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Student Performance and Achievement Goals with Ungraded Individual Readiness Assurance Tests: A 2x2 Crossover Study

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Abstract:	<p>Objectives The objective of this study was to measure the effects of graded versus ungraded individual readiness assurance tests (iRAT) on students' assessment performance and achievement goals in a team-based learning (TBL) classroom.</p> <p>Methods A 2x2 crossover study was conducted in a required second year pharmacotherapy course. Teams 1-8 were assigned to an ungraded iRAT during the first half of the course followed by a graded iRAT the second half of the course (G/UG group). Teams 9-16 were assigned to the opposite grading sequence (i.e., UG/G). Multivariate analysis of variance was used to analyze differences in assessment performance, as measured using iRAT and examination scores. A separate multivariate analysis of variance was used to examine differences in achievement goals.</p> <p>Results There was a significant difference in assessment performance based on iRAT grading condition. Individual readiness assurance tests were higher in the G condition (72.51% versus 67.99%); however, examination scores were similar in the G and UG conditions (81.07% versus 80.32%). There was not a statistically significant difference in achievement goals based on iRAT grading condition.</p> <p>Conclusions In a required second year pharmacotherapy course that uses TBL, student performance on the iRAT was modestly lower in the ungraded iRAT condition; however, student examination scores were unchanged. Task-specific achievement</p>

	goals were unchanged based on iRAT grading condition. Educators using TBL should carefully and wholistically consider the implications of how changes in grading influence incentive structure within their course.
Additional Information:	
Question	Response
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<p>Significance Statement: Provide a brief, 2-3 sentence-long statement regarding the significance of your submission. How does your submission contribute and advance the broad area of pharmacy education?</p>	<p>Existing studies on this topic have used retrospective designs and are limited by confounding, selection bias, etc. This is the first true experimental study comparing the effects of ungraded versus graded iRATs on student performance in a TBL classroom. Furthermore, studies that advocate for "ungrading" frequently justify their stance using achievement goals literature, yet few studies use validated tools to measure changes in achievement goals as a response to changes in grading structure. In contrast, our study used a validated questionnaire by Elliot & McGregor (2001) to measure change in achievement goals.</p>
<p>Promotional Tweet (Please complete even if you personally do not use Twitter): Provide a tweet to promote your submission. If your submission is accepted, AJPE will consider using your tweet to promote your accepted manuscript. (Please see AJPE's Twitter account for examples at https://twitter.com/TheAJPE. You do not need to include the "Read more" text).</p>	<p>To grade or not to grade, that is the question (insert think emoji or Pooh GIF). Learn more about the effects of "ungrading" in a team-based learning course here (insert link)</p>
<p>If your submission is accepted, AJPE would like to appropriately tag authors. List author Twitter handles.</p>	@ZNoelPharmD

October 18, 2023

Gayle A. Brazeau, PhD
Editor
American Journal of Pharmaceutical Education

Dr. Brazeau,

Please find attached our submission, “Student Performance and Achievement Goals with Ungraded Individual Readiness Assurance Tests: A 2x2 Crossover Study” for consideration in *AJPE*.

Team-based learning (TBL) is one of the most common instructional strategies in the health professions education. One of the cornerstones of successful TBL is the individual readiness assurance test (iRAT), which has traditionally been a graded assessment. Considering the push towards “ungrading”, and the emphasis on cultivating mastery-oriented achievement goals in PharmD students, we conducted a prospective 2x2 crossover study in a second-year pharmacotherapy course to measure the impact of ungraded iRATs on assessment scores and task-specific achievement goals.

This study was part of my dissertation work in the Health Professions Education PhD program at the University of Maryland, Baltimore and, unlike existing studies on this topic, we used a true experimental design to control for major confounders, selection bias, etc. Though we do not attempt to make a one-size-fits-all argument for or against graded iRATs, we do discuss the implications of grades and the modest role graded iRATs had on student performance in our course. We feel this is a timely topic considering the ongoing conversations around “ungrading” and pass/fail curricula. We hope it will be of interest to you, and we look forward to feedback from reviewers.

Lastly, carving out 3,000 words and 5 tables/figures from a 150-page dissertation was quite a challenge! Currently, we have 3 tables, 2 figures, one appendix, and a total word count of 3,250 (inclusive of body of text and appendix). We hope there can be some leniency in the word count restriction. Thank you for considering our request.

