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Balancing Rigor, Equity and Pedagogy: The Role of Specifications Grading in Higher Education Assessment

[1]Smita Jadhav
[1]University of Cincinnati, Blue Ash College, USA.

Abstract

This paper examines the impact of Specifications Grading (Specs) compared to Traditional Grading in a General Chemistry II course. Specifications Grading focuses on student competency, aiming to promote deeper learning, academic rigor, and equity through clear and standardized criteria. In this study, students were assessed using tasks aligned with Student Learning Objectives (SLOs) and were provided multiple opportunities to demonstrate mastery. The study found a significant increase in the percentage of students passing under the Specifications Grading system compared to Traditional Grading, with the passing rate increasing from 21% under traditional methods to 56% under Specs. This shift highlights the potential of Specifications Grading to improve student success and mastery of course material. Additionally, a student survey conducted at the end of the course revealed positive feedback toward the Specifications Grading system. Students reported that they found the system to be more transparent and equitable than traditional grading methods. Many expressed that the clear expectations and multiple chances for improvement made them feel more in control of their learning experience, contributing to greater engagement and reduced anxiety. The study concludes that Specifications Grading is an effective and pedagogically sound approach that fosters fairness, promotes mastery, and supports better student outcomes. These insights offer valuable guidance for educators looking to refine their assessment strategies.

Keywords: *Specifications Grading, Traditional Grading, Equity in Education, Competency-Based Assessment, Student Engagement, Mastery-Based Learning.*

1. Introduction

In higher education, finding fair and effective ways to assess student learning is an ongoing challenge. Traditional grading methods, which rely on points and letter grades, often fail to capture a student's true mastery of the subject and may unintentionally create inequities. Research shows that these traditional systems often reward students who have stronger academic backgrounds or are more familiar with academic norms, while leaving behind students who may not have had the same level of preparation (Nilson, 2014). Specifications Grading (Specs Grading) is an alternative system that aims to improve both fairness and learning outcomes by emphasizing competency and clarity. Unlike traditional grading systems, which often include partial credit, Specs Grading requires students to meet predefined criteria for each assignment, and those who fail to meet the standards can revise and resubmit their work. This focus on mastery ensures that all students, regardless of their initial skill level, have the same opportunity to succeed by demonstrating their competency (Nilson, 2014; Largent, 2017).

Studies conducted in various STEM courses, have shown that Specs Grading not only improves student letter grades but also leads to more positive interactions between students and instructors (Nilson, 2014; Largent, 2017). In a General Chemistry I course, for example,

students who followed this grading system demonstrated a higher level of engagement and persistence, as they were motivated to revisit and master the material instead of accepting partial understanding (Martine, 2019). Similarly, large-scale courses, such as those with over 1,000 students, have successfully implemented Specs Grading without significantly increasing instructor workload, by using strategies such as token systems for resubmissions. This grading method also fosters a more equitable learning environment, as it shifts the focus from point accumulation to mastering the course material at one's own pace (McKnelly, 2022).

This study explores how Specifications Grading affects student performance and engagement in a General Chemistry II course, with a particular focus on equity and pedagogy. Building on previous research, this exploration aims to assess whether this system can continue to provide the benefits observed in other courses and whether it can further promote deeper learning and fairness in STEM education (Azizi et al., 2023). Additionally, recent student surveys on the use of Specifications Grading show strong support for the system. Students expressed high levels of satisfaction with the clarity of expectations, the relevance of the content, and the opportunity to retake assignments. This aligns with Sadler's (2005) findings that clear, criteria-based assessment enhances student understanding of the standards they need to meet and improves overall satisfaction with the grading process.

Specifications Grading: A Focus on Equity and Mastery

Specifications grading is a grading system that moves away from point accumulation and instead focuses on mastery of specific learning objectives. Each task or assignment has clear, predefined criteria that students must meet to pass. Unlike traditional grading, which often gives partial credit for incomplete answers, Specs Grading evaluates assignments as either pass or fail based on whether the specifications are fully met. Research in dietetics courses suggests this approach fosters self-regulation and mastery while improving transparency in grading (Svitavsky, 2020). If students don't meet the required specifications, they receive feedback and can revise their work until they achieve the required competency (Largent, 2017).

The system promotes equity by giving all students the same clear expectations and multiple opportunities to succeed, regardless of their initial skill level (Nilson, 2014). Traditional grading methods sometimes favor students who are more familiar with academic norms or have stronger preparation, potentially leaving others behind (Leslie, 2020). In contrast, Specifications Grading levels the playing field by focusing on whether students can demonstrate the required skills or knowledge, no matter how many attempts it takes. By eliminating partial credit and allowing revisions, the system encourages persistence and resilience, ensuring that all students have an equal opportunity to succeed. Moreover, this grading approach has been applied successfully in healthcare education settings, fostering a focus on competency and professional skills (Leslie, 2020). This approach not only improves learning outcomes but also supports the development of a growth mindset in students (Azizi et al., 2023; Nilson, 2014).

Pedagogical Benefits of Specifications Grading

From a pedagogical perspective, Specifications Grading supports deeper learning by requiring students to engage fully with the material. Instead of merely aiming for a passing grade through partial understanding, students must meet the full requirements of each assignment to pass. This system encourages students to take ownership of their learning and engage more meaningfully with the course content, as it emphasizes understanding and mastery over simply accumulating points (Largent, 2017). Additionally, the opportunity for

resubmissions helps to reduce the pressure associated with high-stakes assessments, allowing students to focus on truly mastering the material rather than worrying about losing points (Nilson, 2014).

For instructors, Specs Grading offers a more transparent way to communicate expectations and provide feedback. According to Hattie and Timperley (2007), effective feedback is crucial for student learning and achievement, as it helps students understand their progress and areas for improvement. By clearly defining the standards for each task, Specifications Grading ensures that assessments are closely aligned with the course's learning objectives. Although managing resubmissions may initially require more time, many educators find that the system fosters better student-teacher interactions, leading to more meaningful learning experiences. In essence, Specifications Grading supports a pedagogy that prioritizes mastery, equity, and student engagement, encouraging both students and instructors to focus on learning outcomes rather than point accumulation (Hattie & Timperley, 2007; Nilson, 2014).

2. Method

Participants

The study included a total of 34 students enrolled in a General Chemistry II course during the spring 2024 semester. All students were given the same types of assessments throughout the course, but the Student Learning Objectives (SLOs) were split between two grading methods. One set of SLOs was assessed using Specifications Grading (Specs Grading), while the other set was assessed using traditional grading methods. This approach allowed for a direct comparison of student performance under both grading systems without dividing the students into separate groups. By analyzing how students performed on SLOs graded with Specs versus those graded with traditional methods, the study aimed to determine which approach more effectively supported student learning and mastery.

Procedure and Instruments

This research aimed to investigate the impact of Specifications Grading compared to Traditional Grading on student performance and engagement. Throughout the semester, students completed assessments called Quests, which were a mix of quizzes and tests aligned with key Student Learning Objectives (SLOs). Students had multiple attempts to complete the Quests, with each attempt featuring different versions of the questions to ensure fairness and maintain academic integrity. This approach allowed the study to compare how well students performed with several chances under Specifications Grading versus their performance under Traditional Grading, where they only had one attempt and could earn partial credit.To ensure fairness, both grading methods covered an equal number of topics and questions. At the end of the semester, a comprehensive final exam combined both grading systems, providing a clear opportunity to compare student performance.

The study used Multiple-Choice Questions (MCQs) to measure student performance throughout the semester. All assessments, including the final exam, were conducted in person, while students utilized Canvas, a Learning Management System (LMS), to request retakes and track their progress. The final exam assessed topics from both grading methods, enabling a straightforward comparison. Under Specifications Grading, students needed to achieve at least 80% to pass and could retake assessments if they did not meet the standard. By focusing on MCQs, the study aimed to ensure consistent and fair grading for all students, with performance tracked throughout the semester to evaluate the impact of each grading system on learning outcomes.

Statistical Data Analysis

To analyze the data, a Paired Samples T-Test was used to compare student performance between the two grading methods. The test evaluated whether there was a significant difference in exam scores between students graded using the Specs system and those graded using the traditional method. A dependent t-test revealed a significant improvement in exam scores when students used Specs (M = 35.94, SD = 7.51) compared to when they did not have access to Specs (M = 26.71, SD = 8.48), t (33) = 7.34, p < .001, d = 1.26. This large effect size indicates a substantial positive impact on student performance.

Pass Rates

The number of students achieving a passing grade (C- or better) was significantly higher under Specifications Grading. Specifically, 56% of students passed using the Specs Grading system, compared to only 21% who passed under traditional grading. This demonstrates that Specifications Grading had a notable positive impact on students' ability to meet the required standards, suggesting that it is a more effective method for helping students succeed in the course. Table 1 provides a detailed comparison of the passing rates between the two grading methods, further illustrating the difference in student success. The bar chart in Figure 1 illustrates the average exam scores for students under each grading system, highlighting the significance difference in performance.

Table 1. Performance Comparison Using the Two Grading Methods

Grading Method	Mean Score	Standard Deviation (SD)	Passing Rate (C- or better)
Specifications Grading	35.94	7.51	56%
Traditional Grading	26.71	8.48	21%

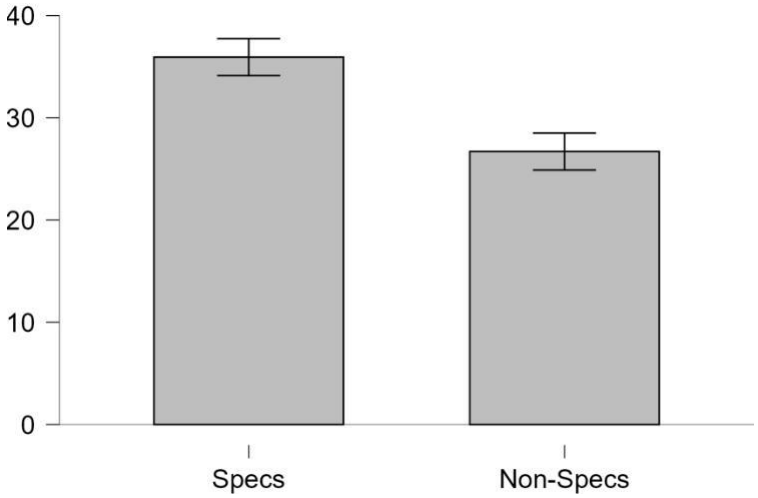

Figure 1. Mean Score for Specifications Grading and Traditional Grading

Table 2 highlights the results of the Paired Samples t-Test and Descriptive Statistics comparing student performance between Specifications Grading and traditional grading. The Cohen's d = 1.26, suggests a large effect size, demonstrating that the impact of Specifications Grading on student performance was not only statistically significant but also substantial. These descriptive statistics show a clear advantage for students graded using the Specs system.

Table 2. Paired Samples t-test and Descriptive

Measure 1	Measure 2	t	Df	P	Cohen's d	SE Cohen’s d

Specs	Non-Specs	7.340	33	< .001	1.259	0.209
		N	Mean	SD	SEM	Coefficient of variation
Specs		34	35.941	7.507	1.287	0.209
Non-Specs		34	26.706	8.484	1.455	0.318

3. Results

The results show a significant difference in student exam performance with the use of Specifications Grading (Specs). This is supported by the p-value and Cohen's d effect size, where a value above 0.8 indicates a large impact. The number of students achieving a passing grade (C- or better) was notably higher with Specs Grading. Specifically, 56% of students passed using Specs, compared to only 21% under traditional grading. Additionally, 12 out of 34 students improved their exam scores and passed when using Specs, highlighting the positive effect this grading method had on student performance.

These findings suggest that Specifications Grading is a more effective method for helping students succeed in the course, leading to better outcomes compared to traditional grading. Table 1 provides a detailed comparison of the passing rates between the two grading methods, further illustrating the difference in student success.

The findings indicate that students performed significantly better when assessed using Specifications Grading compared to traditional grading methods. Additionally, the higher passing rates under Specs Grading suggest that this approach not only helps students improve their understanding but also promotes greater success in achieving mastery of the material.

Based on the survey responses in Figure 2, students reported highly positive experiences with the Quests system, with an overall average score of 4.5 on the Likert scale. The highest-rated aspect was the relevance of the Quest content to the course material, receiving an average score of 4.7. Students also found the ability to retake Quests and the overall value of Quests in the course to be particularly beneficial, both scoring 4.6. Moreover, students expressed strong agreement that they would recommend continuing the use of Quests and felt that it motivated them to engage more with the material (both also scoring 4.6). Confidence in understanding the material saw a slightly lower average of 4.3, indicating room for improvement in this area. The lowest score, 4.2, was given to the specificity of the feedback provided. Overall, the feedback suggests that students found the Quests to be an effective tool for reinforcing key concepts and preparing them for assessments, with clear expectations and instructions contributing to a positive learning experience.

These results support the hypothesis that Specifications Grading is a more effective and equitable method for evaluating student learning in General Chemistry II.

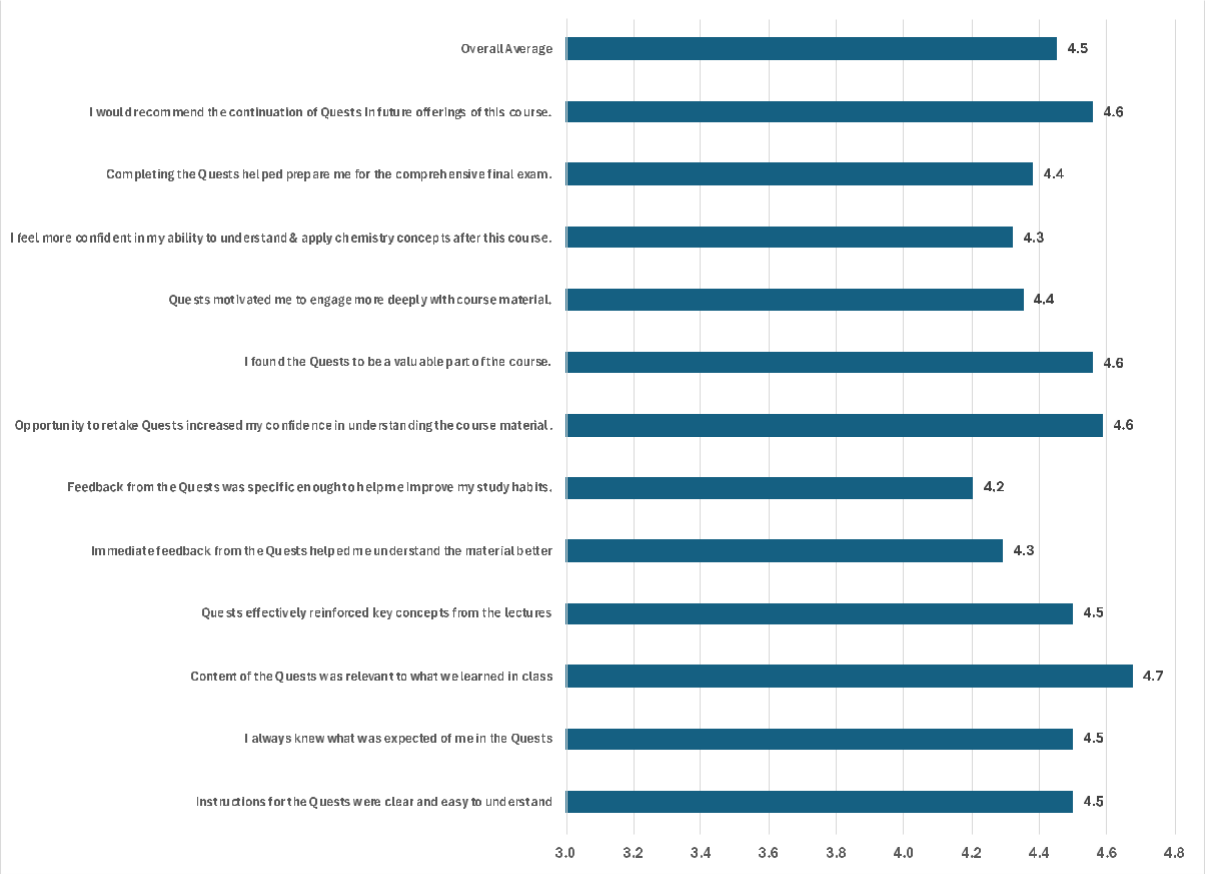

Figure 2. Student Feedback on Quests in a General Chemistry II Course

4. Discussion

The findings from this study suggest that Specifications Grading has a significant positive impact on student performance compared to traditional grading methods. Students who were graded using the Specifications system scored higher on exams and had a higher pass rate. Specifically, the results showed a clear advantage in both exam performance and overall passing rates, with 56% of students passing under Specifications Grading, compared to just 21% under traditional grading. These findings suggest that Specifications Grading helps more students meet the course's required standards (Azizi et al., 2023).This positive outcome aligns with previous research on the effectiveness of Specifications Grading in STEM courses. Studies have shown that Specifications Grading promotes mastery-based learning, encouraging students to fully engage with the material instead of merely aiming for partial understanding (Nilson, 2014). By offering opportunities for revision and resubmission, this system gives students the ability to improve their performance over time, which likely contributes to the higher pass rates observed in this study (Largent, 2017).

Hattie and Timperley (2007) emphasize that feedback is a critical factor in promoting learning, and Specifications Grading's structure, which allows for multiple attempts and continuous feedback, provides students with the opportunity to use this feedback effectively to meet the required standards. Differing perceptions in the feedback process between students and instructors can also significantly affect how feedback is received and acted upon (Carless, 2006; Hattie & Timperley, 2007).

Moreover, the elimination of partial credit in favor of a pass/fail evaluation may be a key factor in driving student success. Without the safety net of partial credit, students are required

to meet clearly defined standards for each task, fostering deeper learning and persistence, which aligns with broader best practices in higher education assessment (Bloxham & Boyd, 2007; McKnelly et al., 2022). This system also helps reduce inequities that are sometimes perpetuated by traditional grading methods, where students with stronger academic backgrounds are often more familiar with point-based systems (Nilson 2014; Ritchey, 2019). In contrast, Specifications Grading focuses on whether students meet the required competencies, giving every student an equal opportunity to succeed, regardless of their starting point (Martin, 2019).

In addition to benefiting students, Specifications Grading has been found to enhance the teaching and learning experience for instructors. Although managing resubmissions may initially seem time-consuming, instructors report more positive interactions with students and a deeper alignment between grading practices and learning outcomes (Blumberg, 2014). Hattie and Timperley (2007) highlight the importance of timely, relevant feedback, and the transparent expectations in Specifications Grading help streamline feedback and foster a more collaborative learning environment (Hendry & Anderson, 2011). Overall, the findings from this study, supported by existing literature, indicate that Specifications Grading not only improves student performance but also promotes equity and engagement in the classroom. This approach encourages students to take ownership of their learning and work towards mastery, providing long-term benefits that extend beyond the classroom (Sadler, 2005; Kohn, 1999).

Interpretation and Significance of Findings

The significant difference in student performance between the two grading methods indicates that Specifications Grading may be a more effective way to ensure students achieve mastery of course material. By focusing on clear, specific criteria and allowing students multiple attempts to revise and resubmit their work, Specifications Grading appears to help students better understand the content and succeed in assessments. The large effect size (Cohen's d = 1.26) further supports the substantial impact of this grading system on student learning outcomes.

These findings align closely with previous research on Specifications Grading, which suggests that this system promotes deeper learning and reduces student stress by providing clear expectations and multiple opportunities for success (Nilson, 2014). The increased pass rates observed in this study are consistent with earlier research, where students using Specifications Grading demonstrated improved academic outcomes, especially in STEM courses. For example, a study conducted in large chemistry courses showed that Specifications Grading helped students from diverse academic backgrounds succeed by focusing on competency rather than point accumulation (McKnelly et al., 2022).

Traditional grading methods, which often emphasize partial credit and focus on overall scores, may not provide the same level of support for students to achieve mastery of key concepts (Largent, 2017). In contrast, Specifications Grading requires students to demonstrate full understanding of the material, encouraging persistence and promoting long-term retention of concepts (Azizi et al., 2023). This shift from point-based evaluations to mastery-based learning helps level the playing field for all students, offering a more equitable approach to grading (Largent, 2017; Azizi et al., 2023).

Implications for Teaching and Learning

The results of this study have important implications for teaching and learning in higher education, particularly in challenging courses like General Chemistry. Specifications Grading

offers a more equitable approach to assessment by giving all students the same clear standards to meet and allowing them multiple chances to improve (Nilson, 2014). This system can reduce the anxiety associated with high-stakes exams and encourage students to focus on learning rather than simply earning points.

For instructors, adopting Specifications Grading may require more time and effort in providing detailed feedback and managing resubmissions. However, the potential benefits, such as improved student understanding and higher pass rates, make it a valuable alternative to traditional grading systems (McKnelly et al., 2022). These findings suggest that educators looking to improve student success and promote equity in their classrooms should consider incorporating Specifications Grading into their teaching practices (Azizi et al., 2023).

Overall, this study adds to the growing body of evidence supporting Specifications Grading as an effective, equitable, and pedagogically sound alternative to traditional grading methods.

5. Limitations and Challenges

As observed by Kohn (1999), traditional grading systems, which focus on points and letter grades, can reduce students' intrinsic motivation and often do not reflect their true understanding of the material. While Specifications Grading has many advantages, such as promoting mastery and fairness, it does come with challenges. One issue is the extra time and effort instructors need to provide detailed feedback and manage multiple retakes, especially in large classes. As Nilson (2014) points out, this can significantly increase the instructor's workload. Some students may also find the pass/fail nature of the system difficult because there is no partial credit. Additionally, the Student Learning Outcomes (SLOs) were divided into two parts, one for Specifications Grading and the other for traditional grading, which may have played to the strengths of some students based on their prior knowledge and understanding of the topics.

Another challenge is that students might start to memorize steps instead of truly learning the material, especially if they know what to expect in retakes. Ensuring academic integrity in a system that allows retakes requires varied assessments to avoid students memorizing answers, a strategy supported by Hendry and Anderson (2011), and close monitoring to prevent cheating.

6. Conclusion

This study demonstrated that Specifications Grading has a positive impact on student performance in a General Chemistry II course, consistent with prior research. Students graded using this system not only scored higher on exams but also had significantly higher pass rates compared to those graded with traditional methods. The results suggest that Specifications Grading provides clearer expectations, supports deeper learning, and creates a more equitable environment by giving students multiple opportunities to meet specific standards. This aligns with previous findings that Specifications Grading encourages mastery by eliminating partial credit, allowing students to focus on achieving competency rather than accumulating points. The large effect size observed in this study highlights the substantial improvement in student outcomes with this approach, which has also been reflected in larger-scale studies in various STEM disciplines.

While these findings are promising, further research is needed to explore the long-term effects of Specifications Grading across different types of courses and student populations. For instance, examining how this grading method influences retention, student motivation, and overall academic success in more diverse educational settings would provide valuable

insights. Additionally, future studies could focus on the scalability of this approach in courses with larger enrollments, as well as its impact on faculty workload and teaching practices.

7. Recommendations

Based on the findings of this study, it is recommended that instructors consider adopting Specifications Grading in a wider range of courses, particularly those that are challenging and require mastery of complex material. This grading system could be especially beneficial in promoting equity and improving student outcomes across various subjects. Future research should focus on exploring how Specifications Grading impacts diverse student groups, including those with different academic backgrounds and learning needs, to better understand its potential to support all students. Additionally, it would be valuable to examine the long-term effects of this grading method on academic performance, retention rates, and success in more advanced courses. To support educators in implementing Specifications Grading effectively, there is a need for training programs and resources that help instructors design clear specifications and provide meaningful feedback to students. By addressing these areas, Specifications Grading could be further refined and widely adopted to improve teaching and learning outcomes.

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