Do Lightly-Flexible Deadlines Support Student Performance?

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Abstract

Since the return to in-person classes after our COVID-19 lockdown semesters, we have implemented a policy of "lightly-flexible" deadlines in three required undergraduate courses in our chemical engineering curriculum. Under this policy, now in effect for two or three years, example solutions and rubrics are not posted immediately when assessments are due, but instead posted 48-72 hours later (the exact timing depends on the class). Students are permitted to upload their work to our Learning Management System (LMS) without penalty up until the time the solutions and rubrics are made available, and after this point, no credit is earned. This policy has helped to alleviate some student issues and complaints about inflexibility, especially if a technical glitch prevented an upload from meeting the deadline, but also in situations when a student has a temporary setback like minor illness or a bad day. From the instructor standpoint, the policy also prevents a considerable number of "judgment calls" about what is or is not a valid excuse for submitting assessments late.

It is observed in the literature that procrastination often correlates with both lower student performance and higher levels of student stress. Having deadlines that are too flexible can lead to students never taking the time to demonstrate the learning outcomes associated with the course. The results from our students confirm in part the correlation between procrastination and student performance. While some students of all levels of performance have made use of the "lightly-flexible" deadline policy, we observe that students who earn C, D, and F grades in these three courses make use of the policy on average two to three times more often than those earning A and B grades. Further, a higher proportion of students with A grades never make use of the policy at all. The data also reveals differences between class levels: in our junior-level course, an average of 0.5 slight extensions per student have been granted, versus on average 1.0 extensions per student among the sophomores and 3.0 extensions per student among the first-years.

Background

The University of Delaware is a medium-sized public institution whose chemical engineering program graduates on average 80 undergraduates per year. The coursework offered out of the department begins in the spring of the first-year with a required introductory course, with each subsequent semester having one to three required chemical engineering courses. The courses considered in this paper are three required courses: an introduction to chemical engineering in the first year, a chemical engineering statistics course in the second year, and a fluid mechanics course in the third year. One faculty member was consistently instructor of record for each of these courses, though sometimes the course was co-taught with either another faculty member or an advanced graduate student completing a teaching fellowship [1]. Courses in Spring 2021 were offered entirely online and synchronously, while all other courses were offered entirely face-to-face. The enrollment in each course (not counting those auditing) is provided in Table 1.

Table 1: Courses Applying the Methods of this Paper

Course	Semester	Enrollment
Introduction to Chemical Engineering	Spring 2021	113
	Spring 2022	88
	Spring 2023	85
Chemical Engineering Statistics	Spring 2021	73
	Spring 2022	93
	Spring 2023	81
Fluid Mechanics	Spring 2022	84

Particularly during the online semesters but even after we returned to face-to-face instruction, there has been an increase in students requesting extensions and other accommodations. Some of these reasons have been direct impacts of COVID (deaths in the family or students needing to quarantine) and others indirect (lack of private space to attend class or work from home; inequities in available technology and internet access; increased stress and anxiety). Rather than add additional burden to students to have to defend their need for extensions, the instructors of these courses agreed to grant extensions to anyone who requested them.

The need to grant extensions leads to another set of decisions to be made. Namely, how long is appropriate for an extension on a problem set, and how and when should sample solutions be shared with the class? There is no way to guarantee that someone with an extension won't access solution files posted online, and while LMSs can track which accounts have accessed which parts of a course website, files can easily be downloaded and shared without such tracking. While admittedly an arbitrary decision at first, extensions were granted for just roughly two days – until 11:59 pm on the Friday of the week of the original deadline – so that solutions could still be posted and viewed by the students who were keeping up with the original deadlines of the course.

It is possible that some students request extensions due to procrastination or poor time-management skills. There have been multiple meta-analyses that describe procrastination as a failure to self-regulate (including [2]), suggestions that procrastination may be a symptom of a learning disability [3], and calls for further research into the nature of "academic procrastination" and its correlation with self-esteem, mental health, and academic success [4]. These are grand ideas outside the scope of this small study, and at the same time, ideas that don't necessarily address all circumstances of late submissions. Many of our own students have offered (unprompted) the reasons for their late submissions, and while some could fall under the umbrella of procrastination, others are due to unforeseen or uncontrollable circumstances.

Some research indicates that having just short periods of flexibility in deadlines may be an effective choice to deal with these circumstances. Too much flexibility can lead to students never completing work at all: students without enough scaffolding working through projects and courses can easily procrastinate significant chunks of work for so long that it is impossible to sufficiently complete work by the end of the semester. Having regular deadlines is a "small-teaching intervention" that can in part help students to avoid academic procrastination. Research

also shows correlations between assignment submission times and final grades (generally, those who submit earlier perform better in a course than those who submit at the deadline or later) and between assignment submission times and self-reported levels of stress (students with later submissions generally report higher levels of stress) [5].