Best,



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EXEMPT DETERMINATION

OF NOTE: The Principal Investigator should review the University of Maryland Baltimore criteria for performing research during the current COVID-19 pandemic emergency. Understand that IRB approval of this research does not suggest that performance of this research under current guidelines is allowed. Failure to comply with the UMB President's directives would be considered non-compliance. The UMB Research directives can be found at <https://www.umaryland.edu/coronavirus/> . If you need clarification or guidance please call the Human Research Protections Office at 410-706-5037.

Date: September 21, 2022

To: Christina Cestone
RE: HP-00102019
Protocol Version and ID #:
Type of Submission: Initial Review
Type of IRB Review: Exempt

Determination Date: 9/21/2022

This is to certify that University of Maryland, Baltimore (UMB) Institutional Review Board (IRB) has reviewed the above referenced protocol entitled, "The Effect of Graded Versus Ungraded Individual Readiness Assurance Tests on Pharmacy Students' Achievement Goal Orientation and Academic Performance in a Team-Based Learning Classroom."

Your protocol has been determined to be exempt under 45 CFR 46.104(d) from IRB review based on the following category(ies):

Category (1): Research conducted in established or commonly accepted educational settings, that specifically involves normal educational practices that are not likely to adversely impact students' opportunity to learn required educational content or the assessment of educators who provide instruction. This includes most research on regular and special education instructional strategies, and research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

The IRB made the following determinations regarding this submission:

- No specific determinations made.

In conducting this research you are required to follow the requirements listed in the INVESTIGATOR MANUAL. Investigators are reminded that the IRB must be notified of any changes in the study. Research activity involving veterans or the Baltimore VA Maryland Healthcare System (BVAMHCS) as a site, must also be approved by the BVAMHCS Research and Development Committee prior to initiation. Contact the VA Research Office at 410-605-7131 for assistance.

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The UMB IRB is organized and operated according to guidelines of the International Council on Harmonization, the United States Office for Human Research Protections and the United States Code of Federal Regulations and operates under Federal Wide Assurance No. FWA00007145.

If you have any questions about this review or questions, concerns, and/or suggestions regarding the Human Research Protection Program (HRPP), please do not hesitate to contact the Human Research Protections Office (HRPO) at (410) 706-5037 or HRPO@umaryland.edu.

Student Performance and Achievement Goals with Ungraded Individual Readiness Assurance

Tests: A 2x2 Crossover Study

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There are no conflicts of interest to disclose.

Abstract

1
2 **Objectives:** The objective of this study was to measure the effects of graded versus ungraded
3 individual readiness assurance tests (iRAT) on students' assessment performance and
4 achievement goals in a team-based learning (TBL) classroom.

5 **Methods:** A 2x2 crossover study was conducted in a required second year pharmacotherapy
6 course. Teams 1-8 were assigned to an ungraded iRAT during the first half of the course
7 followed by a graded iRAT the second half of the course (G/UG group). Teams 9-16 were
8 assigned to the opposite grading sequence (i.e., UG/G). Multivariate analysis of variance was
9 used to analyze differences in assessment performance, as measured using iRAT and
10 examination scores. A separate multivariate analysis of variance was used to examine differences
11 in achievement goals.

12 **Results:** There was a significant difference in assessment performance based on iRAT grading
13 condition. Individual readiness assurance tests were higher in the G condition (72.51% versus
14 67.99%); however, examination scores were similar in the G and UG conditions (81.07% versus
15 80.32%). There was not a statistically significant difference in achievement goals based on iRAT
16 grading condition.

17 **Conclusions:** In a required second year pharmacotherapy course that uses TBL, student
18 performance on the iRAT was modestly lower in the ungraded iRAT condition; however, student
19 examination scores were unchanged. Task-specific achievement goals were unchanged based on
20 iRAT grading condition. Educators using TBL should carefully and holistically consider the
21 implications of how changes in grading influence incentive structure within their course.

