How Gaps Between Target and Midcourse Grades Impact Undergraduates' Studying Intentions and Grade Improvements

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ABSTRACT

We examine how gaps between students' chosen target grades and actual midcourse grades relate to their exam studying intentions and subsequent grade improvements. We further investigate whether those relationships are moderated by students' academic ability (as measured by high school averages) and implicit theory of intelligence or mindset (as measured by questionnaire scores). Our study involved 250 undergraduate students in a first-year business course. The study used linear regression to analyze survey responses at the course's beginning, survey responses near the course's end, and actual course grades. The analysis showed students had greater studying intentions and grade improvements when midcourse grades were farther below initial target grades. Mindset moderated the relationship between grade gaps and studying intentions, whereas academic ability moderated the relationship between grade gaps and grade improvements. These results enhance our knowledge of how students respond to grade feedback and could help instructors assist students to make better decisions about their studying.

Subject Areas: target grades, mindset, studying intentions, feedback

INTRODUCTION

Study Overview

Feedback is integral to learning (Hattie & Timperley, 2007; Mory, 2003; Schartel, 2012; Shute, 2008). Ramaprasad (1983: 4) defines feedback as "information about the gap between the actual level and the reference level of a system parameter which is used to alter the gap in some way". The *self-regulated learning model* (Thurlings, Vermeulen, Bastiaens, & Stijnen, 2013), for example, supposes that students establish goals for each course (*reference level*), assess the grades they get as feedback on their progress (*actual level*), and then adjust their effort as needed to achieve their goals (Butler & Winne, 1995).

However, learners' responses to feedback are not always so straightforward. One potential problem is that students might not define a precise goal for each course (van Lent & Souverijn, 2017). Another is that they might over-estimate their learning progress; weaker students are especially likely to suffer from such *predictive accuracy* problems (Kruger & Dunning, 1999). And even when they do perceive gaps between the actual and reference levels of their learning, they might not respond effectively enough to improve their learning and course outcomes.

Our objective in this study is to understand better how students respond in practice to gaps between their chosen goals and actual grades. To which gaps do students respond most strongly? Are students' immediate subjective responses accompanied by objective performance improvements? How do academic ability and personality affect those responses?

Our study considers 2 grade gaps as potential triggers of student responses:

- The *initial grade gap* is the difference between a student's *midcourse grade*, i.e., their average mark prior to writing the final exam, versus an *initial target grade* they previously had set at the beginning of the course. E.g., the gap is negative when their midcourse grade is lower than their initial target.
- The *revised grade gap* is the difference between a student's *midcourse grade* near the end of the course, versus a *revised target grade* they subsequently set. E.g., the gap is negative when their midcourse grade is lower than their revised target.

The study likewise considers 2 potential student responses to such gaps.

- *Studying intentions* represents a student's planned changes in how they will prepare for the final exam, subsequent to participating in the study, as represented by their answers to a 4-item questionnaire. E.g., the intentions are higher if a student reports they will spend more hours studying than they had originally planned.
- The *grade improvement* is the difference between a student's *final course grade*, i.e., their overall average mark on the course after including the final exam, versus the *midcourse grade* they had before that exam. E.g., the improvement is positive when a student's final course grade is higher than their midcourse grade.

Finally, the study includes 2 potential moderators of the relationships between grade gaps (initial and revised) and student responses (studying intentions and grade improvements).

- Students' overall *academic abilities* are represented by their *high school averages*. These averages are known to be good predictors of first-year university performance and are often used as measures of students' overall academic abilities (e.g., Arnold & Straten, 2012).
- Students' implicit theories of intelligence or *mindsets* are represented by their answers to an 8-item questionnaire. Students vary in their beliefs about intelligence being static (a *fixed mindset*) or malleable (a *growth mindset*), and those beliefs can affect their responses to feedback and their performance (Müllensiefen, Harrison, Caprini, & Fancourt, 2015).

Figure 1 illustrates the hypothesized relationships among these 6 components of our study. The next subsection describes those hypotheses in more detail.

