental health issues and negativity toward grade competition. PSTs cited alternatives to the actual letter grade (which would be student growth, performing competently and mastering skills) and that there should be more focus on effort to increase motivation. This, however, seems to conflict with the tenets of SBG.

This research fills a niche in its examination of PSTs in an upper-level teaching methods course (science teaching) who are experiencing MG in the course itself as it is implemented in real time. As future teachers, their own experience and understanding of this alternative grading system may alter their perception toward implementing and utilizing alternative grading themselves should their career path lead them to work for a school district which is already practicing alternative grading. Our research questions are: What are middle-grades prep students' (the pre-service teachers) attitudes and understanding of Mastery Grading? And how does Mastery Grading affect these students' confidence, motivation to learn, and academic success?

2. Methods

2.1 Course Background and Population

For this study, the sample population of 63 students were enrolled in a science teaching methods course taught by one of the co-authors at a four-year state university for the fall and spring semesters of the 2024-25 and 2025-26 academic years. All students were PSTs in a middle-grades teacher preparation program.

2.2 Course Design

The course met once a week for a 3-hour block of time over 15 weeks and required the PSTs to spend a total of 15 hours in a local middle school science classroom and a technology-engineering classroom. The course had students watch and listen to narrated slideshow presentations or videos about upcoming pedagogical content and respond to various related questions and tasks in a personal class reflection log. The log was accessible for the instructor to read and review, and leave questions, comments, and feedback.

Following class, additional reflection items were provided for students to expound upon, based upon what they did in class related to the week's topic. Responses could include practicing writing lesson plan components and writing scientific questions relevant to the phenomenon of the in-class activity. Further practice with writing questions and explaining relevance of scientific phenomena was done each week in a portfolio linked to their reflection log. This assignment required students to utilize personal pictures and video and develop a series of scientific questions that lead to an investigation exploring and making sense of the phenomena. Students also explained why the phenomena is relevant to the student, society, and an Earth system. Regular feedback and comments were provided to students each week. Students wrote two formal lesson plans on their choice of phenomenon from a given list. For the first lesson plan, each student met with the instructor for feedback and guidance based on their first draft and had the chance to revise and rewrite before being evaluated. The PSTs also had three formal teaching exercises where they were required to teach to the class: the first was a physical demonstration of a scientific process or phenomenon, second was a lesson using graph(s) and data, and the third being a portion or abbreviated version of their second written plan phenomenon.

Because there is a field component with this course, a field reflection log was expected. This log documented the students' observations, actions, questions, and insight into what they were doing and what occurred in the classroom. By the end of the 15 hours (usually 1-2 hours per week throughout the semester), students were required to teach a lesson to at least one of the classes (either science or tech-engineering). This lesson coincided with the topic in the regular curriculum of their field class and mentor teacher. This lesson was evaluated (also using a rubric/Danielson Framework) by the mentor field teacher.

2.3 Research Design

This research design follows a sequential multi-method design, with quantitative data collected first (pre-survey) followed by qualitative data collection questionnaire, coincident with a quantitative post-survey. This methodology can bridge the gap between nuanced human experience and measurable Likert Scale statistics. Multimethod research improves studies by offering enhanced triangulation, broader perspectives and result validity using two or more data collection or analysis approaches.

The process and procedure for collecting data was adjusted over the four semesters of the study. In the first year, once a student completed the consent form, they were directed to complete the pre-survey using Qualtrics. In the last four weeks of the semester, student participants who indicated their desire to participate in an interview were invited to meet with the co-author who was not their course instructor. At the same time near the semester's end, the post-questionnaire was sent to all consenting participants. Interviews were recorded, and a transcript was generated ensuring all identifying factors were removed. The transcripts were analyzed for themes and coded by both authors.

Only 3 students (of 19) in Fall 2024 did both the pre- and post- surveys, but they also interviewed. And in the Spring 2025, only two pre-surveys were completed with no post- and no interviews. This may have been due to the imposition of extra time outside of class.

The data collection process was modified for fall 2025 and spring 2026 to encourage a higher percentage of student participants. Participant recruiting changed from email only, to an in-person request from the second author who was not the course instructor. The mid-semester interview element was removed. The questions in the pre and post-questionnaire were transferred to the students' Class Reflection Log, an ongoing continuous journal completed throughout the course of the semester.

In the fall 2025, 12 of 14 students consented and provided quantitative and qualitative data. In Spring 2026, 7 of 10 students consented but only 5 provided both survey responses and qualitative data, for a total of 20 students providing qualitative data (32% total over the four semesters). The pre- and post-survey questions (both quantitative and qualitative) were asked in the first and last weeks of the semester to all students enrolled in the class and their responses were recorded in their Class Reflection Log. After the semester was completed, logs were copied, identifying factors removed, and only consenting students' logs were utilized for the pre- and post-survey responses. Questions that all participating students answered in both versions of the study are shown in Table 1.

Table 1. Survey questions

Question	Text	Surveys
A	Have you ever had a class (either here or elsewhere/K-12) that has used an evaluation format like the standards-based grading used in your course? (Yes / No)	Pre
B	How pleased/displeased are you with your own progress and evaluation?	Post
C	What do you expect your grade to be in this course? (A / B / C / D / F)	Pre and Post
1	How well do you understand this grading system as it pertains to this class? (Do Not Understand / Somewhat Understand / Mostly Understand / Fully Understand)	Pre and Post
2	The syllabus of this course lists the learning outcomes by which you are evaluated. How confident are you that you understand these learning outcomes? (Fully Confident / Mostly Confident / Somewhat Confident / Not Confident at All)	Pre and Post
3	How motivated are you to learn and understand the course content considering the use of a standards-based grading system in this course? (Not motivated at all / Marginally motivated / Moderately motivated / Greatly motivated)	Pre and Post
4	How do you think the standards-based grading system will impact your academic success in the course? (No impact / Marginal impact / Moderate impact / Significant impact)	Pre and Post
5	When I receive a grade in a class, I understand what this grade says about my performance in the class. (Strongly disagree / slightly disagree / slightly agree / Strongly agree)	Pre and Post
6	The way grades are given in classes is equitable and fair across all instructors in all courses. (Strongly disagree / slightly disagree / slightly agree / Strongly agree)	Pre and Post
7	It is possible to get a good grade (A or B) in a class even if you (the student) have not learned what was taught or done some of the work. (Strongly disagree / slightly disagree / slightly agree / Strongly agree)	Pre and Post
8	A student's grade should be based only on how well they have learned and met the outcomes taught in the class. (Strongly disagree / slightly disagree / slightly agree / Strongly agree)	Pre and Post
9	In addition to learning and meeting course outcomes, a student's grade should include which of the following components (select all you feel should apply): (Attendance / Effort / Good behavior / Class participation / Turning work in on time (not late) / Extra credit / None, it should only be based on meeting the learning outcomes.)	Pre and Post
I.	How did you adapt in any way to mastery grading used in this course? (open ended)	Post

II.	How did the use of mastery grading in this course affect your mindset in terms of learning and applying content and completing work? (open ended)	Post
III.	What is the relationship between learning and grading and have you ever experienced in a class a mismatch between what you learned and the grade you received? Can you provide the example? (open ended)	Post
IV.	Tell me about a time in this class when you felt you really learned and understood something – why did you feel you learned and how do you know? (open ended)	Post
V.	What do you think I wanted from you in this course – was it more about good grades or learning and obtaining new skills? How do you know/why? (open ended)	Post
VI.	What have you experienced as the difference between the traditional grading system and mastery grading when it comes to learning? (open ended)	Post

Data analysis using qualitative methods and a hybrid approach of inductive and deductive thematic analysis and coding was implemented (Hatch, 2023). The data was analyzed through multiple passes of the students' responses to the various items by the two authors. They separately read each of the responses and identified new emergent themes in the phrases, sentences, and paragraphs that the students wrote in their logs. After this, the authors met to establish operational definitions of the themes and determine examples of these themes from the responses. To ensure reliability, the researchers used constant comparative analysis and met on multiple occasions to establish consensus (Strauss, 1987) by identifying the theme where it occurred within the participants' responses in the interviews and logs and finalizing agreement between the authors. If the authors differed on code placement of a particular journal entry, they discussed differences and revised themes until consensus was achieved. Each theme was also defined operationally (Table 2) so that the authors understood and were clear on the various meanings that a particular code could have.

Table 2. Primary themes and their definition

Theme	Definition
Deeper Thinking	More critical thinking and reflection about learning and teaching and science teaching.
Recognition of Growth	Self-awareness of learning, accomplishment, and academic success.
Reduction of Pressure	Less stress and worry with respect to achieving a particular grade on an assignment or impact on overall course grade.
Increased Effort	Dedicated to producing mastery-level work and not accepting just passing or passable.
Slowing Down	Being more reflective on doing work as per guidelines and learning, less rushing to complete work for the points.

3. Findings

3.1 Quantitative

Of the twenty students who completed both pre and post surveys, sixteen were experiencing standards-based grading for the first time while three had previously been in a class that used a grading format like standards-based or mastery grading. One student did not answer the question. All students earned a final grade of an A except for one student who earned a B. The students who achieved a final grade of A met all 8 learning outcomes at mastery level, and the single student with a B met 7 criteria at mastery level. As one would expect when students gain experience with a phenomenon, over the course of a semester, students' self-reported understanding of the MG system and their

confidence in understanding the course learning outcomes improved. Students' self-reported understanding increased significantly from pre-assessment (Mdn = 3.00, IQR = 2.75-3.00) to post-assessment (Mdn = 4.00, IQR = 4.00-4.00), $V = 120.0$, $p = .0003$, $p_{adj} = .0024$, $r = 0.125$. Student confidence in understanding the course learning outcomes also demonstrated an unadjusted significant increase from pre-assessment (Mdn = 3.00, IQR = 3.00-4.00) to post-assessment (Mdn = 4.00, IQR = 3.75-4.00), $V = 55.0$, $p = .0367$, $r = -.417$, though this effect did not remain significant after controlling for multiple testing ($p_{adj} = .1468$) (see Table 3).

Table 3. Wilcox Test results

Question	N	Pre Mdn (IQR)	Post Mdn (IQR)	Test Stat (V)	p (unadjusted)	p (BH adjusted)	Effect Size (r)
1	20	3.00 (2.75-3.00)	4.00 (4.00-4.00)	120.0	0.0003	0.0024	0.125
2	20	3.00 (3.00-4.00)	4.00 (3.75-4.00)	55.0	0.0367	0.1468	-0.417
3	20	4.00 (3.00-4.00)	4.00 (3.75-4.00)	10.0	0.5716	0.7621	-0.793
4	20	3.00 (3.00-4.00)	4.00 (3.00-4.00)	37.0	0.7447	0.8511	-0.568
5	20	4.00 (3.00-4.00)	3.50 (3.00-4.00)	22.0	0.3075	0.4920	-0.693
6	20	3.00 (2.00-4.00)	3.00 (2.00-4.00)	35.0	0.8903	0.8903	-0.584
7	20	2.00 (1.75-3.00)	2.50 (2.00-3.25)	69.5	0.2843	0.4920	-0.296
8	19	3.00 (3.00-4.00)	3.00 (2.00-4.00)	16.0	0.2430	0.4920	-0.729

For the remaining Likert response questions, no statistically significant difference was observed between pre and post surveys. However, it is worth noting that student motivation to learn remained high throughout the semester with no statistically significant change between pre and post surveys indicating this grading system does not negatively impact their learning motivation. Interestingly, students' perceptions on how SBG would impact their academic success moved to the extremes at the end of the course from more moderate responses during the pre-survey. (See Table 4)

Table 4. Survey results

1. How well do you understand this grading system as it pertains to this class?				
	Fully Understand	Mostly Understand	Somewhat Understand	Don't Understand
Pre	3	12	5	0
Post	16	4	0	0
2. The syllabus of this course lists the learning outcomes by which you are evaluated. How confident are you that you understand these learning outcomes?				
	Fully Confident	Mostly Confident	Somewhat Confident	Not confident at all
Pre	8	11	1	0
Post	15	5	0	0
3. How motivated are you to learn and understand the course content considering the use of a standards-based grading system in this course?				
	Greatly motivated	Moderately motivated	Marginally motivated	Not motivated at all
Pre	14	5	1	0
Post	15	5	0	0
4. How do you think the standards-based grading system will impact your academic success in the course?				
	Significant impact	Moderate impact	Marginal impact	No impact at all
Pre	6	11	3	0
Post	11	6	0	3
5. When I receive a grade in a class, I understand what this grade says about my performance in the class.				
	Strongly Agree	Slightly Agree	Slightly Disagree	Strongly Disagree
Pre	13	7	0	0
Post	10	9	1	0
6. The way grades are given in classes is equitable and fair across all instructors in all courses.				
	Strongly Agree	Slightly Agree	Slightly Disagree	Strongly Disagree
Pre	7	7	6	0
Post	9	4	7	0
7. It is possible to get a good grade (A or B) in a class even if you (the student) have not learned what was taught or done some of the work.				
	Strongly Agree	Slightly Agree	Slightly Disagree	Strongly Disagree
Pre	3	4	8	5
Post	5	5	6	4
8. A student's grade should be based only on how well they have learned and met the outcomes taught in the class.				
	Strongly Agree	Slightly Agree	Slightly Disagree	Strongly Disagree
Pre	9	7	3	1
Post	7	6	5	1

To examine whether student attitudes toward grading components changed from pre- to post-assessment, exact McNemar's tests with Benjamini-Hochberg false-discovery rate adjustments were conducted across the seven criteria (N = 20) (Table 5). While directional shifts were observed—most notably a decrease in students believing grades should include 'Turning work in on time' (73.7% to 52.6%) and 'Effort' (94.7% to 78.9%)—none of the shifts reached

statistical significance after adjusting for multiple comparisons. It appears that after a semester of experiencing MG grading, students' perceptions of what a grade should include remained relatively static.

Table 5. Question nine McNemar Test results

9. In addition to learning and meeting course outcomes, a student's grade should include which of the following components (select all you feel should apply):									
Item	n	Pre Yes		Post Yes		Flip No to Yes	Flip Yes to No	P Value	
		count	percent	count	percent			Unadjusted	Adjusted BH
Attendance	20	17	85	14	73.7	2	4	0.6831	0.9563
Effort	20	19	95	15	78.9	0	3	0.2482	0.8391
Good behavior	20	10	50	6	31.6	1	4	0.3711	0.8391
Class participation	20	16	80	15	78.9	2	2	1.0000	1.0000
Turning work in on time	20	15	75	10	52.6	0	4	0.1336	0.8391
Extra credit	20	6	30	5	26.3	3	3	1.0000	1.0000
None – only learning outcomes	20	2	10	3	15.8	2	0	0.4795	0.8391

From the pre and post survey data, it appears that students' exposure to MG increases their understanding of the grading system and learning outcomes while still supporting high levels of motivation. Students' underlying beliefs about what should count toward a grade remained more resistant to change, reflecting the persistence of traditional grading assumptions.

3.2 Qualitative

The qualitative study examined what middle-grades prep students' (pre-service teachers) attitudes and understanding of Mastery Grading were and how Mastery Grading affected these students' confidence, motivation to learn, and academic success. The primary themes that emerged, as well as the number of occurrences from the participants' responses, are: 1) Deeper Thinking, 2) Recognition of Growth, 3) Reduction of Pressure, 4) Increased Effort, 5) Slowing Down and defined in Table 6.

Table 6. Primary themes and occurrences

Primary Theme	Occurrences
Deeper Thinking	33
Recognition of Growth	21
Reduction of Pressure	19
Increased Effort	18
Slowing Down	15

The students' quotes listed within each of the 5 themes as representative examples of that theme are presented in sequential or chronological order from their interview or survey responses.

3.2.1 Deeper Thinking

Students expressed moving beyond rote memorization to truly master concepts and skill by connecting new information to existing knowledge and understanding their own ability.

"...when I do my best, as long as I'm doing what I'm supposed to...and following (his) criteria...I know that I'm doing okay...and I know that I need to improve from that." "Carson" F24

“...made me go deeper into content and material, I wanted to turn in the best work I could present.” GM F25

“Fixing the mistakes will also help me because I will be able to look back at what I did wrong and fix it, which will put that content in my head.” MJ S26

“Learn how to think like a scientist, understand the world around you, and learn how to guide your future students through that same curiosity.” YH F25

“I was able to focus on understanding the material and improving my skills.” KO F25

“...I would think about it in the sense of my own future classroom...so I took more lesson ideas away. I like learning about different ways you can teach different topics.” EW F25

Students themselves noticed their own learning and progress.

“...for this standard-based, you can see and show that you actually improved.” “Marie” F24

“...I noticed I really learned and understood the content...because we have practiced them so much and applied them in different assignments that I was easily able to connect...into lessons I created...” ND F25

“...understanding why...made the whole thing so much more interesting...I understood the actual science behind it. And once I started thinking about CO₂ being all around us, it me realize how tiny those particles are and how something so small can create a visible reaction...it wasn't memorization, it was real understanding.” YH F25

“I know I learned because I started implementing them in my lessons...and talked about them to show how it is being used...” BS F25

“...I started noticing it naturally in other lessons and even thinking about how I would create my own openings. It's something I now pay close attention to and feel confident applying...” BW F25

Identification and ability to think more profoundly about the concepts they were taught and applying them to tasks at hand, and their work itself, appears to be at the front of many students' minds.

3.2.2 Recognition of Growth

Students expressed more clarity and emphasized recognition of their own growth and learning, as opposed to just doing something for a grade.

“...he was like...moving forward I just want you to think about this (aspect of teaching), and the next time I did...It wasn't like an inflection of like this is what you did wrong, but oh, here's where you can improve.” “Marie” F24

“...when we'd get a grade back...he would give us feedback on what we did well and how we can grow from that, it wasn't just a letter grade, it was this is how you can grow, this is how you can get better...I'm not defined by my letter, I'm defined by my work.” “Carson” F24

“...learning was more fluid in this class. Learning looked different for everyone...everyone's growth looked different...this let's everyone's learning be on their own terms and allows everyone's journey to be their own.” EW F25

“...I was more focused on the learning experience than getting a grade moving forward without clarity.” YG F25

“...the difference...is that you accomplish and master the skill, traditional grading is what you show and turn in, traditional grading can measure a skill, but not always. Mastery shows your understanding.” GM F25

“Traditional grading ranks and sorts students based on overall performance while mastery grading makes sure all students reach a clear level of understanding.” GR S26

The students' comments show that they realized growth of their own abilities and understanding of content and that the new grading format contributed to these realizations.

3.2.3 Reduction of Pressure

Students were transparent about how MG led them to feel less pressure about grades and submitting assignments.

Less pressure

“...he didn't really put pressure on us (about) getting good grades...or stressing assignments for grades, more like making sure that we were able to apply science and make us better teachers.” “Carson” F24

“...know that I could (make revisions) made the process feel less pressured and more focused on actual learning than perfection.” KO F25

“...it took some pressure off since I knew I would have opportunity to redo an assignment if I could...” IB S26

“...it took a lot of pressure off the assignments.” IB S26

Reduce stress

With less pressure may come a reduction of stress, the physical or emotional reaction.

“...why am I stressing over it?...because it’s new...but if I saw it again, I’d be like, OK, like this is what to expect.”

“Marie” F24

“I think there’s a lot of stress removed from it...because I’m not getting a grade back...it was like, okay I’m doing something well but it’s not like I’m great yet...I know I need to work a little bit harder.” “Carson” F24

“I wish school districts and colleges would use this grading system because it limits the amount of stress a student has when it comes to grades...” RD F25

“In the traditional grading system I am nervous about my grade and it makes me stressed. This is because I put a lot of pressure on myself to get good grades. In this class I knew that even if I did not fully accomplish mastery on an assignment, I would be able to try again and fix it.” MJ S26

“... it took the stress off of receiving a few points off for small mistakes, where it’s more based on an overall grade.” JL S26

Worried less

Less uncertainty and anxiousness also played a role in the reduction of pressure for the pre-service teachers.

“...mastery grading treats mistakes as part of the learning process...I felt more motivated and less anxious because I knew I had space to grow instead of being judged on a single attempt.” CR F25

“Instead of worrying about grades to focus more on the actual learning. I was more comfortable trying new things or ideas in lesson plans because I knew I could go back and make changes where they were needed.” AB S26

Whether pressure, stress, anxiety, or worry, the generally negative emotions associated with these feeling seemed to lessen because of the mastery grading format.

3.2.4 Increased Effort

In order to obtain or ensure mastery, students showed they were there to put forth a more concerted effort.

“I’m not presenting to try and get an A, I’m going out there to do my best.” “Carson” F24

“Since we were not trying to achieve a grade and rather a level of work...I put more effort into the work I put forth” RD F25

“I held myself to a higher standard than I usually do when it comes to a typical grading system.” ND F25

“I interpreted it as my effort of understanding the material...” YG F25

“...pushed me to focus on quality of my thinking rather than just finishing the task.” YH F25

“...focus more on the quality of my learning, my improvement, and the feedback I received.” KO F25

But students also realized that doing the bare minimum just to pass was not an option, and that they could not hide with less than mastery level work.

“...I put more thought into my work...so even if it’s considered B-level work, it is not mastery” GM F25

“In a traditional grading system, it feels like ...you can still get a decent grade even if you didn’t fully understand or you didn’t really try. Because of that, it’s easier to focus on points instead of actual learning. With mastery grading, you can’t hide behind partial credit.” BW F25

There appeared to be a behavioral shift with the new grading system.

3.2.5 Change in Behavior

“...even though I got superior, I got feedback on how I could make it even better for next time...it wasn’t like I got an A and that’s it.” “Carson” F24

“It made me want to get everything correct the first time.” MM F25

“...adjust to a way where you had to put all your effort and best work in...” BS F25

“...that is what pushed me more to put 100% of my effort into getting the best grade I possibly could.” EW F25

“I paid attention in class so I know how to complete assignments.” MJ S26

“I was more comfortable trying new things or ideas in lesson plans” - AB S26

Mastery grading may have changed students’ motivation to uptick their efforts in learning and understanding the content and their ability to apply it.

3.2.6 Slowing Down to Learn

Finally, the students were not just rushing to get work done and earn points to be at a certain grade.

“...giving myself more space to actually think and be creative in my work, instead of rushing just to get points, it let me slow down and make the assignments feel like me...” YH F25

“It gives students the time and space to genuinely learn with having their work immediately labeled with a grade.” KO F25

“...shifted my focus from just getting the assignment done to actually making sure I understood the concepts well enough...” CR F25

“...focus more on the content to fully understand when completing assignments and going back to improve work when it was needed” AB S26

“...being able to actually grasp what we needed to do and not focus on the grade at all.” “Carson” F24

Students noted how the new grading system allowed learning to happen.

“It pushed me to slow down, revise my work, and make sure I really understood what I was doing...and make sure my work showed what I learned” BW F25

“I could go back and learn more...and get better...this let me think and learn more when I did not fully get everything correct the first time.” EW F25

“...it is important for a student to learn materials, not only complete work to get a good grade or keep busy.” JL S26

“...really focus on following the rubric and making sure the assignment was all good...I focused on every detail....It made me put in more time...I would prepare better and practice and review my final product...” BS F25

It was not a race to get things done, get a grade, and move on. The students’ perspective that the process of mastery grading allowed them breathing room and time to learn, improve, and flourish.

4. Discussion

The goal of this research was to identify what pre-service teachers in a science teaching methods course attitudes and understanding of MG was and how it affected their confidence, motivation to learn, and academic success. Quantitative survey results indicate that student motivation to learn and be academically successful was consistently high and that there was little change over the semester. There was a slight shift in their understanding of the potential impact of mastery grading system on their academic success, as they experienced MG and saw its potential benefits to improve their learning and their work, which would result in greater academic success. The most fascinating piece of the survey results, however, may be the PSTs unchanging views toward what factors should be considered for a letter grade. Many students who responded continued to cite attendance, effort, and extra credit, as components to be computed into a grade, even after their generally positive views and outcomes of MG as students.

Results from the qualitative data analysis revealed comments directly tied to a variety of generally positive attitudes and affect toward MG. Whether the fellows’ responses spoke to reflecting more deeply upon their work and its quality, self-realization of growth in their abilities and skills as a pre-service teacher and slowing down their own learning process to intensify their effort, which not only ultimately improved their outcomes but also removed a level of stress and pressure about their grade.

This trend of deeper thinking supports the findings of Stirrup (2023) where this aspect and growth mindset was evident from students’ comments about their quality of learning, retention of information, and what they should focus their work and efforts on. Student’s improved understanding of their abilities and mastery of content was also evident as described by Ice (2024), while better retention and improved learning was reported by Tripp et al. (2025).

The above finding may be related to the reduction of stress or pressure students felt as they grew accustomed to the new grading format. Tripp et al, (2025) also noted student’s decentering grades as the course progressed. This may have allowed them more time to revisit and practice ideas and skills and read and apply the feedback they received

from the instructor on different tasks, a feature cited by Ma (2023). This also may be attributed to time and opportunity to go back and redo, revise, and improve upon their work, an aspect described by dos Santos et al. (2024), Das (2025), and Garzone et al. (2023).

These themes are connected to the increased effort students were willing to put forth, once they grew comfortable and familiar with the process and procedures of MG. Because MG draws from Self-Determination Theory of Motivation, students have more autonomy in their own level of learning and feel more in control of their grade. Thus, students are motivated to prove mastery of the topics and skills. This also connects to the theme of Recognition of Growth, which may be aligned to a student's self-efficacy. As students experienced feedback, either positive or encouragement to revise and change to improve the quality of their work, they realized that taking the time and putting forth more effort into understanding concepts and complete tasks successfully was evidence they could and would succeed. Increases in self-confidence and self-efficacy were noted by Ma et al. (2025) and Morris et al. (2024), and Gargac (2024), and may be similar to the expressed recognition by students in this study.

5. Limitations and Conclusions

Some limitations were identified during this study that may have affected the findings. First was that all data is self-reported by the student, which may lead to certain bias in their responses to respond in a certain way rather than how they may have truly felt. Although the researchers never saw any data until after the semester was complete, and grades were submitted, this may have impacted students' thinking.

Another limitation was the limited number of participants and student response rate. The class size each semester was always under 20 students. A majority of students in the first year of data collection did not participate in the study, so the data pool became limited for both quantitative and qualitative results. Only one-third of all students who took the course may not be representative of all the students and their experience with MG.

The third limitation was the change in the data collection method. When this transitioned from separate surveys and scheduled interviews to expected work questions to be completed as part of the expected class routine, response rates did go up, and these are the majority of students in the study, but still not uniformly distributed across four semesters of data collection.

The purpose of this study was to understand what were middle-grades prep majors and pre-service teachers' attitudes and understanding of Mastery Grading, and how MG affected these students' confidence, motivation to learn, and academic success. Despite any limitations, this study offers outcomes for both research and practice.

Despite a low percentage of participants, those who did participate shed light on the benefits and positive outcomes of MG. As alternative grading systems become more widespread in their use, a paradigm shift may begin to occur in students of any major, as they realize the key positive aspects that the PSTs in this study recognized and described. This may increase motivation to improve learning, resulting in greater academic success, and may provide an improved measure of student understanding and skill ability. Future research on student self-efficacy and confidence using established valid and reliable instruments to measure changes or growth in these characteristics is warranted.

Traditional grading systems often measure when a student learns, rather than if they learn. This may reduce education to a race against the clock. By contrast, MG shifts the focus to deeper and more enduring understanding by decoupling the learning process from a punitive process of point reduction. By alleviating this anxiety, fostering a more resilient growth mindset, and providing ongoing transparent feedback and slowing down the process, this approach transforms evaluation into a tool for empowerment, as noted by the PST participants in this research. Ultimately, transitioning to mastery-based systems ensures that a letter grade at the end of the semester reflects actual competence and skill acquisition, creating an educational landscape where every student has the opportunity to achieve true proficiency.

Acknowledgments

We greatly appreciate the valuable contributions of the students (PSTs) in the methods class that participated in our study. We also thank Dr. Naomie Nyanuno, Associate Provost for Learning Teaching Innovation, and Dr. Cheryl Neale-McFall, Associate Provost for Research and Creative Activities, at West Chester University, for providing the initial support and opportunity to develop and conduct this research, with the creation of the Pedagogical Innovations Faculty Learning Community.

Authors' contributions

Dr. Roemmele was responsible for teaching the methods course, and developin the study design and data collection

and analysis and manuscript draftin. Dr. Pantazes oversaw participation consent, research design, and data analysis and drafting the manuscript. Both authors read and approved the final manuscript.

Funding

This work was supported by initial funding from acceptance into the Pedagogical Innovations Faculty Learning Community at West Chester University.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics

Research was approved through the University Institutional Review Board.

Ethics approval

The Publication Ethics Committee of Sciedu Press.

The journal and publisher adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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