Introduction

Team-based learning (TBL) is a structured form of collaborative learning that has flourished since the 2000's, becoming one of the most common instructional strategies in health professions education around the world.¹⁻³ Its rise in popularity can be attributed to a variety of factors, such as the structure and rhythm that it creates within a course, the ability to facilitate large class sizes with a single instructor, promoting higher order thinking, and emphasizing team performance and peer-to-peer accountability.³⁻⁵ TBL is strongly supported by learning theories (i.e., social cognitive theory, constructivism) and numerous studies have demonstrated it to be an effective instructional strategy for achieving learning outcomes.⁶⁻¹¹

Various publications have outlined the essential elements of TBL.^{3-5,12} One such element is to ensure proper incentives and individual accountability for pre-class preparation. Without adequate preparation, student learning during complex team cases and application activities is stifled. Historically, students' incentive for pre-class preparation has been fueled by a graded low-stakes assessment at the start of each class, also known as the individual readiness assurance test (iRAT). The iRAT generally consists of a series of selected response questions covering foundational pre-class content. Experts in TBL have cited that the iRAT "must be a substantial enough portion of the final grade so that students feel compelled to prepare but not so large that the iRAT turns into high-stakes testing".^{13(p143)} Thus, to give proper "weight", iRATs generally comprise approximately 10% of the course grade.^{4,13}

Despite being a powerful incentive to promote learning behaviors inside and outside the classroom, careful consideration must be given to the downsides of grades, too. For example, grades increase student stress and anxiety^{15,16}, encourage surface-level processing¹⁷, and promote student goals that are focused on comparison with peers, rather than on task mastery. To this latter point, Elliot & McGregor describe such goals as *achievement goals*, and includes either

1 This was a prospective 2x2 crossover study that evaluated the effect of two iRAT grading
2 conditions, graded (G) or ungraded (UG), on students' assessment performance and achievement
3 goals in a required pharmacotherapy course. The independent variable was iRAT grading
4 condition. The dependent variables for assessment performance included iRAT and examination
5 scores. The dependent variables for achievement goals included scores for each of the four
6 achievement goals using the 2x2 achievement goal framework by Elliot & McGregor (Appendix
7 A).²⁷

8 The study was conducted during the Fall 2022 semester in a required 4-credit hour
9 cardiovascular pharmacotherapeutics (CV PT) course. Students in the CV PT course were in
10 their second professional year of a 4-year PharmD program. The CV PT course consists of nine
11 modules covering various cardiovascular and cerebrovascular disease states. For historical
12 perspective, the CV PT has used TBL for three years and adheres to traditional TBL structure
13 and best practices, including permanently formed and instructor-created teams of 5-6 students,
14 peer evaluations, in-class application activities that follow the "4S" framework, and a graded
15 readiness assurance tests with immediate feedback. InteDashboard™ is used for all in-class TBL
16 activities and peer evaluations.

17 The study included two periods (Figure 1). Period 1 contained the first four modules of
18 the course (hypertension, dyslipidemia, acute coronary syndrome, and primary prevention), and
19 period 2 contained the last four modules of the course (chronic heart failure I and II, arrhythmias,
20 and stroke). The middle module (venous thromboembolism) was used as a washout between the
21 two study periods. During each study period there were 4 iRATs administered (one for each
22 module), one summative examination consisting of approximately 60 selected response
23 questions, and Elliot & McGregor's Achievement Goal Questionnaire (AGQ).¹⁷

1 Teams were divided into one of two study sequences (Figure 1). TBL teams 1-8 were
2 assigned to a graded iRAT (G) during period 1 and an ungraded iRAT (UG) during period 2
3 (denoted as the G/UG group henceforward). In contrast, students in TBL teams 9-16 were
4 assigned to an ungraded iRAT (UG) during period 1 and a graded iRAT (G) during period 2
5 (denoted as the UG/G group henceforward). Students in the graded iRAT condition were told
6 that their grade on the iRAT would be based on the percentage of questions answered correctly
7 (e.g., answering 3 out of 5 questions correctly equals 60%). In the ungraded condition, students
8 were told that if they were present for class and completed the iRAT, they would receive full
9 credit regardless of their score. Importantly, students were made aware of their iRAT grading
10 condition during each study period so that changes in their pre-class studying behaviors, and the
11 resultant changes in knowledge acquisition, could be measured on assessments. All students
12 enrolled in the course were assigned to an iRAT grading sequence, but only students who
13 acknowledged and completed the consent form were included in the analysis.