Figure 1. Diagram illustrating overall study structure. Solid lines represent main effects and dashed lines represent moderating effects.
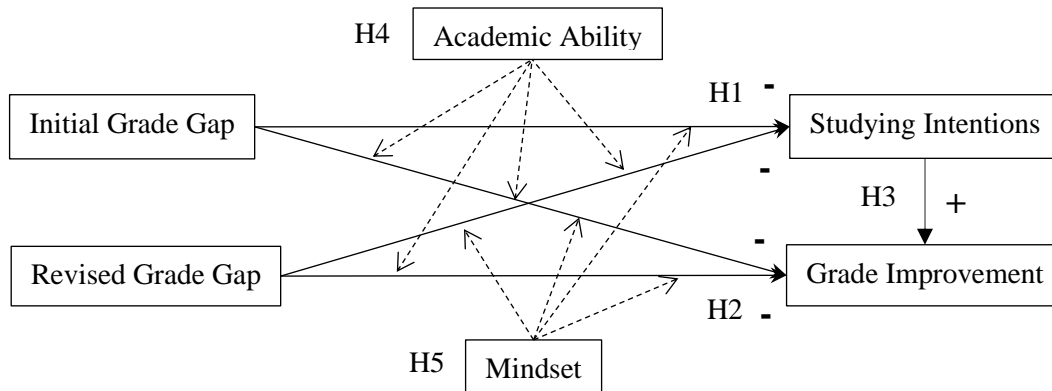
This study is part of our larger research program to help university students better understand their current progress and likely outcomes, both within individual courses and across overall degree programs. Knowing how students respond to grade gaps could help instructors provide better feedback in their courses. That in turn could enable students to make better decisions related to course selection, effort allocation, and course withdrawal. Better student decisions could consequently help universities improve retention and graduation rates.

Hypotheses and Related Literature

Responding to Feedback

Many learning theories highlight the importance of feedback and student responses to it. Feedback is important in behaviorism, cognitivism, social cultural theory, meta-cognitivism, and social constructionism (Hattie, 2009). According to *self-regulated learning* theory, students should respond to feedback that indicates differences between actual and target grades (Butler & Winne, 1995; Nicol & Macfarlane-Dick, 2006; Sitzman, Ely, Brown, & Bauer, 2010). *Metacognition* and *self-monitoring* are also relevant here (Ben-Eliyaju & Bernacki, 2015).

One practical complication with such theories is that students do not always define precise course goals. For example, van Lent and Souverijn (2017) found that only 270 of 492 students (55%) had a course-specific goal in mind prior to being asked for one. In their goal setting experiment, students who were asked to *set* a course goal did better than those who were not so asked (the control group). However, students who *raised* their original goal when encouraged to do so by a course-appointed mentor performed no better than the control group.

Students' goals also vary by type. *Achievement goal* theory (e.g., Nichols, 1984; Dweck, 1986) differentiates between *performance goals* (where students can *demonstrate* their ability by obtaining high grades) and *mastery goals* (where they can *improve* their ability by learning challenging material). Students who select performance goals generally select lower goals than students who select mastery goals.

Another complication is that students can have difficulty accurately estimating their likely course outcomes. Low *predictive accuracy* impedes effective self-regulation and goal setting (Beyer, 1999: 280), whereas high predictive accuracy permits students to better manage their time and effort, and thereby improve their course performance (Grimes, 2002; Hacker, Bol, Horgan, & Rakow, 2000). Empirical research suggests students in introductory courses have low predictive accuracy (Falchikov & Baud, 1989; Wüst & Beck, 2018). Fortunately, students' predictions can become more accurate as a course proceeds (Koriat, 1997) because they receive performance feedback on assignments and tests, while becoming better acquainted with course content, exam formats, and instructor expectations (Hacker et al., 2000). More broadly, *meta-cognitivism* suggests that students can develop themselves as self-regulated learners, as feedback helps them "learn to learn" (Brown, 1987; Garner, 1987).

Finally, while learning theory often focuses on working to bring performance in line with goals, in practice students also adjust their goals to reflect their performance (Ramaprasad, 1983). Armstrong and MacKenzie (2017) noted that students tended to revise their grade goals downward as a course progressed. Similarly, Wüst and Beck (2018) found that students reduced their grade expectations following a test. Those reductions were smaller in a second-term course than in a first-term course, primarily because student grade predictions at the start of the second term were less optimistic.