The final decision we made was to have no penalty for late work, as long as it was submitted before sample solutions published within the LMS. This was helpful for making sure that problem set grades reflected only student learning, and not time of submission. Since all assignments were scored to the same rubric with no penalties applied for late submission, individual problem performance could more easily be reviewed and analyzed for continuing improvement and direct assessment needs for accreditation.

Other faculty and our department advisory board expressed surprise and curiosity at the implementation of the above policy, especially for the entry-level courses, since they would argue that students needed to learn self-discipline and time management from the beginning (and it is true that lower-level students exhibit more procrastination-like behaviors than higher-level students [4]). Faculty often cite examples like inflexible deadlines for grant proposals as a reason students should be taught early and often to complete all of their work on time. So, a simple question arises from the implementation of this specific late policy: does having "lightly-flexible" deadlines set students up for success or not? As a first attempt to answer this question, we retroactively investigated the LMS sites for the courses using this policy to look for trends in student behavior and final grades.

Methods

Traditional problem sets remain a staple feature of these three courses. For eight to ten weeks out of the semester, a set of usually four problems would be assigned and due one week later. In total, for all three courses, problem sets were worth 20% of the final grade. In both online and face-to-face courses, each individual problem submission is collected through a separate portal in our Learning Management System (LMS). For example, if "Homework Set 1" were published on a Wednesday, there would be four portals, for "Homework Set 1, Problem 1," and so on, each with the same due date and time of the start of class one Wednesday later. However, the LMS portals were programmed with both a due date and an availability date – so problems due during the day on a Wednesday would still be accepted by the system until 11:59 pm on the Friday of that week. After this time, sample solutions for the problems were made available to all students through the LMS, and the LMS would not permit new submissions past this time.

The source of problem sets varied through the courses – some problems were designed "from scratch" by the instructor(s), some were assigned directly from the required textbook for the course, and some were recycled from previous implementations of the course. On average, roughly one third to one half of each course's problem sets were brand new the year they were assigned.

The three years' worth of the Introduction to Chemical Engineering and Chemical Engineering Statistics courses were structured the same way, such that they respectively collected exactly 32 and 36 problem submissions across the span of the semester each year. The Fluid Mechanics

course had different numbers of problems on some weekly sets, resulting in 47 problem submissions for the 2022 year considered here.

LMS gradebooks were reviewed retroactively to tally the number of late and missing submissions per student as well as the final letter grade earned in the course. The LMS gradebook was exported directly from the site and identifying information was removed before reviewing this information.

Results and Discussion

Final grades for students were binned into ranges, where "A" includes both A and A- grades; "B" includes B+, B, and B-, "C" includes C+, C, and C-, and "Lower" includes all other grades, since a C- or better is a prerequisite to continue with the next course in the chemical engineering sequence. For each student within a bin, the number of late individual homework submissions were tallied. The percentage of students who took advantage of the policy out of the number of students who earned a grade in each range is presented in Table 2.

Table 2: Percentage of Students Submitting One or More Late Problems by Course and Final Grade

Course	Introduction to Chem-E			Chem-E Stats			Fluids
Year	2021	2022	2023	2021	2022	2023	2022
A	41	21	40	14	7	13	24
B	37	41	62	27	23	10	6
C	52	71	82	50	42	42	44
Lower	73	88	100	40	40	0	25
Overall	44	43	67	23	24	15	18

It is worth noting that students of all performance levels have used the opportunity to submit late, so this policy came to the aid of even some students who ultimately earned A grades.

The average numbers of late submissions per student are collected in Table 3.

Table 3: Average Number of Late Problem Submissions by Course and Final Grade

Course	Introduction to Chem-E			Chem-E Stats			Fluids
Year	2021	2022	2023	2021	2022	2023	2022
A	1.5	0.7	1.2	0.3	0.5	0.8	0.1
B	2.4	1.5	3.9	1.7	0.7	0.3	0.3
C	3.8	7.3	9.3	1.8	2.5	1.9	1.0
Lower	5.2	7.8	9.4	3.0	8.8	0	1.5
Overall	2.8	2.8	5.5	1.1	1.2	0.6	0.5

There is a clear negative correlation between the number of late submissions and overall success in the course. In nearly every case, students earning grades in the A- or B-range need on average only one allowance to submit a single problem – only part of one problem set – late.