14 Achievement goals were measured using the Achievement Goal Questionnaire (AGQ)¹⁷,
15 a validated instrument that has been used extensively in post-secondary education, including
16 pharmacy students.^{30,30-32} The AGQ consists of 12 questionnaire items divided equally across
17 four achievement goals (i.e., three questions per achievement goal; Appendix A). Consistent with
18 the original AGQ, a 7-point Likert scale ranging from 1 (“not true at all of me”) to 7 (“very true
19 of me”) was used. Each questionnaire item was scored based on the Likert scale response. A
20 mean score was calculated for each of the four achievement goals in each study period.

21 Students were required to complete the AGQ following the last module in each study
22 period (i.e., after modules 4 and 9), but before summative examinations took place. Students
23 completing both questionnaires were eligible to receive extra credit on the final examination. It

1 should be noted that the extra credit was removed when completing the statistical analysis.
2 Students' raw iRAT scores were stored in InteDashboard™, regardless of grading condition, and
3 examinations scores were stored in Exam Soft™. Qualtrics was used to administer and collect
4 responses to the AGQ.

5 *Statistical Analysis*

6 All iRAT and examinations questions underwent a multi-step review process by faculty
7 instructors in the course. Questions were reviewed for item flaws and alignment with the module
8 and course learning objectives. Post-hoc review of the assessment questions was also performed
9 and any questions with a critical flaw were removed from the analysis. Descriptive statistics
10 were used to compare baseline demographic information (e.g., work history, gender, age, grade
11 point average). Chi-square and t-tests were used to analyze baseline differences in demographic
12 information.

13 Multivariate analysis of variance (MANOVA) was used to analyze within-subject
14 differences in assessment performance and achievement goals across the two iRAT grading
15 conditions. The multivariate analysis of assessment performance included within-subject
16 differences in iRAT scores and examination scores between study periods. The multivariate
17 analysis of achievement goals included differences in each of the four achievement goal scores
18 (mastery-approach, mastery-avoidance, performance-approach, performance-avoidance).
19 Significant omnibus tests were followed by univariate testing with one-way analysis of variance
20 using Bonferroni correction. The data were analyzed for period, group, and carryover effects.

21 The results of the power analysis revealed that to detect a medium effect size (Cohen's f
22 = .25) with 80% power and alpha equal to .05, a sample size of 33 students in each group was
23 needed. For comparison, a total of 198 students would be needed in each group to detect a small

1 effect (Cohen's $f = .10$) and a total of 14 students in each group would be needed to detect a large
2 effect (Cohen's $f = .40$). A medium effect size was chosen based on what would provide a
3 meaningful result and what was feasible with the given convenience sample in the course.

4 **Results**

5 All students in the class ($N = 91$) signed and acknowledged the consent form to
6 participate in the study. Students in Teams 1-8 ($n = 47$) were assigned to the G/UG grading
7 sequence and students in Teams 9-16 ($n = 44$) to the UG/G grading sequence. The mean age of
8 participants was 25.42 years ($SD = 3.98$), and the average grade point average was 2.89 ($SD =$
9 $.47$) (Table 1). There were no statistically significant differences in baseline characteristics
10 between groups.

11 *Assessment Performance*

12 The omnibus test demonstrated a statistically significant main effect of the iRAT grading
13 condition on assessment performance, $F(2,88) = 3.851$, Wilks' $\Lambda = .992$, $\eta^2 = .080$, $p = .025$.
14 There was no significant within-subject difference based on treatment period, $F(2,88) = .288$, η^2
15 $= .008$, $p = .750$, nor was there a significant between-subject difference based on intervention
16 sequence, $F(2,88) = 340$, $\eta^2 = .008$, $p = .713$. These findings indicate that there were no
17 significant period or carryover effects, and that the observed differences were indeed attributable
18 to changes in grading conditions.

19 Post-hoc univariate testing demonstrated a significant effect of the iRAT grading
20 condition on iRAT scores ($F(1,89) = 6.813$, $p = .011$, $\eta^2 = .071$) but not on examination scores
21 ($F(1,89) = .723$, $p = .397$, $\eta^2 = .008$) (Table 2). Within-subject iRAT scores were 4.53% ($SD =$
22 17.09) higher during the graded iRAT condition than the ungraded condition. Figure 2 depicts
23 the difference in iRAT scores and examination scores, respectively, for each group during
24 periods 1 and 2.