Our study aims to account for several of these practical complications. To begin with, we let each student freely select their individual target grades, as only when they take ownership of a goal can it play a significant role in self-regulation (Sadler, 1989). Like Armstrong and MacKenzie (2017), we ask students for their target grades at two points in time. This lets us evaluate which of two potential grade gaps might be most salient to their responses. We also reuse that study's 4-item questionnaire for assessing studying intentions; see Appendix for details. In this regard, we expect to replicate the study's finding that students tend to increase their studying intentions when their midcourse grades are lower than their target grades.

- *Hypothesis 1a. Initial grade gaps will be negatively associated with studying intentions. E.g., students will have higher studying intention scores when their midcourse grades are farther below their initial targets.*

- *Hypothesis 1b. Revised grade gaps will be negatively associated with studying intentions. E.g., students will have higher studying intention scores when their midcourse grades are farther below their revised targets.*

Our study goes beyond Armstrong and MacKenzie (2017) by examining whether grade gaps are also associated with objective grade improvements, rather than just subjective intentions. If grade gaps trigger increased studying for the final exam, that could in turn produce higher exam marks and grade improvements. Alternatively, grade gaps could lead to grade improvements by sparking better class attendance, improved note taking, greater class engagement, etc. Our hypotheses consider both these potential pathways.

- *Hypothesis 2a. Initial grade gaps will be negatively associated with grade improvements. E.g., students with midcourse grades farther below their initial target grades will achieve larger grade improvements.*
- *Hypothesis 2b. Revised grade gaps will be negatively associated with grade improvements. E.g., students with midcourse grades farther below their revised target grades will achieve larger grade improvements.*
- *Hypothesis 3. Studying intentions will be positively associated with grade improvements. E.g., students with higher studying intention scores will achieve larger grade improvements.*

Moderating Effect of Academic Ability

Our study also extends Armstrong and MacKenzie (2017) by considering how students' academic abilities might moderate the way they respond to grade gaps. Previous research has shown that students with weaker academic performance tend to have worse predictive accuracy and be more prone to overestimating their grades (Armstrong, 2013; Kruger & Dunning, 1999). Since students with weaker ability are more prone to *have* grade gaps (Armstrong & MacKenzie, 2017), it is plausible they will also have more problems in *responding* effectively to such gaps.

In our study, we use students' high school averages to represent their overall academic ability. These averages are known to be good predictors of first-year university performance and are often used as measures of students' overall academic abilities (e.g., Arnold & Straten, 2012; Armstrong & Biktimirov, 2013). We consequently expect students' academic ability, as represented by their high school averages, to moderate the four relationships described above. That is, students with higher high school averages are more likely to respond to midcourse grades being below their targets.

- *Hypothesis 4a. The influence of initial grade gaps on studying intentions will be stronger in students with higher high school averages.*
- *Hypothesis 4b. The influence of revised grade gaps on studying intentions will be stronger in students with higher high school averages.*
- *Hypothesis 4c. The influence of initial grade gaps on grade improvement will be stronger in students with higher high school averages.*
- *Hypothesis 4d. The influence of revised grade gaps on grade improvement will be stronger in students with higher high school averages.*

Moderating Effect of Mindset

The other potential moderator we consider is students' *implicit theory of intelligence* or *mindset*; i.e., the extent to which they believe intelligence is determined at birth, versus being malleable and subject to change throughout their life (Dweck, Chiu, & Hong, 1995). Dweck (2006) refers to these opposing viewpoints as *fixed mindsets* and *growth mindsets*, respectively. People with growth mindsets do not necessarily believe everyone can achieve the same level of intelligence, but rather that each individual can further develop the intelligence they have (Blackwell, Trzesniewski, & Dweck, 2007). Although some studies view fixed and growth mindsets as separate but related constructs (Abd-El-Fattah & Yates, 2006; Bodill & Roberts, 2013; Dupeyrat & Mariné, 2005), most see them as opposite ends of a continuum (Aditomo, 2015; Claro, Paunesku, & Dweck, 2016; Costa & Faria, 2018; Mercer & Ryan, 2009).