There is also a clear decrease in student need to make use of this policy with increased time in the program, with course-wide averages of three to five late submissions per student in the first-year course, roughly one late submission per student in the sophomore year, and a fraction of a late submission per student in the junior year. Some part of this decrease in late submissions could be explained in the sense that one cannot take the junior-level course without passing the sophomore year. Students who were more likely to have more late submissions are also more likely to not qualify for the next course, which reduces the lateness of submissions in future courses.

The above analysis does not take into consideration the number of submissions that are entirely missing. We do not have a way to tell if a missing submission would have eventually been submitted but even later, or if a missing submission is the result of no attempt ever. Missing submissions resulted in zeroes for grades, which would obviously lower a student's overall course grade as well. They also explain some of the discrepancy in the sophomore and junior courses, where the percentage of students submitting late assignments and earning a D or lower is lesser than those earning a C – because those D or lower students are not submitting at all, rather than merely late.

Table 4 shows that, indeed, the number of missing submissions negatively correlates even more strongly with final course grades.

Table 4: Percentage of Students Not Submitting One or More Problems by Course and Final Grade

Course	Introduction to Chem-E			Chem-E Stats			Fluids
Year	2021	2022	2023	2021	2022	2023	2022
A	0	6	7	22	0	0	6
B	5	14	24	27	20	16	13
C	48	47	82	11	50	33	38
Lower	82	100	80	100	100	100	75
Overall	21	25	33	32	25	19	19

Our students who did not pass the class almost always skipped one or more problem submissions. More dramatically, Table 5 shows that those who did not pass the class, on average, did not submit 40% of more of the problems at all.

Table 5: Average Number of Missing Problem Submissions by Course and Final Grade

Course	Introduction to Chem-E			Chem-E Stats			Fluids
Year	2021	2022	2023	2021	2022	2023	2022
A	0	0.09	0.07	0.5	0	0	0.24
B	0.12	0.17	0.76	1.15	0.48	0.53	0.26
C	1.48	1.24	2.29	7.67	3.25	2.67	2.81
Lower	13.5	14.0	12.2	24.8	13.4	29.7	23.5
Overall	1.16	1.60	1.80	2.99	1.45	1.83	1.85

As one result of the above analysis and a change in instructors for the junior-level fluid mechanics course in 2023, for the first time the "lightly-flexible" deadline policy was (1) stated outright in class and on the syllabus and (2) set a limit on the number of times the policy could be used before there is a penalty to the overall grade. Problems were still graded as normal even if this limit was exceeded, but an overall percentage deduction (up to 5%, or one quarter of the "problem set" component of the grade) was applied at the very end for exceeding the limit of four late submissions. In this semester, the number of late submissions increased compared to both the previous year's fluids class (a different cohort than this year's fluids class) and the previous year's statistics class (the same cohort as this year's fluids class) – 23 out of 73 students submitted at least one problem late, with an average of 1.2 late submissions per student. This is probably explained by everyone being more clearly aware of the policy and strategically choosing to make use of it at some point during the semester.

Conclusions and Next Steps

We continue to implement the "lightly flexible" deadline policy in the introduction and statistics course in the spring of 2024, but without explicitly stating the policy outside of how Canvas communicates due dates and submission portal availability times. Some instructors remain concerned that not having a published policy may negatively discriminate against students who would not ask for an extension versus those who would. Therefore, a future review of the data shown here may be considered, to break down the number of extensions requested or taken based on gender or race.

Another future analysis is to compare student performance on exams compared to how often students submit work late or do not submit work altogether. It is unlikely that students who earned a D or lower in our courses earned the grade solely based on the scores assigned on homework problems – these students would also need to earn low grades on the rest of the courses' projects and exams.

References

1. Russell, T. W. F., Argoe, M., Forbes, F., and Broadbelt, L. J (2014). "Graduate Student Teaching Fellowship Program." *Chemical Engineering Education*, 48(1), 37-41.
2. Steel, P (2007). "The Nature of Procrastination: A Meta-Analytic and Theoretical Review of Quintessential Self-Regulatory Failure." *Psychological Bulletin*, 133(1), pp. 65-94.
3. Rinaldi, A. R., Roper, C. L., and Mehm, J (2021). "Procrastination as Evidence of Executive Functioning Impairment in College Students." *Applied Neuropsychology: Adult*, 28(6), pp. 697-706.
4. Zacks, S. and Hen, M (2018). "Academic Interventions for Academic Procrastination: A Review of the Literature." *Journal of Prevention & Intervention in the Community*, 46(2), pp. 117-130.
5. Miyake, A., and Kane, M. J (2022). "Toward a Holistic Approach to Reducing Academic Procrastination with Classroom Interventions." *Current Directions in Psychological Science*, 31(4), pp. 291-304.