1 students were incentivized to be present for class and thus were more likely to learn from their
2 peers during in-class activities, regardless of whether they prepared for class.

3 Another notable difference in our study is that the tRAT remained graded. Although this
4 seems counterintuitive in light of the “ungrading” movement, maintaining a graded tRAT was a
5 strategic decision based on the premise of social interdependence theory. Social interdependence
6 exists when individuals share common goals, and each individual’s actions are affected by the
7 actions of others.^{33,34} Taking it a step further, positive social interdependence exists when
8 members of a team believe that they benefit both individually and collectively when they work
9 towards shared common goals, and that team success depends on the contribution of all team
10 members. Studies have demonstrated that having positive goal interdependence results in higher
11 achievement, greater productivity, and a sense of “ought to” within individuals.³³⁻³⁵ Thus, we
12 believe the positive social interdependence created because of the graded tRATs fueled not only
13 team performance but also individual performance (i.e., pre-class preparation). Perhaps this
14 explains, in part, the magnitude of difference in iRAT scores between our study and the one by
15 Behling et al.²⁹

16 In contrast to the results of our study, Eudaley et al.²⁷ found no difference in grades when
17 iRATs were graded versus ungraded; however, there are important differences in the study
18 design and educational context between these two studies. The retrospective design of the study
19 by Eudaley et al. limits the ability to make causal inferences, but perhaps most notable is that the
20 study was conducted in an elective ambulatory care course. The results from such a course are
21 likely to be influenced by selection bias (i.e., higher achieving students, who are more likely to
22 complete pre-class preparatory materials, may have been more likely to take the course). In

1 comparison, the present study was conducted in a required PharmD course that included both
2 higher and lower performing students.

3 Acknowledging the nuances of how educational context influences outcomes is critical,
4 and attempting to generalize this study's findings to other TBL classrooms should be done
5 cautiously. Extrapolating the results of this study to other courses using TBL may produce
6 entirely different outcomes depending on the overarching incentive structure within the course.
7 As an example, consider whether these findings could be extrapolated to first-year pharmacy
8 students. Pharmacy students in their first professional year have much less exposure to the
9 practice of pharmacy and have a relatively undeveloped sense of professional identity. As a
10 result, first-year pharmacy students may be less capable of relating what they are doing in the
11 classroom to what they will be doing as a future pharmacist. This subtle difference may be
12 enough to produce a much more pronounced effect on assessment scores when the incentive of a
13 graded iRAT is removed. Further, differences in student motivation exist in contexts outside of
14 health professions education, such as undergraduate education. In short, the results of this study
15 should not be blindly applied to all courses using TBL.

16 Achievement goals can be defined as "the purpose for engaging in competence-relevant
17 behavior".³⁶ In essence, achievement goals explain *why* students engage in a particular learning
18 task. Many studies have cited the need to promote mastery achievement goals as a reason for
19 "ungrading"; however, few have studied the impact of such changes on achievement goals. This
20 study investigated students' task-specific achievement goals and found no difference despite
21 changes in grading structure. The relative stability of students' achievement goals is not entirely
22 surprising. Prior studies have demonstrated relative stability in achievement goals across a
23 similar learning task within a course or semester and studies within health professions education

1 have demonstrated fluctuations in achievement goals only over longer durations (e.g., semester-
2 over-semester and year-over-year).^{37,38} In the present study, changes in achievement goals were
3 measured within a single 8-week course and assessments of achievement goals were separated
4 by only four weeks. This could at least partially explain why there were no observed changes in
5 students' achievement goals.

6 It is also important to note that all other aspects of grading in the course relied on
7 traditional grading measures. For example, examinations still accounted for 60% of the total
8 grade in the course. It is plausible that subtle changes in the iRAT grading structure were not
9 significant enough to produce changes in task-specific achievement goals, and thus it remains
10 uncertain how more substantive changes to grading (e.g., changing to pass/fail course) would
11 have influenced the findings. It is also possible that changes in grading structure alone are not
12 enough, and that it needs to be coupled with an intervention to teach students about the
13 malleability of achievement goals and the benefits of adopting mastery goals.^{36,39}

14 Despite the prospective study design and control over between-subject confounders, there
15 are several notable limitations to consider. The study investigators identified that students in the
16 ungraded iRAT condition spent ~20% less time completing the iRAT. This raises the question
17 about whether students' iRAT scores in the ungraded condition were lower simply because they
18 put forth less effort and/or did not see the value in completing the assessment. This study also
19 used selected-response for the assessment questions, which is an imperfect and incomplete
20 measure of learning. It is worth noting, however, that the assessments underwent a multi-step
21 review process for quality assurance. Post-hoc analysis of performance indicated good internal
22 reliability and consistency (Kuder-Richardson 20 value equal to 0.74 and 0.72 for examinations
23 1 and 2, respectively).