Educational researchers have increasingly become interested in the mindset concept over the past two decades. Dweck (1999) argues that students with growth mindsets choose more challenging (mastery) goals and employ adaptive learning strategies to improve their abilities. A growth mindset has been associated with stronger academic engagement (Martin, Nejad, Colmar, & Liem, 2013) and performance (Blackwell et al., 2007; Burnette, O'Boyle, VanEpps, Pollack, & Finkel, 2013; Müllensiefen, Harrison, Caprini, & Fancourt, 2015; Romero, Master, Paunesku, Dweck, & Gross, 2014). For example, Ravenscroft, Waymire, & West (2012) found that students with a growth mindset have the greatest improvement in course grades from one exam to the next. In a meta-analytic review of 46 studies, Costa and Faria (2018) concluded there is a low-to-moderate association between students' growth mindset and academic performance, both in specific subjects and in overall achievement.

We expect students' mindset, as measured by an 8-item questionnaire score, to moderate the 4 main relationships in our study. That is, students with higher (more growth-oriented) mindset scores are more likely to respond to midcourse grades being below their targets.

- *Hypothesis 5a. The influence of initial grade gaps on studying intentions will be stronger in students with higher mindset scores.*
- *Hypothesis 5b. The influence of revised grade gaps on studying intentions will be stronger in students with higher mindset scores.*
- *Hypothesis 5c. The influence of initial grade gaps on grade improvements will be stronger in students with higher mindset scores.*
- *Hypothesis 5d. The influence of revised grade gaps on grade improvements will be stronger in students with higher mindset scores.*

METHODOLOGY

Student Population

This study took place at a Canadian university accredited by the Association to Advance Collegiate Schools of Business. The university has about 1600 students in its 4-year undergraduate business degree programs. These students must take a 1-semester business principles course, normally in their first semester. The course contains 4 assessment components

each worth 25% of the total course grade: a writing proficiency evaluation, test #1, test #2, and a final exam. The two tests and the exam have identical formats: 50 multiple-choice questions and five short-answer questions. Grades are recorded on a scale from 0 to 100: 0-49 is a failure or "F," 50-59 is a "D," 60-69 is a "C," 70-79 is a "B," and 80-100 is an "A." The average final course grade is normally about 60. Typically, about 20% of students fail the course and another 20% withdraw before completion; most of those retake the course in a later semester. The course's design and outcomes have been relatively consistent throughout the past decade.

Data Collection

We collected the data during the fall semesters of 2017 and 2018. Each semester, we administered 2 student surveys. Participants completed Survey 1 in class at the start of the 12-week semester. The paper survey form asked students for their high school average (0-100) and the initial target grade they were aiming to achieve in the course (0-100). The survey also included a mindset questionnaire (see appendix) containing 8 Likert-type questions (1-7 each) taken from Dweck (2016, pp. 12-13). It had 4 questions related to growth mindset and 4 related to fixed mindset. The mindset questionnaire and scores were discussed during a lecture later in the course; consequently, every student in class completed Survey 1, though each could anonymously opt to exclude their scores from our research.

Participants completed Survey 2 online later in the semester after they knew all their marks apart from the exam. The survey software asked students to input the marks from their writing proficiency evaluation (0-100), test #1 (0-100), and test #2 (0-100), plus the revised target grade (0-100) they subsequently expected to receive for the overall course. The software averaged the writing and test marks to calculate the midcourse grades.

Survey 2 also asked students 4 Likert-type questions (see appendix) about whether they subsequently intended to modify their studying for the exam. The survey did not define "studying" but left it open for students to interpret in their own contexts. To avoid taking an overly restrictive view, the survey measured studying intentions along four dimensions: whether students intended to change *how much* they studied, *how* they studied, *when* they studied, or *how seriously* they studied. We did this because studying is not simply a question of quantity. even though students and faculty mostly believe that grades are related to time spent studying (Grimes, 2002). However, neither Schuman, Walsh, Olson, and Etheridge (1985) nor Michaels and Miethe (1989) found such a relationship. Furthermore, Rau and Durand (2000) suggest that *when* students study (its timing) might be better than *how much* they study (the amount) with respect to predicting exam performance. Burns (2007) argues that even without evidence of a relationship, the amount might still matter: if students believe a relationship exists, it is likely to affect their grade predictions.

Since participation in Survey 2 was voluntary, a research assistant emailed all students when the survey was put online and again one week later to encourage them to take part. As well, two participants were randomly selected to receive their choice of either a free second-term course textbook, or a $50 gift certificate for the university bookstore.

Survey data from any students who withdrew from the course, or who missed writing any of the tests, were excluded from our study. Data from students who missed either survey or who opted out of the study were also excluded.

A research assistant collected the responses from Survey 1 and Survey 2, along with a list of final course grades from the instructor. The assistant matched these 3 data sets by student identification number and removed any data from students who had opted out. The assistant then removed the identification numbers to provide us with anonymized data, in accordance with the procedure approved by the university's research ethics board.

We then used SPSS 25 statistics software to analyze the data in terms of summary statistics, correlations, and linear regressions. Before performing the regressions, we prepared the data by coding the year as a dummy control variable, with 0 for 2017 and 1 for 2018. We also centered all the quantitative variables by subtracting the respective means from each value. (Such centering reduces potential multi-collinearity problems among the variables and their interaction terms; see, e.g., Aiken & West, 1991). To represent each moderating effect, we multiplied the centered values of the respective moderating and independent variables to create an interaction term. When running stepwise linear regressions in SPSS, we used the default procedure where variables enter when $p \leq .05$ and exit when $p \geq .10$.

RESULTS

Comparing Population versus Sample

For the 2 semesters of the study combined, approximately 975 students in total started the course, of which 246 withdrew or otherwise did not write the final exam. Of the 729 students who completed the course and exam, 250 participated in both surveys while 479 did not, giving a 34.3% participation rate. Table 1 compares the participating and non-participating students with respect to high school averages and final course grades. Non-participants' values are derived indirectly by comparing the participants' values to the combined ones. For both parameters, the differences between participants and non-participants are statistically significant ($p = .000$). As with previous research (e.g., Armstrong, 2013; Westerman, Perez-Batres, Coffey, & Pouder, 2011), students with stronger academic performance were more likely to participate.

Table 1. Participating versus non-participating students

	Participants	Non-Participants	Combined
Number of students	250	479	729
High school average mean	84.45	82.55	83.20
Final course grade mean	61.50	53.49	56.24

Participants' Grades

Table 2 shows summary statistics for participants' actual and target grades. Students tended to set initial targets below their high school averages but still unrealistically high. After receiving their midcourse grades, they lowered their targets substantially. However, even after

that revision they continued to expect final grades higher than their midcourse ones; in reality, they ended-up slightly lower.

Table 2. Actual and target grades

	Initial Target	Midcourse Grade	Revised Target	Final Grade	Initial Gap	Revised Gap	Grade Improvement
Mean	78.32	63.04	69.08	61.50	-15.28	-6.04	-1.55
SD	6.84	12.88	10.13	12.45	13.64	8.42	3.20
Max	100	87.5	95	88	15.3	16.3	6.77
Min	60	19.97	25	22	-59.8	-64.6	-10.3

Table 3 displays summary statistics for the mindset and studying questionnaires. Each student's studying intention score is simply the sum of the 4 question responses ranging from 1 to 7. The total score thus could range from 4 to 28, where higher scores indicate greater studying intentions. For each student's mindset score, the scores for the 4 growth mindset questions were added to the reverse-scored responses of the 4 fixed mindset questions. This created a range from 8 to 56, where higher scores indicate more growth tendencies and fewer fixed ones. This approach is consistent with past mindset research (Aditomo, 2015; Claro, et al., 2016; Costa & Faria, 2018; Mercer & Ryan, 2009). Cronbach's alpha was .791 for mindset and .909 for studying intentions, indicating good reliability (Nunnally, 1978).

Table 3. Questionnaire scores

	Mindset Score	Studying Intentions
Mean	37.5	20.0
SD	7.98	6.00
Max	56	28
Min	13	4
Cronbach's α	0.791	0.909

Correlations

Table 4 shows the Pearson correlation coefficients for all pairs of quantitative variables. As expected, high school averages are positively correlated with both grade gaps; e.g., students with lower high school averages tended to earn midcourse grades farther below their initial target grades and set revised targets farther above those midcourse grades. The grade gaps likewise have strong positive correlations with each other; e.g., students who set overly high initial target grades also tended to set overly high revised ones.

More interestingly, both grade gaps show moderate negative correlations with studying intentions and weak negative correlations with grade improvements. E.g., students with midcourse grades farther below their target grades had higher studying intention scores and smaller decreases in their final grades. Contrary to expectations, studying intentions show no

significant correlation with grade improvements; e.g., students with greater intentions to increase their studying before the final exam did not get any greater improvements from it.

Table 4. Pearson correlation coefficients. Correlations with $r \geq .163$ have $p < .01$ (*), while those with $r \geq .207$ have $p < .001$ (**).

	Mindset Score	High School	Initial Gap	Revised Gap	Studying Intentions
High School Average	0.048				
Initial Grade Gap	0.048	0.228**			
Revised Grade Gap	0.005	0.226**	0.662**		
Studying Intentions	0.071	-0.171*	-0.450**	-0.339**	
Grade Improvement	-0.076	0.075	-0.182*	-0.170*	0.049

Linear Regressions

Table 5 shows the regression output from using all hypothesized relationships to predict studying intentions. It reports the regression coefficient B, the standardized coefficient β, the statistical significance p, and the variance inflation factor VIF. Only 3 variables have $p \leq .05$: year, initial grade gap, and the interaction of mindset score with revised grade gap.

Table 6 shows the results of using the same set of variables in a stepwise regression procedure, such that the final model only included statistically significant variables. The initial grade gap had the strongest influence on studying intentions; as expected, students with midcourse grades farther below their initial target grades had greater studying intentions. The only significant moderating effect was that of mindset score on the revised grade gap; students with more growth-oriented mindsets tended to react more strongly to gaps between their midcourse grades and revised target grades. Finally, students in the 2018 sample tended to have greater studying intentions than did those in the 2017 sample.

Table 5. Regression for Studying Intentions with all variables; $R^2 = .255$

	B	β	p	VIF
Constant	19.048			
Year	1.979	.165	.004	1.072
Initial gap	-.152	-.347	.000	1.883
Revised gap	-.108	-.152	.063	2.140
Initial gap * Mindset score	.000	-.008	.904	1.473
Initial gap * High school	.010	.128	.087	1.799
Revised gap * Mindset score	.018	.159	.022	1.537
Revised gap * High school	-.015	-.123	.124	2.058

Table 6. Regression for Studying Intentions with only significant variables; R^2 = .237

	B	β	p	VIF
Constant	19.170			
Year	1.773	.148	.010	1.045
Initial Gap	-.196	-.446	.000	1.019
Revised gap * Mindset score	.016	.141	.014	1.040

We subsequently redid the stepwise regression using only the initial grade gap and its interaction terms, while leaving out the revised grade gap and its interaction terms. This follow-up test had 2 purposes. The conceptual purpose was to investigate whether the remaining interaction terms might substitute for the omitted ones in their absence. The methodological purpose was to check whether the sequential nature of the stepwise algorithm had unduly affected its results. The initial grade gap`s interactions with mindset score and high school average did not become significant in either case.

Table 7 shows the regression output from using all hypothesized relationships to predict grade improvement. Only 2 variables are significant: the year and the initial grade gap.

Table 7. Regression for Grade Improvement with all variables; R^2 = .132

	B	β	p	VIF
Constant	-.750			
Year	-1.681	-.263	.000	1.108
Initial gap	-.044	-.188	.029	2.044
Revised gap	-.002	-.005	.952	2.171
Initial gap * Mindset score	.001	.039	.593	1.473
Initial gap * High school	.003	.059	.464	1.820
Revised gap * Mindset score	-.000	-.005	.946	1.570
Revised gap * High school	.006	.100	.247	2.078
Studying intentions	-.006	-.011	.870	1.341

Table 8 shows the results of inputting the same variables into a stepwise regression. The initial grade gap's influence is statistically significant: students with midcourse grades farther below their initial target grades tended to get larger grade improvements. The moderating effect of high school average on the revised grade gap is also significant; students with higher high school averages tended to react more strongly to midcourse grades being below their revised target grades. Finally, students in the 2018 sample tended to obtain slightly smaller improvements in their grades than did those in 2017.

Table 8. Regression for Grade Improvement with only significant variables; $R^2 = .128$

	B	β	p	VIF
Constant	-.821			
Year	-1.738	-.272	.000	1.015
Initial Gap	-.044	-.189	.002	1.045
Revised Gap * High school	.009	.140	.021	1.031

We also redid this stepwise regression while leaving out the revised grade gap and its interaction terms. In this case, the interaction of initial grade gap and high school average became significant ($p = .037$), taking the place of the revised grade gap and high school average.

DISCUSSION

Support for Hypotheses

Hypothesis 1: The analysis provides more support for Hypothesis 1a than for 1b regarding the effects of grade gaps on studying intentions. Both the initial and revised grade gaps have significant correlations with studying intentions; but the initial grade gap's correlation is stronger and is the only significant one in the stepwise regression. Students reacted to gaps between their initial target grades and midcourse grades by increasing their studying intentions.

Hypothesis 2: Similarly, the analysis provides more support for Hypothesis 2a than for 2b regarding the effects of grade gaps on grade improvements. Both the initial and revised grade gaps have significant correlations with grade improvements; but the initial grade gap's correlation is stronger and is the only significant one in the stepwise regression. Students reacted to gaps between their initial target grades and midcourse grades by getting better (less negative) grade improvements.

Hypothesis 3: Our results did not support Hypothesis 3 regarding the influence of studying intentions on grade improvement. Their correlation is not significant, nor is their relationship in the stepwise regression. Schuman et al., (1985) and Michaels & Miethe (1989) also failed to find such a relationship.

Hypothesis 4: Our results support Hypothesis 4d but not 4a, 4b, or 4c regarding the moderating effect of academic ability. The only significant moderating effect is for the relationship between revised grade gaps and grade improvements. For a given grade gap, grade improvements were larger for students with above average academic ability than for those with below average ability.

Hypothesis 5: Our results support Hypothesis 5b but not 5a, 5c, or 5d regarding the moderating effect of mindset. The only significant moderating effect is for the relationship between revised grade gaps and studying intentions. For a given grade gap, studying intentions were stronger for students with more growth mindset tendencies than for those with more fixed mindset tendencies.

Contributions and Implications

Research and Theory

On the one hand, our results suggest students *on average* respond in relatively straightforward ways to lower-than-expected midcourse grades. The larger their initial grade gaps, the more they increase their studying intentions and (to a lesser extent) the more they improve their final course grades.

On the other hand, the results also show that *individual* student's responses can vary significantly from those average tendencies, depending on their mindsets and abilities. For a given grade gap size, students with more growth-oriented mindsets increase their studying intentions more but without getting any greater grade improvements. Conversely, students with stronger academic abilities obtain greater grade improvements but without making extra increases in their studying intentions.

This implies that research on learning should examine more than just the average student response to experimental treatments. It is important to also consider how an individual student's characteristics can cause their responses to differ significantly from those of their classmates. Students might react strongly as individuals even if their average response as a group is negligible.

Our work also shows that predictive accuracy remains an important concern even after students receive midcourse grade feedback, as students continue to set overly optimistic goals when they revise their target grades. This confirms what others have found (Armstrong & MacKenzie, 2017; Wüst & Beck, 2018). Predictive accuracy is known to be more problematic for students with weaker academic abilities (Kruger & Dunning, 1999). One contribution of our study is to reveal that predictive accuracy can also be more problematic for students with growth mindsets, at least in first-year university courses. Growth mindsets are often considered advantageous for students; however, among our first-year students they merely triggered stronger studying intentions, not stronger grade improvements. This builds on the finding from Armstrong and MacKenzie (2017) that first-year students with a higher sense of personal control, another normally advantageous trait, tend to set higher goals but not obtain higher grades.

Teaching in Practice

Given these concerns, our results suggest it could be worthwhile for instructors in first-year university courses to help students improve their predictive accuracy. Simply warning them about overly optimistic target grades has been shown to have little impact (Plous, 1995). In the course we studied, students are informed, both in writing in the syllabus and verbally during the first lecture, that the class average typically ends up around 60. Despite those clear cautions, participants' mean initial target grade of 78 was only slightly below their mean high school average of 84. It seems they largely discounted the course-specific information and instead relied mostly on their high school averages as reference points.

Of course, it can be difficult to encourage new university students to lower their targets to more realistic levels without creating a fearful and negative class environment. One potential approach could be to frame individual student grades relative to class averages. For example, a student who expects an 80 but then receives a 65 could interpret that as a sign of individual failure, and consequently drop the course or even quit school. By contrast, if the student can be encouraged to frame their individual 65 in the context of the class average being 60, they might find it less demotivating. This might require more instructor-student interaction, as simply providing feedback and asking for revised targets still results in overly high expectations.

