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ABSTRACT
In this paper, we detail the implementation of initiatives designed to support instructional strategies aimed at fostering more fair and inclusive learning practices in Precalculus, Calculus 1, and Calculus 2 courses at the University of Texas Rio Grande Valley. We discuss the progression of course coordination efforts intended to improve students' learning and mitigate the detrimental effects of the COVID-19 pandemic on students' mathematics education. Prepandemic early coordination initiatives involved adoption of common textbooks, syllabi, and content coverage across all sections of each course. Subsequent course improvements involved the incorporation of active learning to engage students in collaborative problem-solving sessions with the support of undergraduate Learning Assistants. We have adopted Specifications Grading, an alternative grading system, as part of our most recent reform endeavor to invigorate students' success in Calculus 1.

KEYWORDS
Coordination; active learning; specifications grading; growth mindset; calculus

1. INTRODUCTION

The University of Texas Rio Grande Valley (UTRGV) was formed in September 2015 through the consolidation of two legacy higher education institutions, both located in south Texas and separated by 65 miles. The state's investment in the new university represented a commitment to increase opportunities for students in the U.S.-Mexico border region. UTRGV is one of the largest Hispanic-Serving Institutions in the U.S. with Fall 2022 student enrollment exceeding 31,000; 91% of students being of Latino descent; 55% being first-generation college students; and 60% eligible for Pell grants. After the consolidation, the mathematics departments from both campuses were combined into the School of Mathematical and Statistical Sciences (SMSS). In this paper, we outline the various curricula and pedagogical reforms that the department has undertaken in Calculus 1. In Section 2, we discuss initial implementations of coordination. Section 3 discusses revised modifications and our preparedness in Calculus 1 to the COVID-19 pandemic. In Section 4, we discuss curricula learnings from the pandemic which resulted in adopting a more

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equitable assessment method in Calculus 1. Section 5 discusses the department's latest implementation of Specifications Grading, followed by current findings in Section 6. Then Section 7 discusses the current status of additional department innovations. Finally, concluding remarks are provided in Section 8.

2. GROUNDWORK OF PAST INITIATIVES

After the consolidation in 2015, faculty from the two campuses met frequently to weave together initiatives and forge a common teaching culture. Initially, no coordination existed among the core courses offered on both campuses, and no common textbooks were adopted for common courses. This led to new opportunities and challenges, particularly regarding the coordination of core courses. One campus had a well-organized coordination system with common textbooks, syllabi, and lecture/exam schedules, along with a dedicated course coordinator managing homework, quizzes, and exams. On the opposite campus, the coordination was limited to a common textbook and final exam, with fewer shared practices.

It was crucial to establish better coordination to ensure fairness and similar standards for all students and minimize expenses for those who repeated courses on different campuses (e.g., [14]). Achieving effective coordination was essential for providing a well-rounded and inclusive learning experience while boosting student involvement [19], but it involved overcoming longstanding challenges and encouraging faculty to collaborate.

In Fall 2015, the SMSS recognized that faculty on different campuses were covering core course topics differently, with various textbooks and learning resources and diverse outcomes. To address this, the department began cultivating coordination practices, including the adoption of common textbooks, syllabi, and content coverage. In Spring 2016, a pilot program was initiated to improve student success in Calculus 1 and Calculus 2. The initiative encouraged faculty volunteers from both campuses to collaborate in revamping these courses. The resulting pilot included common interventions such as collaborative problem-solving sessions, modeled after Treisman's work in the mid-1980s [18]. It expanded in Spring 2017, and faculty agreed on 80% commonality for syllabi, assessments, exams, and weekly topics. The pilot program continued for two years, with a small group of faculty volunteers showing strong buy-in.

After successfully piloting collaborative problem-solving sessions and coordination in a subset of Calculus 1 and Calculus 2 classes, the department was awarded a two-year SEMINAL Project grant in Fall 2018 to expand the program in active learning methods to Precalculus, Calculus 1, and Calculus 2 (P2C2) courses. The grant allowed the introduction of Precalculus classes to collaborative problem-solving sessions, and coordination across the two campuses. Over the first year, 24% of Precalculus, 50% of Calculus 1, and 35% of Calculus 2 sections participated in the Project. This expanded significantly in future years and grew to include other core courses.

One primary method for increasing active learning through the project grant was implementation of weekly collaborative problem-solving sessions. These sessions replaced traditional lectures and occurred every Friday for 50–75 min. During the sessions, students worked in groups on worksheets related to topics covered earlier in the week. Faculty and undergraduate Learning Assistants (LAs) provided support and guidance. Students were encouraged to discuss with peers and use various resources, including lecture notes, textbooks, and software like Wolfram Alpha and Desmos. The exercises aimed to develop skills, enhance communication with mathematical terms, and foster conceptual understanding. In addition to assisting students during the weekly problem-solving sessions, LAs graded worksheets and offered Q&A sessions for all students outside of class.

In Villalobos et al. [19], the effectiveness of the Project was assessed by comparing student pass rates and common final exam scores in Project and non-Project courses. Precalculus and Calculus 1 students in Project classes performed better than their counterparts in non-Project classes. The study served as a starting point for further investigations into factors that may influence instruction using active learning and standards-based grading strategies in core mathematics courses.

3. WEATHERING THE PANDEMIC THROUGH COORDINATION

When the COVID-19 pandemic occurred in March 2020, the university had been on Spring Break, and thereafter, faculty were provided an additional week to adjust their teaching to online teaching for the remainder of the semester. At the time of the pandemic, all sections of Precalculus and Calculus 1 classes were coordinated. The coordination resulted in large part from the SEMINAL Project targeting P2C2 courses. Therefore, these classes transformed to online teaching with relative ease. The coordinating team provided much assistance to the P2C2 instructors and found itself doing many "firsts" with respect to online teaching.

Zoom sessions with P2C2 instructors were provided to discuss best practices for online teaching and share ideas, which made it less likely that individuals felt overwhelmed as the team worked together. Additionally, the coordinators created multiple choice and free response questions for online exams and continued to share materials with instructors to solicit feedback. Teams of faculty provided guidance on how best to conduct online collaborative problem-solving sessions. Learning Assistants were assigned to each class to supervise small groups of students through breakout rooms in Zoom while instructors assisted students who indicated help was needed and randomly visited each breakout room. Information was shared on how to create online assignment submissions for worksheets and exams in the learning management system, Blackboard Learn.

4. PANDEMIC REVELATIONS IN TEACHING

The pandemic exposed inequities in teaching and learning from the K-12 level to the college level with a digital divide, under-resourced classrooms, and decreased

enrollment in higher education [16]. In particular, K-12 students in Fall 2020 were three months behind on average in Mathematics while students of color were three to five months behind [5]. The sudden change of teaching modality from face-to-face to online brought new challenges to instructors and students. Some of the main challenges for instructors consisted of evaluating students and providing opportunities for effective student-student and instructor-student interactions, while students faced issues of online accessibility and learning from home in a distracting environment [10]. Issues of academic integrity arose from faculty's lack of preparation for online assessment and proctoring. This was exacerbated by students' stress about online learning. In essence, the pandemic produced a generation of students who were unprepared for subsequent courses [10].

We experienced similar hurdles as instructors and sympathized with our learners. This led us to seek new ways to improve our teaching methods and help our students learn and succeed. In Spring 2021, several instructors involved in the SEMINAL Project attended an introductory workshop on an alternative grading method in College Algebra organized by SEMINAL. Our pilot in Calculus 1 in Fall 2021 was motivated by a desire to increase equity for all groups of learners [2,12]. A team of five faculty were identified in early Summer 2021 to implement the alternative grading method of Specifications Grading in Calculus 1. The team attended the two-day online Mastery Grading Conference-University STEM Focus in June 2021. The conference discussed challenges, expectations, and initial efforts by faculty and departments to implement Specifications Grading in STEM courses. As the team was beginning to create curricula materials, common syllabi, and learning targets for Calculus 1, we reached out to Dr. David Clark, an organizer of the conference from the Department of Mathematics at Grand Valley State University, to guide us through developing an effective Specifications Grading assessment method for the Calculus 1 course. We took Clark's advice and benefited from material he shared with us to prepare a Specifications Grading-based system for Calculus 1. Two sections of Calculus 1 were piloted in Fall 2021 and more sections joined in Spring 2022 and thereafter.

4.1. Specifications Grading and Growth Mindset

Specifications Grading represents a grading approach centered around achieving unique learning targets (or learning objectives/outcomes) within a course [12]. Rather than allocating points for assessments, students receive a detailed assessment report, indicating either a pass/fail or satisfactory/unsatisfactory progress towards the learning targets. These learning targets could encompass various aspects of students' work, such as the tasks' completeness, the solving of mathematical problems, and the adherence to specific criteria in writing mathematical proofs. Most importantly, this approach allows students with opportunities to improve their work and resubmit it to meet the desired learning target. At the end of the semester, letter grades (i.e., A, B, C, D, F) are assigned based on the learning targets achieved. This system ensures that students are aware of the grading criteria from the beginning

and can plan their efforts accordingly to achieve their desired letter grade. Additionally, partial credit is not offered in assignments but rather feedback is provided to guide the student in their resubmission and understanding. This minimizes conflicts between students and faculty and saves faculty time that would otherwise be spent determining partial credit scales. By implementing Specifications Grading, educational institutions uphold rigorous academic standards, promote student motivation, foster a sense of accountability for one's grades, and discourage academic dishonesty [12,13]. The multiple reassessment opportunities aligned with specific learning targets allow learners and facilitators to track progress in a fine-grained manner and tailor support and skill-building to individual student needs. Our implementation constitutes an asset-based approach to address pandemic-related learning gaps [8].

We argue that using Specifications Grading provides an educational space that can foster a "growth mindset" among students. This is a mindset in which the learner believes that their talents can be developed with time and practice as opposed to a "fixed mindset" in which the individual believes in innate talent incapable of being developed by anyone not born with it [7]. Indeed, Sun [17] claims that there are 14 teaching practices that have the potential to foster a growth mindset in mathematics classrooms, some of which involve giving feedback and evaluating students. Sun [17] also suggests that practices such as offering verbal praise, providing written feedback, granting opportunities for additional assistance, and implementing grading policies that allow students to revise their work can contribute to the development of a growth mindset among students. Since Specifications Grading allows students to make multiple attempts at meeting learning objectives, receive written feedback on assessments, and seek extra help, we contend that instructors who adopt Specifications Grading could significantly enhance students' growth mindset and, most importantly, their overall achievement in mathematics.

5. IMPLEMENTATION OF SPECIFICATIONS GRADING IN CALCULUS 1

The team decided to implement Specifications Grading in a subset of Calculus 1 classes in Fall 2021 after learning about Specifications Grading and Growth Mindset through workshops, meetings, and literature reviews. Of all courses in the department, Calculus 1 was the first course to implement Specifications Grading. Below we describe our implementation of Specifications Grading in Calculus 1.

For our implementation of Specifications Grading in Calculus 1, assessments consisted of individually completed learning targets and collaborative problem-solving sessions where students worked together on worksheets associated with learning targets. The combination of worksheets and individual assessments permitted students to earn credit for a specific learning target. Online homework through WeBWorK was also part of the course grade. As part of the coordination, each instructor was provided with a schedule consisting of weekly lectures, collaborative problem-solving sessions, along with exam dates. Two coordinators created worksheets, exams, and weekly reassessments.

5.1. Learning Targets

Learning targets were grouped into 5 subject areas: limits; conceptual understanding of the derivative; using differentiation rules; applications of the derivative; and conceptual understanding of the integral along with the Substitution Rule. Additionally, learning targets were divided into supplementary learning targets and core learning targets of which the latter are essential for passing the course. Credits earned for a subset of the supplementary learning targets were a factor in determining the letter grade for the course. Students earned credit for a learning target through correct completion of a worksheet offered during the collaborative problem-solving sessions and through an individual assessment (exam) of that learning target.

Assessments of learning targets were graded on a pass/no-pass basis. Students had multiple opportunities to earn credit for worksheets by resubmitting re-worked problems and/or by orally explaining their work; in these instances, instructors had the option of asking students additional questions to affirm that students understood concepts. Exam credit was earned through four exams containing the respective learning targets. If students did not receive credit for learning targets, opportunities for reassessment were provided on each Friday of the semester after the first exam. Students could reassess as many learning targets as needed on Fridays. For the students who could not reassess on Fridays (due to job or transportation issues), opportunities to reassess on Mondays or after class were handled individually by instructors.

To encourage students to learn concepts and increase their likelihood of passing missed learning targets from exams, students were asked to seek tutoring from the university's Learning Center, the MathLab, the class-assigned Peer-Led Team Learning leaders, or the instructor on the missed learning targets and submit a Tutoring Signature Slip on the day of reassessment.

5.2. Initial Implementation

In its initial implementation in Fall 2021, 32 learning targets were created and divided into 19 supplementary learning targets and 13 core learning targets. Credit for each learning target required correct submission of both the worksheet and exam assessment/reassessment. Moreover, WeBWorK homework was a required part of the semester grade. The WeBWorK problems provided students with online homework to practice concepts and understanding. The semester grade was determined by credits earned for the core learning targets, supplementary learning targets, and the WeBWorK average grade; see Figure 1.

5.3. Modifications to Specifications Grading

As the project progressed and feedback was obtained, adjustments were made to the learning targets. We present the adjustments that were implemented in Spring 2023.

Semester Grade	Core Learning Targets (out of 13)	Supplementary Learning Targets (out of 19)	WebWork (avg total grade)
A	13	≥ 16	≥ 85%
B	13	≥ 13	≥ 75%
C	13	≥ 10	≥ 65%
D	16 of any CORE/Supplementary		≥ 50%
F	Have not fully completed any of the above rows.		

Figure 1. Fall 2021 grade distribution in Calculus 1 with Specifications Grading.

Semester Grade	Core Learning Targets (out of 10)	Supplementary Learning Targets (out of 11)	Non-testing Learning Targets (out of 6)	WebWork (avg total grade)
A	10	≥ 9	5	≥ 85%
B	10	≥ 7	4	≥ 75%
C	10	≥ 5	3	≥ 65%
D	12 of any Core/Supplementary			≥ 50%
F	Have not fully completed any of the above rows.			

Figure 2. Spring 2023 grade distribution in Calculus 1 with Specifications Grading.

First, we noted that some exams contained too many learning targets; for example, two exams were comprised of eight learning targets. Many of these learning targets required answering multiple questions. We distilled the number of learning targets from 32 to 27 with 10 core learning targets, 11 supplementary learning targets, and 6 non-testing learning targets. The core and supplementary learning targets still required credit earned from worksheets and exam/reassessments. However, the exam/reassessment component was removed for some learning targets to reduce the large number of questions on exams. The learning targets requiring only worksheet credit were called non-testing learning targets. See Figure 2 for letter grade requirements.

5.4. Blackboard Gradebook in Specifications Grading

The gradebook is a cornerstone of Specifications Grading. It was a challenge to find or create one that was easy to use by both instructors and students, with secure access, and with the ability to calculate the grade based on the various learning targets and the online homework. After exploring several free and commercial gradebooks, the team decided to modify the gradebook in Blackboard Learn, which is our institution's officially adopted learning management system. A master gradebook was created in a template course to be copied by instructors into their own section's Blackboard Learn course. Blackboard Learn (Release 3900.69.0-rel.35+f94c281) has limited capabilities of calculating average, weighted average, minimum, maximum, and total scores for all or selected columns and categories. In addition, the lowest and highest grades can be dropped or used from selected

TOTAL LEARNING TARGETS COMPLETED	CORE LEARNING TARGETS COMPLETED	SUPPLEMENTARY LEARNING TARGETS COMPLETED	NON-EXAM LEARNING TARGETS COMPLETED	L1-EX	L1-WS	L1
6.00	3.00	0.00	3.00	0.00	1.00	50.00%
25.00	10.00	9.00	6.00	1.00	1.00	100.00%

Figure 3. Screenshot of Blackboard gradebook for Specifications Grading.

columns and categories. Our implementation used these capabilities by adding artificial, hidden columns with fixed values and intermediate calculations. The team created a gradebook template that showed the student the status of their various learning targets. The current grade was also shown in the form of columns "D at least?", "C at least?", "B at least?", and "A?" with values "not yet" or "yes."

The grading columns for the 27 learning targets were coded according to the topics they covered. Limits: L1-L4; conceptual understanding of the derivative: DM1-DM6; differentiation strategies: DS1-DS4; applications of the derivative: DA1-DA5; and conceptual understanding of the integral (Fundamental Theorem of Calculus) and the Substitution Rule: FTC1-FTC8. Twenty-one of the 27 learning targets were deemed completed through both exam and worksheet components. This required the creation of additional gradebook columns with "EX" (exam) and "WS" (worksheet) designation. For example, gradebook columns "L1-EX" and "L1-WS" had maximum score 1 each for completion and had corresponding gradebook category L1. The learning target's column L1 was calculated as a total of the L1-EX and L1-WS columns with primary display percentage and "running total" set to "no" to show 0% if the student had not obtained credit for both the exam and worksheet components; 50% if one component of the learning target had been completed; and 100% if both the exam and worksheet components had been completed.

Figure 3 provides an example of the Blackboard gradebook showing two horizontal rows for two distinct students. In particular, the first row shows that the student required exam credit for L1. Hence column L1-EX was marked as 0 while column L1-WS was marked as 1 indicating that the student gained worksheet credit for learning target L1. In total, column L1 was marked as 50% mastery since the student required exam credit for learning target L1. The second row shows that this student was awarded credit for both the worksheet and exam for learning target L1 and hence there was no further need to complete assessments for L1 as evidenced by the score of 100% in column L1. Furthermore, the gradebook shows the current number of learning targets completed by each student during the course.

6. STUDENT SUCCESS IN INNOVATIONS

In this section, we provide quantitative and qualitative measures to show the success of Specifications Grading in a subset of Calculus 1 classes. We begin by describing pass rates over three recent semesters and conclude with feedback from two students

Table 1. Average pass rates (and number of sections) for Calculus 1 classes with and without Specifications Grading.

	Fall 2021	Spring 2022	Fall 2022	Spring 2023
Specifications Grading	55.27 (2)	65.77 (9)	69.11 (8)	81.30 (11)
No Specifications Grading	58.65 (9)	68.21 (5)	57.9 (5)	78.14 (4)

with contrasting views dependent on their participation or non-participation in Specifications Grading.

6.1. Pass Rates in Calculus 1

Specifications Grading has continued to be applied to a subset of Calculus 1 classes in the fall/spring semesters since Fall 2021. Its implementation began in Fall 2021 with 2 sections of Calculus 1 and with increased participation thereafter. Table 1 shows the average pass rate and the number of classes with Specifications Grading and without Specifications Grading, which applied traditional grading methods, over four semesters. The large increase in average pass rate with Specifications Grading occurred in Spring 2023. This increase can probably be attributed to the revision of the number of learning targets and familiarity with the assessment method in addition to the consistency of instructors teaching Specifications Grading and the close coordination of assessment/retesting and grading structure as opposed to the traditional courses where each instructor creates their own exams, grading structure, and may adjust grades as they see fit. The data presented is preliminary and we plan to study how students who are enrolled in Specifications Grading perform in subsequent courses such as Calculus 2.

6.2. Math Identity and Specifications Grading in Calculus 1

One way to measure student success is through examination of final grades. However, to gain a more comprehensive and multifaceted assessment of the effectiveness of our efforts, we chose a case study approach [20] to delve into two of our students' mathematics identity development in these classes. The literature has consistently emphasized the positive influence of a strong mathematics identity on students' academic choices, experiences, and accomplishments [4]. According to Adams [1], mathematics identity refers to the beliefs and attitudes that students develop about their competence in mathematical settings and their ability to utilize mathematics effectively in various aspects of life. This includes the students' (1) beliefs about their own mastery of mathematics, (2) beliefs about how others see them as a "math person," (3) their interest in mathematics, and (4) their overall belief that they are indeed a "math person" [3]. A summary of the preliminary findings that have stemmed, thus far, from these efforts is provided.

Case study research involves an in-depth exploration of a phenomenon, by which researchers investigate the "how" and "why" questions about the phenomenon by

using quantitative and/or qualitative analysis of multiple data sources [20]. We performed a case study analysis of two students to explore the phenomenon of students' experiences in Calculus 1 courses with Specifications Grading versus traditional grading. We collected survey data that measured each students' mathematics identities before and after their course [4] and conducted semi-structured interviews [6] with each participant at the end of their course to analyze the influence of Specifications Grading and traditional grading on their mathematics identity development. We used qualitative data analysis involving rounds of inductive and deductive coding [11] to analyze the transcripts of the interviews. For further description of these analyses, see [8].

Two students, Carlos and Oscar (both pseudonyms) were selected for this case study primarily because of their similar background characteristics. They both identified as bilingual in Spanish/English, male Hispanics, and were Junior undergraduate Engineering majors. They had both previously withdrawn from their respective traditionally graded Calculus 1 courses due to low grades. In their interviews, both students highlighted experiencing minimal lecturing time during their previous Calculus I coursework. Instead, the instructors of both students focused extensively on covering example problems and homework assignments during class time to prepare students for quizzes and major examinations. Where these two experiences seemed to differ is in the collaborative aspect of their respective former instructors and their courses.

Carlos claimed his previous Calculus I instructor emphasized collaborative learning activities a lot more than Oscar. Carlos said his previous Calculus I course had plenty of opportunities for classroom discussions and collaborative assignments. Carlos also said he experienced more in-class time to work on assignment corrections, as opposed to Oscar, and he claimed an overall stronger connection between the material being covered and real-life scenarios and other subjects. However, once they enrolled in their current Calculus I course, a striking difference between Carlos's and Oscar's experience became apparent. Oscar's participation in a Specifications Grading course appeared to have a notable impact on his identity development, unlike Carlos, who was enrolled in a traditionally graded Calculus 1 course. Therefore, these two cases presented an intriguing theoretical contrast, as often observed in case study research [20]. Choosing these students as participants allowed us to exemplify the most differing pair of cases in which both students are "similar on all the measured independent variables, except the independent variable of interest" (p. 304) [15], where the variable of interest here is the students' experience in Specifications Grading or traditionally graded Calculus 1 courses.

The data suggested that Oscar's experience in his Specifications Grading Calculus 1 course had a profound impact on his academic progress. Given the ample opportunities to resubmit his work, he demonstrated persistence in retaking exams until he successfully mastered his desired learning targets. This contrasted sharply with his previous encounter in a traditionally graded Calculus course, where failure to achieve mastery on the first attempt led to feelings of demoralization. For instance, he explained about his old grading system, "you get a 60 or you don't pass

and so you are doomed… it's demoralizing and makes me not want to continue trying to pass." Notably, his encounter with Specifications Grading may have influenced his overall growth mindset towards learning as he underwent a shift in his perspective, viewing mathematics as attainable rather than an innate talent. Below are some excerpts from Oscar's experience:

> At one point, I would say – you know what? some people are gifted in Calculus and some people are not, and I am not, and I guess it's not reachable for me – But, you know, if you do it once, if things go right once, you know for sure you can do it again… . it all has to come down to the mentality that you have towards this type of subject or any subject in that matter, because anybody can switch on a dime and have the mentality and dedication to say – You know what? I am going to be successful in math! – Because that happened to me.

This transformation possibly contributed to a positive change in his perception of his mathematical comprehension and abilities, as proposed by Cribbs and colleagues [3]. This may have impacted Oscar's interest in mathematics and how he saw himself as a mathematically adept individual. In fact, Oscar expressed an increased interest in mathematics, stating that his success in the Specifications Grading Calculus 1 course motivated him to look forward to his Calculus 2 course.

Carlos, on the other hand, faced several challenges in his traditionally graded Calculus I course, including struggling to keep up with the rapid pace and the absence of opportunities to resubmit assignments. This experience seemed to reinforce his belief in a fixed mindset, as he perceived mathematical proficiency as inaccessible to everyone.

> It's frustrating because… I know that I'm not that much [of a math person]. But unfortunately, they [family and friends] keep this illusion, and I'm forced to be pushed down this path that they think I am on, but I'm not… [before] I excelled at it [mathematics]… but things were a lot easier. I didn't have to worry about it as much. So, I'd like get higher grades, but now, I am expecting the same when I'm struggling more. So, it's not quite the same anymore.

While it cannot be assumed that a Specifications Grading course would have automatically provided a slower pace for Carlos, it is plausible to consider that being in a course where students are allowed multiple attempts to demonstrate mastery might have aligned better with Carlos' preferences for a Calculus 1 course.

During discussions about their overall mathematics identity, both Oscar and Carlos acknowledged that they did not fully identify as "math people." However, upon analyzing their interview responses, it became evident that Oscar and Carlos had distinct perspectives on what being a "math person" entailed and, therefore, most likely impacted their responses. Oscar's concept of a "math person" focused on possessing a comprehensive understanding of mathematics, with an emphasis on continuous growth and development. He felt that he had not yet reached that level of comprehension but believed that becoming a math person was an achievable goal for anyone who aspired to attain it, reflecting his growth mindset. Carlos, on the other hand, associated being a "math person" with the ability to score highly in

mathematics. Therefore, he did not identify with the label, as he had been struggling to score highly in his traditionally graded Calculus 1 course.

Overall, we can see that Oscar saw a "math person" as someone who possesses the knowledge and skills which can be attainable by anyone. Conversely, Carlos believed that a "math person" is characterized by high achievement, something he felt incapable of reaching. We argue that a growth mindset cultivated through a Specifications Grading Calculus 1 course could serve as a promising approach to enhance students' mathematics identity, particularly among historically underserved mathematics students. Available evidence indicates that this pedagogical/assessment approach, whether through direct or indirect means, affects students' mindsets concerning learning. When applied to a Calculus 1 course, Specifications Grading has the potential to strengthen students' perceptions of competence and performance, ultimately fostering a positive influence on their interest, recognition, and overall mathematical identities.

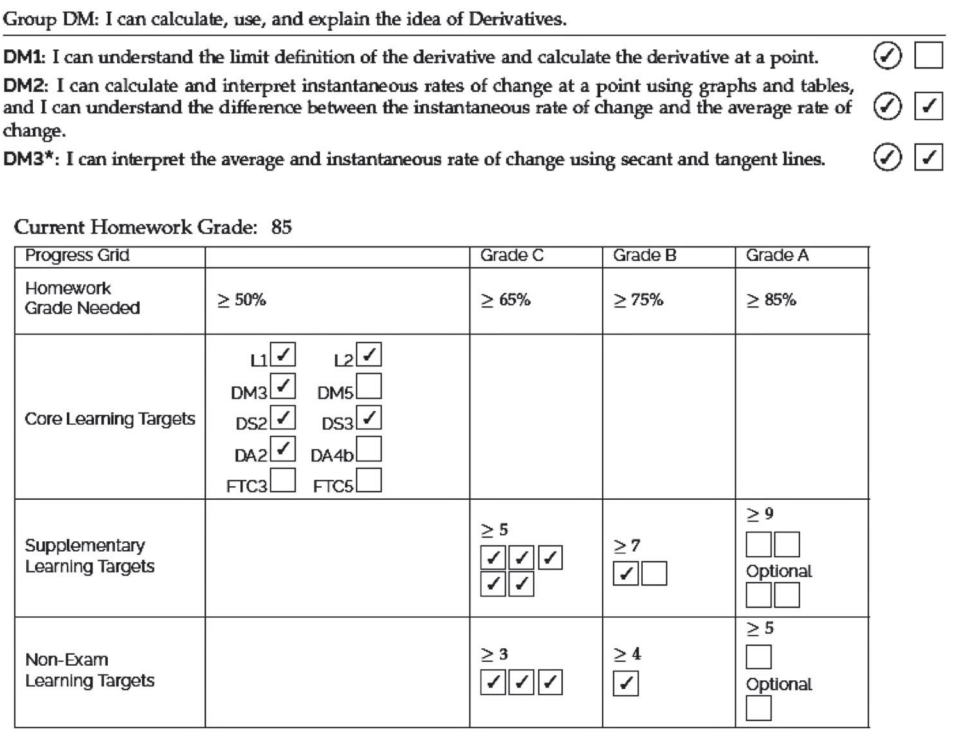
7. CURRENT STATUS OF DEPARTMENTAL INNOVATIONS

Now we discuss additional innovations and interventions that have been implemented in the department as a result of past reform efforts in Calculus 1. We begin by describing the on-going improvement of progress reports in Specifications Grading, the expansion of Specifications Grading to other core math courses, and finally discuss the implementation of the Peer-Led Team Learning (PLTL) assistance program in Calculus 1 and other math courses.

7.1. New Student Progress Grid Dashboard

In summer 2021, we created a gradebook configuration in the Blackboard LMS to support students' understanding of their grades and their progress in the course. In addition to showing results for individual assessments of learning targets, the gradebook kept track of their overall progress towards grades of A, B, C, D, and F in the course. To overcome the limitations of Blackboard's presentation of grades, a supplementary custom LaTeX template was devised using the R programming language that further improved the presentation of student progress [9]. This template automatically generated individualized PDFs from the gradebook in Blackboard, offering a clear checklist format with checkmarks denoting earned credits for each learning target. The PDFs featured a table summarizing students' progress towards grades of C, B, and A. Figure 4 provides a screenshot of the learning targets credited (top figure) and the overall progress of the student in earning learning targets (bottom figure); note that the "$*$" in "DM3$*$" in the top figure denotes that it is a core learning target.

To further enhance student understanding of their progress and to provide a more accessible and efficient solution, the project hired a student to develop a dedicated website. The website was deployed in Fall 2023. Upon deployment, the website facilitated a streamlined process for both instructors and students. Instructors were



Group DM: I can calculate, use, and explain the idea of Derivatives.

DM1: I can understand the limit definition of the derivative and calculate the derivative at a point. ✓ ☐

DM2: I can calculate and interpret instantaneous rates of change at a point using graphs and tables, and I can understand the difference between the instantaneous rate of change and the average rate of change. ✓ ✓

DM3*: I can interpret the average and instantaneous rate of change using secant and tangent lines. ✓ ✓

Current Homework Grade: 85

Progress Grid		Grade C	Grade B	Grade A
Homework Grade Needed	≥ 50%	≥ 65%	≥ 75%	≥ 85%
Core Learning Targets	L1 ✓ L2 ✓ DM3 ✓ DM5 ☐ DS2 ✓ DS3 ✓ DA2 ✓ DA4b ☐ FTC3 ☐ FTC5 ☐			
Supplementary Learning Targets		≥ 5 ✓ ✓ ✓ ✓ ✓	≥ 7 ✓ ☐	≥ 9 ☐ ☐ Optional ☐ ☐
Non-Exam Learning Targets		≥ 3 ✓ ✓ ✓	≥ 4 ✓	≥ 5 ☐ Optional ☐

Figure 4. Portion of the customized progress template for students.

able to easily upload grades exported from Blackboard to the website. Students could securely log in to access their personalized dashboards. The dashboard provided a comprehensive summary of their grades, progress towards specific learning targets, and overall advancement in the course. The deployment of the web-based progress tracking system is a significant step towards improving students' understanding and engagement with the Specifications Grading methodology in Calculus 1. Figure 5 provides a screenshot of the dashboard where orange marks denote core learning targets and gray marks denote supplementary learning targets. Compare this figure with Figure 4.

7.2. Additional Course Implementations of Specifications Grading

The positive results of the Specifications Grading implementation in Calculus 1 motivated the department to develop similar programs for College Algebra, Precalculus, and Elementary Statistical Methods. The materials for Precalculus and College Algebra were successfully created in Summer 2022, and 4 sections of Precalculus were piloted in Fall 2022. The following semester in spring 2023, 4 revamped sections of College Algebra were piloted. The Precalculus and College Algebra courses used the template and experience from Calculus 1 to create their curricula. For Precalculus and College Algebra, the revised courses consist of 23 and 22 learning targets, respectively, and assessments such as WeBWorK assignments,

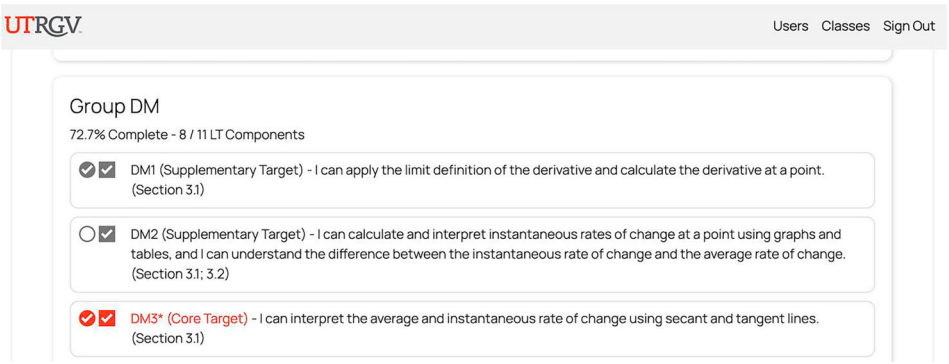


Figure 5. New student dashboard progress grid deployment.

worksheets and reassessments were implemented in the curricula. Expansion to Elementary Statistical Methods was initiated in Summer 2023 and was piloted the following fall semester.

7.3. PLTL implementation

Implementation of the Peer-Led Team Learning (PLTL) assistance program prior to the pandemic resulted in significantly increased pass rates in College Algebra. Hence the next step was to implement PLTL in additional core mathematics courses. The Learning Center provided funding to implement PLTL in Calculus 1 classes in Spring 2022 which was critical since the SEMINAL funding period to hire undergraduate Learning Assistants had ended in December 2021. Thus, PLTL leaders replaced the Learning Assistants from the SEMINAL Project in collaborative problem-solving sessions. The PLTL leaders lead the collaborative problem-solving sessions twice a week for 50–75 min each session, provide one hour of tutoring, and meet with instructors to discuss the week's worksheet problems.

8. CONCLUSION

The UTRGV School of Mathematical and Statistical Sciences has undergone coordination, curricula, and pedagogical reform to improve student success. Some of these efforts began as pilot programs and have continued with a consistent team of faculty. Opportunities for expansion of programs continued with a SEMINAL subaward and university funding. The COVID-19 pandemic in Spring 2020 offered additional opportunities to renovate the curricula and promote student motivation, inclusive learning practices, and accountability through the alternative grading system of Specifications Grading in Calculus 1. We continue to improve on the Specifications Grading curricula through the modification of learning targets and WeBWorK homework, along with implementing a web-based tool for progress reports. Given preliminary results, Specifications Grading in core courses

shows promise to improve student learning, retain students in STEM majors, foster students' growth mindsets, and improve their mathematics identities.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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