A Self-Study of the IRE 5-Point Grading Scale for Promoting Growth Mindset

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Introduction

Engineering education as a discipline places a great focus on assessment of learning. However, to promote equity within engineering programs, we must take a critical look not only at our assessment practices, but also at our grading practices and policies. This self-study details the use of a 5-Point grading scale within a program that teaches design, technical, and professional learning. The grading system eliminates the use of letter grades on individual deliverables and assessments, instead focusing on providing students with feedback and framing that helps them grow and improve as engineers. The paper will share background about alternative grading systems, define the 5-Point grading scale in the context of these existing systems, and analyze the grading system in the context of equity. The Iron Range Engineering (IRE) program has been improving upon this grading system for over ten years, so this paper shares culminating ideas and tips for how to frame and implement a similar grading system within design, technical, and professional learning.

Background

Exploring Alternative Grading Methods

Many educators and students alike view grading as a necessary evil of learning. The traditional A-F grading scale has been used for much of the last century to communicate information about a student's learning [1]. However, the widespread introduction of the A-F grading scale led to unnecessary stress and harm to students [2], questions about the accuracy and validity of the grading system [3], and a sudden shift from learning to earning enough points to get a desired grade [4]. Furthermore, traditional grading schemes can further amplify the effects of biases and policies that negatively impact students from underserved groups [5]. Despite these concerns, the A-F grading system is still largely used in educational institutions today [1], and the question still remains: Is there a way to communicate student learning without leading to unnecessary harm and a lack of intrinsic motivation? To answer this question and place the focus back on learning rather than earning points, a variety of alternative grading schemes have been implemented both in K-12 and higher education spaces.

Many of these alternative grading approaches are designed to add additional structure and transparency to the grading process. For example, mastery-based grading is an alternative grading strategy where students are assessed on their ability to show mastery of a specific concept. Rather than earning an averaged score on an exam, information is communicated to the student about their level of understanding on each of the specific concepts included [6].

Standards-based grading takes a similar approach where the instructor chooses concepts and skills to be the "standards" within the course, and students are assessed on their ability to meet each of those standards. Students are not graded on things like participation because these activities are not tied to mastery of a standard [7, 8]. Competency-based grading takes a similar approach, but also places greater focus on the dependencies of certain concepts on one another; students in the course must show proficiency in one area before moving on to the next [9]. These three assessment strategies are very closely related and are sometimes used interchangeably to explain a grading scheme that focuses on evaluating students on course standards rather than on their behaviors throughout the course.

One other form of alternative grading takes a fundamentally different approach that removes some of these structures to allow for a more nuanced approach to evaluation. In an un-grading structure, both instructors and students participate in holistic reflection and assessment throughout the course. Proponents of un-grading often note that success outside of the classroom depends not only on development of knowledge and skills, but also behaviors and practices. Therefore, an un-grading approach often does include assessment of things like participation in class or timeliness. This holistic approach recognizes that different students have different goals and interests and makes pathways to success that support the intrinsic motivation of students.

A challenge of alternative grading is balancing both structure and nuance. Structured grading schemes such as standards-based and mastery-based grading help clearly communicate to students their level of competency in specific areas. They also place greater emphasis on learning concepts and skills rather than earning points. However, they typically do not evaluate other skills that are harder to quantitatively measure – even if those skills are important for students to practice and gain feedback on. More nuanced grading schemes such as un-grading create space for evaluation of professional and creative skills, but the reduced structure can lessen clarity for students on the learning outcomes and expectations.

An Introduction to the Iron Range Engineering Program

This balance of nuance and structure in evaluation becomes especially important in programs that place importance on technical, design, and professional learning. The ABET accredited IRE program is a work-based engineering program where students not only take technical courses, but also courses in design and professionalism. Design and professionalism courses are co-taught by multiple faculty and staff members.

The IRE program is an upper division engineering program where students complete two years at a community college before transferring into the program. They spend their first semester of upper division taking technical coursework while completing a design project and participating in professional development. This combination of activities prepares them for their next two

years, which they spend in full-time internship and co-op engineering positions while receiving their remaining technical credits through remote learning.

From the very beginning of the program in 2010, an emphasis has been placed on balancing the three areas of learning: design, technical, and professionalism. Therefore, the grading and evaluation of students in the program needs to accurately measure and meaningfully communicate progress in each of these three areas.

The IRE 5-Point Grading Scale

The IRE 5-Point grading scale was introduced to support student learning in the program. It aims to draw upon the strength of structure that comes with mastery or standards-based approaches as well as the flexibility and qualitative feedback that comes with an un-grading approach.The program has a wide variety of deliverables in design, technical, and professionalism learning – and the 5-Point scale was designed to evaluate student learning in each of these contexts. In all three of these areas, some outcomes are best graded using structured metrics, whereas other outcomes are best graded by providing nuanced feedback that accounts for a student's prior learning, their progress, and their individual approach to a process. Although the interpretations of the grading scale may differ depending on the area of learning and the specific assignment, the underlying messaging of the 5-Point scale is consistent. In general, a '5' represents exemplary work, a '4' represents desired work, a '3' represents acceptable work, a '2' represents weak work, and a '1' represents deficient work [10]. Because student grades still need to comply with the university system's A-F scale, final semester grades are posted using the conversion in Table 1. However, throughout the semester, grades are always framed using the 5-Point scale for growth mindset rather than the assignment of a grade on the A-F scale.

Table 1 The 5-Point scale and alignment with official letter grades. Scores on the 5-point scale are converted to letter grades only at the end of the semester to be input into the institutional grade system.

Minimum Score Needed on 5-Point Scale	< 2.00	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	> 4.67
Letter Grade	F	C-	C	C+	B-	B	B+	A-	A	A+

Methods

To communicate the IRE 5-Point scale and explore its affordances and limitations, a self-study was conducted using the guidelines from LaBoskey [11]. The self-study reports on how the IRE 5-Point grading scale has been implemented in each of the three areas of learning: design, technical, and professionalism. The three pillars of equitable grading from Feldman's book *Grading for Equity* [5] will be used as a framework for the self-study.

The three pillars of equitable grading are accuracy, bias resistance, and growth mindset. Accuracy is the ability of a grading system to measure learning without considering unrelated factors. For example, if a grade is supposed to represent knowledge gained on a specific concept, deducting points for late work could decrease the accuracy of the grade because timeliness is not related to knowledge of the topic. Bias resistance is the ability of a grading system to resist implicit biases during the grading process. To improve bias resistance, evaluators should be careful when assessing subjective items such as participation or communication to ensure grades are not solely based on a judgment call of the evaluator that could be prone to implicit biases. Finally, a growth mindset is the ability of a grading system to place focus on growth and learning rather than earning enough points. To support a growth mindset, a grading system should provide meaningful feedback and offer chances for improvement.

For the analysis, each of the three pillars of equitable grading will be applied to the three types of learning (i.e., technical, design, and professionalism) covered through the IRE program. This process is summarized in Figure 1. Each of the authors of this self-study are faculty members for the IRE program and have experience using the 5-Point scale. This work is the culmination of a decade of using the grading scale to support student learning.

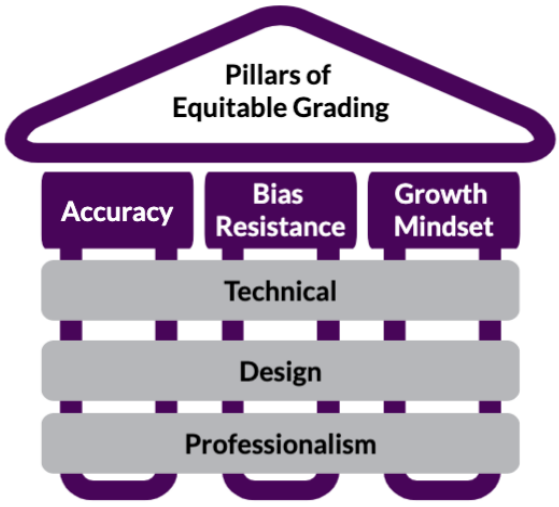

Figure 1. The analysis for this self-study was conducted by applying each of the 3 pillars of equitable grading from [5] to each of the 3 components of learning in the IRE program: technical, design, and professionalism.

Analysis

The following sections will show how the IRE 5-Point scale for promoting growth mindset is interpreted for the three types of learning (i.e., technical, design, and professionalism). The three pillars of equitable grading (i.e. accuracy, bias resistance, and growth mindset) will also be discussed for each of the types of learning.

Technical:

In a technical context, the five-point scale is used under a slightly different interpretation than design and professionalism are, which will be explained in the next two sections, but can still align with the design and professionalism scale. The interpretation of the scale is shown in Table 2 for technical contexts.

Table 2 Interpretation of the 5-Point Scale for technical

1	2	3	4	5
A student is demonstrating no or unacceptable technical understanding and deliverables.	A student is demonstrating a need for improvement in their technical understanding and deliverables.	A student is demonstrating acceptable technical understanding and deliverables,	A student is demonstrating desired technical understanding and deliverables.	A student is demonstrating exemplary technical understanding and deliverables.

Four is always the transition between a "desired" grade and "exemplary", indicated by the transition from the B range to the A range (Table 1), so we aim to have students at this level. A '4' indicates that the students successfully completed all parts of the assignment with standard definitions, protocols, neatness, etc. If they are to push toward a 5, they show effort in *extending* and *deepening* their understanding, such as finding different applications than those talked about in class, applying their understanding at work, showing extremely strong organization and presentation skills, and reflecting on their own learning processes. Examples of technical deliverables and student outcomes that can be assessed using this framing include standard textbook homework problems, compare and contrast worksheets, team project documentation, oral exams, etc.

Grading for Accuracy

The 5-Point Scale is used for *all* deliverables in *all* technical courses, but those deliverables may be different depending on the course (e.g., describe and define sheets, homework problems,

learning journals, deep learning activities [DLA], quizzes, etc.). Weighting of these assignments can vary by course, but the consistency of using the same grading scale across all assignments and all technical courses supports the ability to have accuracy in grading since expectations are similar throughout deliverables. Technical courses contain a lot of deliverables, so the grades and feedback for the course are not based upon just a few deliverables, such as a couple of exams and a huge paper. This allows students to get the necessary practice in a low-stakes environment, which also allows faculty to make sure over the average of the entire semester, students are receiving an accurate and representative grade.

Some faculty members have chosen to have a professional conduct grade, which includes timeliness, quality of work, engagement in class, and effort in communication (e.g., late submissions, missing class, etc.). This allows all scores for students' submissions to be graded on the actual quality and effort in work, not on the timeliness. Students are then able to accurately see how they actually did on the assignment/assessment. All deductions for late work, communication, etc. are instead taken from the professional conduct grade.

Grading for Bias Resistance

Typically, only one person is evaluating the deliverables in technical understanding (though there are exceptions for unique assessments like fundamental principle exams), so there can be room for bias in the instructor's evaluation. Some of the ways instructors may combat this is by having students evaluate themselves or one another in addition to the instructor's evaluation, allow re-doing of work (which could also align with growth mindset), giving plenty of thorough qualitative feedback, both spoken and written, and having a lot of low-stakes deliverables versus just a few to combat one bad or biased grade. Many instructors also choose to use rubrics here to allow for constant and structured reminder guides in grading.

Grading for Growth Mindset

Compared to the traditional grading scale where a '4/5' would be a low B or high C, a '4/5' for IRE students is desired and leaves room for growth above "desired" work. Students are able to see that there is a desired way to complete things, but there is still room to *deepen* that understanding and *extend* it to other realms. This allows students to really develop their expertise in a given topic and it's up to them whether they take that opportunity or not. If the desired score was simply a 5/5, students would be more focused on getting the grade and being done with it versus leaving space and opportunity for "how could I do better?"

Faculty also make an effort to include not only a numeric score on the students' deliverables, but also qualitative (i.e, written and/or spoken) feedback. From this feedback, students are better able

to set goals and focus on how they can improve their learning instead of simply seeing the grade and moving on.

Design:

The IRE program requires all junior and senior students to take a 3-Credit design course each semester. While the student project may come in various forms (industry sponsored, co-op work, faculty-led research and student entrepreneur project etc.) [12], we translate the 5-Point based grades into expectations that describe the level of professional work. A grade of '2' means there is "significant improvement needed" and below '2' is considered to be unacceptable work. A grade of '3' refers to Student Engineer, '4' represents Engineering Intern and '5' indicates Professional/Experienced Engineer. Senior students are expected to achieve '4' and above, preparing them for their first job or co-op position.

Table 3 Interpretation of the 5-Point Scale for design

1	2	3	4	5
A student is unable to develop a technical solution and fails to document learning experience.	A student is unable to develop a technical solution but has demonstrated learning experience.	A student can develop a solution to an open-ended design problem and appropriately document the learning experience.	A student develops multiple solutions with detailed validation and assessment. Learning experience is well documented.	A student develops multiple viable solutions with validation and strong evidence. Learning experience and future work are well documented.

Examples of design deliverables and student outcomes that can be assessed using this framing include technical design reports, design review presentations, client communication memos, etc.

Grading for Accuracy

The accuracy of grading for design assessment is reflected by the multiple components of a design project including technical learning, design process, and communication, each carrying a weight percentage. One example of this is how design grades are given after a careful assessment in a Design Review in which student teams present their work to a general audience and then answer questions in a closed door meeting with just the team and the evaluators. Occasionally, the student team will choose an iterative design process and try to deliver a "minimal viable product" (MVP) at the first design review [12]. Table 2 presents a rubric for the expectations for

a ‘4’ level, which resembles the growth of a prospective engineering intern throughout their first several months in an industry setting. For instance, the key words evolve from “following guidelines” to “value creation”, from “perform” to “reflect”, and from “able” to “effective”, indicating a pathway of growth.

Table 4 Expectations of three design reviews throughout the semester. The expectations listed here are based on ‘4’ that indicates a level of an engineering intern. Some keywords indicating growth are bolded.

	Design Review 1 Expectations	**Design Review 2 Expectations**	**Design Review 3 Expectations**
Technical Learning (25%)	-Team has identified and documented appropriate learning goals -Individuals have carried out an action plan -Individuals have collected evidence of improvement	-Team has tracked the learning progress -Individuals have done reflection on **lessons learned** -Multiple resources have been identified	-Team has documented learning outcomes and hold individuals accountable -Individuals have collected evidence of completion and reflection on lessons learned -Technical knowledge is described and generated
Design Process and Solution (50%)	-**Followed** clear design process and have a quality planning -Demonstrated reasonable use of ideation techniques -Developed an MVP that meets the basic requirement -Able to assess the strengths and weaknesses of the MVP -Preliminary plan for next steps	-**Performed** adequate technical research and collect relevant information -Appropriately assessed the strengths and weaknesses of the solution -Applied evaluation criteria to make design decisions and provided a testing/validation plan	-Delivered a design solution or product prototype -Collected and analyzed data to validate the feasibility of solution -**Reflected** on the overall process and possible limitations for improvement occurred

Communication and Presentation **(25%)**	-Accurately presented the scoping work and background information -Kept poise and appropriate confidence -**Able** to answer question based on existing knowledge -Listens respectfully when receiving feedback	-Presented in-depth technical research information -Clearly communicated details of solution/model -Explained answers with appropriate detail (not just short answers nor rambled too long) -Able to answer questions outside of "expert areas." -Followed rule of 1/X	-Presented the solution with high quality visuals or animations -Clearly communicated the **value created** for the stakeholders -Delivered an organized presentation that engaged audience -**Effective** use of presentation techniques (eye contact, grammar, energy, body language, voice pace/volume, dress) -Followed rule of 1/X

Grading for Bias Resistance

Typically, expectations are given by faculty/instructors to assess the learning and justify the grades in design. ABET outcomes are often used to scaffold such expectations [13]. At the IRE program, besides the requirement from ABET, expectations are adjusted based on a broader discussion among multiple stakeholders: faculty, industry professionals, experienced engineers, and students. For example, in Table 1, the rule of 1/x (i.e., each teammate should have equal contribution and time to speak) was suggested by a student who was less vocal in the presentation. The “ability to answer questions outside of expert areas" was added by an industry partner, who argued that learning often occurs outside the comfort zone.

In grading practice, we focus on improving transparency and mitigating bias. We developed a negotiation process with three steps. First, the initial grade is decided by the design review panel consisting three or four faculty, facilitators or industry partners. After discussing the team’s strength and weakness, the panel will come to an agreement of a “suggested grade”, which is sent to the team facilitator. Second, the facilitator will also have a one-on-one discussion with each individual regarding their personal contribution. There is a flexibility to adjust the grade by ±0.5 if the individual goes beyond or under the expectation for routine work. For instance, the team lead who has extra duty in project management may receive higher grades based on the adjustment. Third, if a student feels the grade is unfair or unsatisfactory, they will be given an opportunity to negotiate an individual contract with the facilitator. The contract lays out a timely action plan for improvement. If the student takes timely action and meets the expectations by next design review, then the previous grade can be revised retrospectively. In short, the three-step

negotiation process ensures all the stakeholders are participating in the grading process. While promoting inclusion in the grading process, it significantly reduces potential bias from any individual.

Grading for Growth Mindset

At the IRE program, the principle of project-based learning goes beyond hands-on skill training. The goal is to create a working environment that resembles an industry setting but also offers a safe space for failure. There are two approaches to reach this goal. First, as revealed in Table 4, part of the grades comes from the ability to address the feedback (i.e., lessons learned), especially at the beginning of a project. It is worth noting that a grade is released to students always with detailed written feedback in each category. During the next design review, students will be specifically asked how they implemented the previous feedback and what technical improvements they made. Second, a short reflection report is immediately due after the design review. The reflection directs students to self-assess the highlights vs. lowlights of the design review experience by giving themselves a grade [12]. If this grade deviates vastly from the panel's grade, the student is encouraged to have an in-depth discussion with faculty or facilitators.

For a variety of reasons, the first design project is often challenging to junior students. Although we developed the grading policy for equity and inclusion, in practice, there are students who either neglect the feedback or fail to do accurate self-assessment, resulting in a lower grade than '3'. It presents us with a moment of education to promote the growth mindset. On one hand, we communicate with them that overconfidence and excessive self-doubting are equally damaging to their performance; on the other hand, we stress that learning from failure is a pathway to reach point '4'. Once they have a better understanding of their grades, they could better focus on feedback and therefore see a clear pathway for improvement.

<u>Professionalism:</u>

Professionalism is the level at which a student is conducting appropriate engineering behaviors such as communication, teamwork, and timeliness. The interpretation of the 5-Point scale for professionalism (Table 5) is similar to Design in that it aligns expectations with those of a student engineer, engineering intern, or professional engineer.

Table 5 Interpretation of the 5-Point Scale for professionalism

1	2	3	4	5
A student is participating in unacceptable professional behavior.	A student is still developing their appropriate professional behavior.	A student is demonstrating professionalism at the level of a student engineer.	A student is demonstrating professionalism at the level of an engineering intern or co-op.	A student is demonstrating professionalism at the level of a professional engineer.

Examples of professionalism deliverables and student outcomes that can be assessed using this framing include written communication, team conduct assessments, responses to reflection prompts, presentations, timeliness of assignments in technical courses, etc.

Grading for Accuracy

The accuracy of grading is promoted by collaborative grading efforts among faculty and staff members. Each grader has experience working in the engineering field, which gives them a baseline for framing which level a student is at. To promote accuracy in professionalism grading, attention should be paid to making sure evaluation metrics align with what is being assessed. For example, students in the program respond to written reflection prompts (i.e., learning journals) each week about their learning process. When evaluators are grading these reflection responses, they are evaluating the quality of the reflection – not necessarily the evaluator's personal viewpoint. For example, one reflection prompt may ask a student to identify three strategies they can use to be successful in the upcoming semester. The evaluator is not assessing the specific strategies chosen, but rather the student's ability to reflect upon the potential use of these strategies. This alignment between the assignment goals and the evaluation metrics are key for promoting accurate grading.

Grading for Bias Resistance

To reduce bias in professionalism grades, a variety of faculty and staff take part in the assessment process, and multiple assignments are implemented to help identify any scores that may be out of the ordinary. By including multiple assignments with multiple graders, biased grades are more likely to be identified and either adjusted or omitted. For assignments and outcomes that are more subjective, multiple evaluators participate in the grading process to provide meaningful feedback from different angles. For example, students are assessed on their presentation skills by giving a TED-like talk. This assignment is graded by more than one evaluator because each evaluator may have different perspectives about what makes a strong presentation. Evaluators

still give a score, but they also give feedback that provides the students with further context about how the presentation was received by each of the evaluators.

Grading for Growth Mindset

Much of the messaging around professionalism grading focuses on an idea of growth and continuous improvement. By framing a '3' as "student engineer", a '4' as "engineering intern", and a '5' as "professional engineer", students recognize that they are able (and expected) to grow and improve throughout their educational and professional career. In some cases, expectations are clear and measurable (e.g. turning things in on time, communicating absences ahead of time). In other cases, professionalism is subjective to the evaluator and context. The IRE 5-Point scale creates pathways for both of these types of assessments. For measurable items, a rubric can be used to show and communicate performance on a specific item. For subjective items, the 5-Point scale can give students a better understanding of how their performance would be perceived by a future employer while still recognizing that they are learning and growing as engineers.

A key component of the IRE grading system is providing feedback and multiple chances for improving upon that feedback. Because Professionalism is a course that students take each semester, they are able to improve in their reflection, writing, presentation, and communication skills through the feedback and monitor their own growth..

Discussion

Through the self-study, the authors identified how the IRE 5-Point scale aligns with other alternative grading methods, suggested guidelines for implementation of the scale, and determined potential future work.

Alignment between the IRE 5-Point Scale and Other Alternative Grading Methods

The IRE 5-Point scale provides a unique framing for assessment of student work that is appropriate for assessment of both objective and subjective measures. When evaluating engineering learning, some metrics are specific and measurable (e.g. being able to complete specific types of circuit analysis problems). The IRE 5-Point scale communicates progress in these areas to students through a numbered scale. Other alternative grading methods such as mastery-based, standards-based, and competency-based grading also work well in these sorts of situations because mastery is attainable for these goals. However, there are also many skills in engineering learning that cannot be mastered in such a specific and measurable way, such as communication and design. These types of skills are still important to assess because of their importance in engineering work, but alternative grading schemes like mastery-based, standards-based, and competency-based grading are not framed in a way that communicates that students can and should continue to improve in these areas. On the other hand, methods like

un-grading are organized around growth and reflection, which is helpful for these more subjective matters. Similarly, the 5-Point scale also allows for assessment of more subjective things such as professionalism, communication, and design. However, un-grading methods fall short at communicating progress in specific and measurable learning goals. The 5-Point scale uniquely supports learning across various courses and contexts through shared language that supports an attitude of learning and improvement.

Guidelines for Implementation

During the self-study analysis, key guidelines for implementation were also identified. Although there is flexibility in how each faculty member or program may implement the scale, the use of the scale requires more than simply swapping out letters for numbers. The three guidelines that were identified as key tenets of the grading scale are listed below.

1. **Clearly communicate with students about what the grading scale means.** For most traditional grading scales, a 3/5 is equal to a D or a 60%. With the 5-Point scale, a 3/5 aligns with a B- and just means that a student has areas for growth and improvement in that area. To successfully implement the 5-Point scale, instructors should help students reframe their understanding and interpretation of the grading scale.
2. **Ensure that the assignment expectations and corresponding feedback align with the type of assignment.** For criteria that are measurable and more objective, it is important to communicate with students how they will be assessed. For example, if you are grading something like timeliness, it should be clear to students how their behaviors will map to the 5-Point scale. On the other hand, criteria that are more subjective, it is important to communicate feedback and context to the students so they are able to see where the score is coming from. If they earn a '3' on their design review document, there should be clear feedback about how they can improve for next time.
3. **Allow space for continuous improvement.** One of the main goals of the IRE 5-Point scale is to promote a growth mindset among students. Therefore, if this scale is being implemented, there should be pathways for students to use the feedback they have received. One option for doing this is allowing for retakes or resubmissions. Students can take the feedback they earned to increase their score on a specific assignment or metric. Alternatively, assignments from earlier in the semester can be weighted less heavily than assignments later in the semester. Students can implement feedback they receive, and their final grade is not bogged down by their earlier work.

Potential for Future Work

Areas of future work were also identified during the self-study process, including reliability testing and getting student perspectives. Reliability testing could include assessing intra-rater and inter-rater reliability while using the 5-Point scale when compared to other grading scales.

Student perspectives could include exploring how student perceptions of the scale compare to faculty perceptions and the mental and emotional impact of the grading scale compared to traditional grading scales. This paper gave an overview of the breadth of applications of the 5-Point Scale, so future work may also include presenting the typical deliverables and examples of each level of the grading scale for reference by other educators (see [14] as an example that discusses the use of this grading scale for oral exams).

Conclusion

This self-study analyzed the use of the IRE 5-Point grading scale for technical, design, and professionalism learning. It used the Pillars of Equitable Grading as a framework to illustrate how this scale can be implemented. Finally, it identified how this grading system compares to other methods for alternative grading, key guidelines for implementation, and possibilities for future work. The IRE 5-Point grading scale balances the structure and scaffolding of standards- and mastery-based grading while communicating the nuance and flexibility found in un-grading systems. This balance supports an attitude of growth mindset – students know where they are meeting expectations, where they can work to improve, and where they have exceeded expectations.

Any grading strategy has its pros and cons, but that does not mean that educators should not continue to evaluate their grading practices. Grades impact students academically, financially, mentally, and emotionally. As Kelly Hogan and Viji Sathy state in their book *Inclusive Teaching:* "No matter what strategy is used, it is worth reflecting upon how you show students it is OK to make mistakes via your grading scheme. One bad day or one misstep need not derail a student's plan or communicate that they do not belong in your discipline" [15]. If engineering educators want to continue to recruit and retain engineering students from *all* backgrounds, it is important to continue to assess how our grading practices either support or inhibit student mindset.

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