Another interesting suggestion is to grade assignments for growth (Dweck, 2010). That is, instructors could provide a "preliminary grade" on an assignment, accompanied by an offer to revise that grade if students continue to work on and improve their assignment.

Our results also suggest that teaching practice, like research, must be mindful of individual student characteristics. For example, when dealing with students who are academically strong and have growth mindsets, professors might encourage them to set more ambitious goals. Such students could respond by enhancing their studying (thanks to their mindsets) and obtaining better grades (thanks to their abilities). Conversely, providing the same encouragement to students with weaker abilities and fixed mindsets might instead be unproductive, unless perhaps supplementary tutoring or other academic support is also provided. Of course, tailoring instruction this way is easier in upper-level courses with small classes than in first-year courses with hundreds of students.

Limitations and Future Research

One limitation of our data was the lower participation rates among students with lower marks, a common problem in studies where student participation is optional. This implies some of our results might be less applicable to this group. With respect to teaching practice, it suggests that instructors offering enhanced feedback in their classrooms should make participation mandatory, perhaps as part of a low-stakes homework assignment.

One limitation of our analysis was the use of stepwise regression. It is possible that the sequential nature of the calculations might have affected which variables were ultimately found to be significant. However, the fact that those regression results agree with both the earlier correlation results and the subsequent follow-up regressions provides some reassurance.

Our study included mainly students in their first university term after high school. Transitions between school levels, such as from high school to university, place extra demands on learning strategies, while also disrupting them (Grolnick & Raftery-Helmer, 2015). Students in higher years of university have more experience, and so may have more realistic grade goals and a better sense of how to achieve them. As well, they should be more accustomed to receiving midcourse feedback and may respond differently to it. Future research therefore could examine undergraduate students beyond the first year, and/or graduate students, to see whether they respond similarly to first-year undergraduates. Future studies also could include other academic programs and universities to see if student responses vary by specialty or geography.

Another line of research could examine the impact of providing feedback earlier in a course. In the course we studied, students were asked for a revised target grade when 75% of their course grade was known. It is possible that students would have responded differently if they had been asked for revised target grades earlier, when only 25% or 50% of their course grade was known. Similarly, a course structure that provides low-stakes assessments very early in the course might encourage students to adjust their target grades and studying intentions sooner, leading to larger grade improvements.

Much theoretical work on learning focuses on the idea that students will reduce any gaps between their goals and their grades by increasing their efforts and thus their grades (Butler & Winne, 1995; Nicol & Macfarlane-Dick, 2006). However, that effect was not apparent in either our study or that of Armstrong and MacKenzie (2017). Instead, both studies saw students primarily reducing their targets (Ramaprasad, 1983; Wüst & Beck, 2018). Future research could explore this goal adjustment process.

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APPENDIX

Mindset Questionnaire

Responses range from 1 (strongly disagree) to 7 (strongly agree). The numbers indicate each question's mean and median score, respectively, after reverse scoring where needed.

5.18   5   Your intelligence is something very basic about you that you can't change very much. (reverse scored)

4.75   5   You can learn new things, but you can't really change how intelligent you are. (reverse scored)

4.80   5   No matter how much intelligence you have, you can always change it quite a bit.

4.90   5   You can always substantially change how intelligent you are.

4.86   5   You are a certain kind of person, and there is not much that can be done to really change that. (reverse scored)

4.71   5   No matter what kind of person you are, you can always change substantially.

4.89   5   You can do things differently, but the important parts of who you are can't really be changed. (reverse scored)

3.45   3   You can always change basic things about the kind of person you are.

Studying Intentions Questionnaire

Responses range from 1 (strongly disagree) to 7 (strongly agree). The numbers to the left indicate each question's mean and median score, respectively.

5.25   6   Now that I have completed this exercise, I plan to increase the number of hours that I study for this course.

4.58   5   Now that I have completed this exercise, I plan to change how I study for this course.

5.18   5   Now that I have completed this exercise, I plan to begin preparing earlier for my final test.

5.00   5   Now that I have completed this exercise, I will take my studying for this course more seriously than I have in the past.

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