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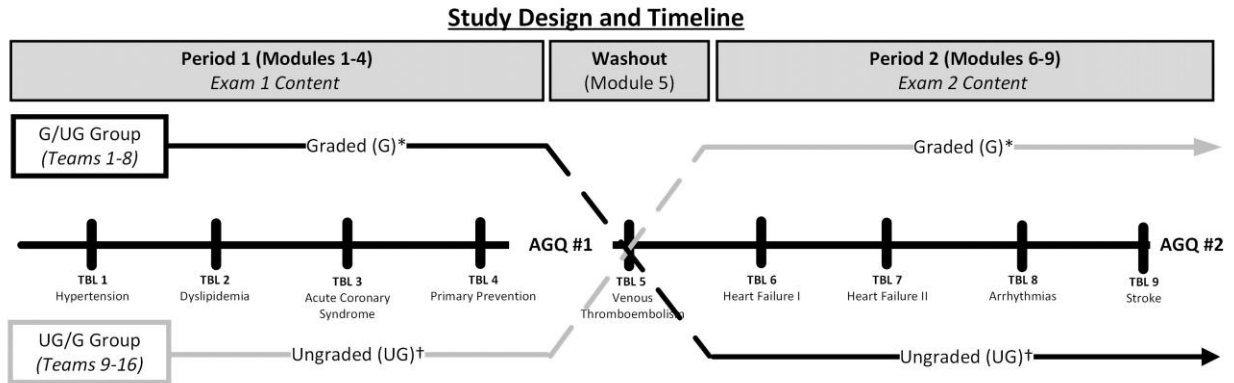
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Figure 1. Crossover Study Design and Timeline



*Grades assigned based on correctness

†Full credit given for completing the individual and team readiness assurance process, regardless of correctness

AGQ = Achievement Goal Questionnaire (Elliot & McGregor, 2001); G = graded; RAT = readiness assurance process; TBL = team-based learning; UG = ungraded

Table 1. Demographics Table with Univariate and Bivariate Statistics

	Overall	Group 1 (G/UG) <i>n</i> = 47	Group 2 (UG/G) <i>n</i> = 44	<i>p</i>
Age, years, <i>M</i> (<i>SD</i>)	25.42 (3.98)	25.43 (4.00)	25.41 (3.99)	.764
GPA, <i>M</i> (<i>SD</i>)	2.89 (.47)	2.84 (.43)	2.95 (.51)	.373
Gender				.655
Female, <i>n</i> (%)	60 (65.9)	32 (68.1)	28 (63.6)	
Male, <i>n</i> (%)	31 (34.1)	15 (31.9)	16 (36.4)	
English as a second language, <i>n</i> (%)	26 (28.6)	11 (23.4)	15 (34.1)	.259

Note. There were no statistically significant differences in baseline characteristics between groups. GPA = grade point average; *M* = mean; *n* = number of participants; *SD* = standard deviation

Table 2. Analysis of Variance of Within-Subject Differences in Assessment Scores

		Period 1		Period 2		Within-Subject Differences (G – UG)		F	η^2	p
		M	SD	M	SD	M	SD	(1,89)		
iRAT	G/UG	71.95	10.89	68.62	13.95	3.33	15.12	6.813	.071	.011
	UG/G	67.35	12.87	73.07	16.92	5.72	17.92			
Exam	G/UG	79.82	9.24	80.31	9.01	.49	9.21	.723	.008	.397
	UG/G	81.82	8.70	80.82	8.45	1.00	7.29			

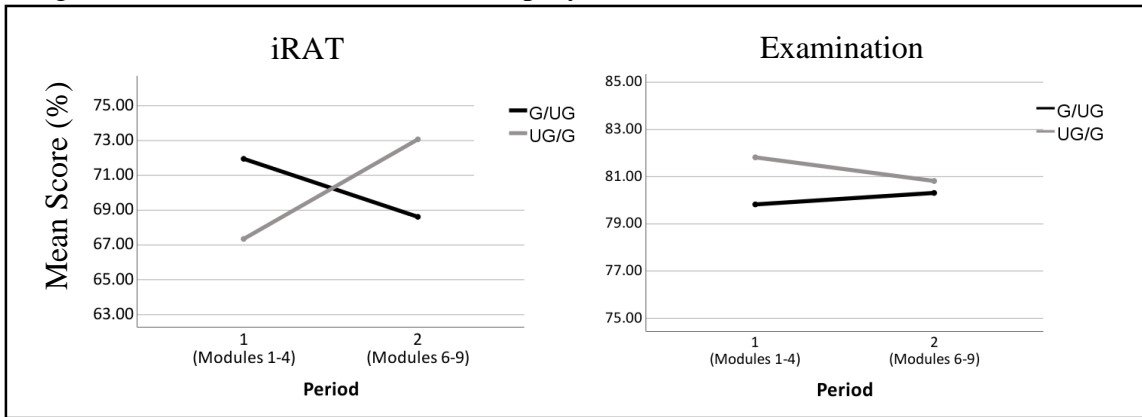
Note. G = graded; UG = ungraded

Table 3. Achievement Goal Scores by Group and Period

	Period 1		Period 2	
	<i>M (SD)</i>	<i>Mdn</i>	<i>M (SD)</i>	<i>Mdn</i>
Performance-Approach (PAp)				
G/UG	4.70 (1.39)	5	4.16 (1.25)	4.33
UG/G	4.98 (1.57)	5	4.67 (1.59)	5
Performance-Avoidance (PAv)				
G/UG	5.79 (1.23)	6	5.67 (1.04)	5.67
UG/G	5.54 (1.30)	6	5.26 (1.59)	5.67
Mastery-Approach (MAp)				
G/UG	6.16 (.75)	6	5.92 (.91)	6
UG/G	6.27 (.74)	6.33	6.33 (.63)	6.33
Mastery-Avoidance (MAv)				
G/UG	5.26 (1.34)	5.33	4.98 (1.04)	5
UG/G	5.10 (1.34)	5.33	4.83 (1.52)	5

Note. Mean and median are provided for completeness. Inferential statistics were performed using within-subject differences in mean achievement goal scores. G = graded; UG = ungraded; *M* = mean; *Mdn* = median; *SD* = standard deviation

Figure 2. iRAT and Examination Group-by-Period Effects



Appendix A. Achievement Goal Questionnaire and Codes

Achievement Goal	Item Code	Questionnaire Items
Performance- Approach (P-AP)	PAP1	<i>"It is important for me to do better than other students."</i>
	PAP2	<i>"It is important for me to do well compared to others."</i>
	PAP3	<i>"My goal in this class is to get a better grade than most of the other students."</i>
Performance- Avoidance (P-AV)	PAV1	<i>"I just want to avoid doing poorly in this class."</i>
	PAV2	<i>"My goal in this class is to avoid performing poorly."</i>
	PAV3	<i>"My fear of performing poorly in this class is often what motivates me."</i>
Mastery-Approach (M-AP)	MAP1	<i>"I want to learn as much as possible from this class"</i>
	MAP2	<i>"It is important for me to understand the content of this course as thoroughly as possible."</i>
	MAP3	<i>"I desire to completely master the material presented in this class"</i>
Mastery-Avoidance (M-AV)	MAV1	<i>"I worry that I may not learn all that I possibly could in this class"</i>
	MAV2	<i>"Sometimes I'm afraid that I may not understand the content of this class as thoroughly as I'd like"</i>
	MAV3	<i>"I am often concerned that I may not learn all that there is to learn in this class"</i>

CRediT Statement

Zachary R. Noel: conceptualization; methodology; formal analysis; data curation; writing – original draft; visualization; **Violet Kulo** – conceptualization; formal analysis; methodology writing – review & editing **Christina Cestone** – conceptualization; supervision; methodology **Hyun-Jin Jun** – methodology; formal analysis; writing – review & editing **Michael Sweet**– conceptualization **Karla Kubitz** – writing – review & editing **Karen Gordes** – conceptualization; supervision; writing – review & editing

Declaration of interests

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

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: