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Piloting a Flexible Deadline Policy for a First-Year Computer Programming Course

Isha Bhatt, University of Michigan

Isha Bhatt is a graduate student pursuing a Master of Science in Robotics at the University of Michigan. She is also a Graduate Student Instructor (GSI) for Engineering 101: Introduction to Computers and Programming, a required first year engineering course. Her teaching responsibilities include teaching labs, holding office hours, and implementing staff professional development efforts through the Foundational Course Initiative. Isha previously received her bachelor's degree in Computer Engineering, also from the University of Michigan. As an undergraduate student, she was an Instructional Aide for Programming and Data Structures, a direct follow-on course to Engineering 101. In addition to teaching, Isha is interested in software for embedded and autonomous systems and deep technology startups.

Dr. Laura K. Alford, University of Michigan

Laura K. Alford is a Lecturer at the University of Michigan. She researches ways to use data-informed analysis of students' performance and perceptions of classroom environment to support DEI-based curricula improvements.

Lesa Begley
Ryien Hosseini
Deborah A. Lichti, University of Michigan

Dr. Deborah Lichti earned her B.S. in Fisheries and Aquatic Science at Purdue University and her M.S. and Ph.D. at East Carolina University in Biological Sciences specializing in coastal ecology. Currently, Deborah is a Instructional Consultant in the Foundational Course Initiative in the Center for Research in Learning and Teaching. While completing her doctoral studies, she redesigned the second-semester introductory biology laboratory, integrating authentic research experiences using citizen science. After joining the University of Delaware in the Interdisciplinary Science Learning Laboratories, she continued developing authentic learning experiences for students in her integrated biology and chemistry course. Deborah has also created pedagogical training programs for graduate assistants teaching lab courses and mentored both undergraduate and graduate students interested in teaching. Her areas of expertise include qualitative and quantitative assessment, STEM curriculum development, and graduate student training.

Piloting a Flexible Deadline Policy for a First-Year Computer Programming Course

Abstract

This complete research paper details our analysis of how implementing a generous flexible deadline policy impacted student performance across course assignments over one semester in a large introductory computer programming course. Our goal was to help students stay on track for the course by posting regular deadlines while reducing stress for students by allowing them to submit past the deadline for all assignments.

Some key questions we address through our research are: 1) For which course assignments do students benefit from having a flexible deadline policy? 2) Is enforcing a "hard" deadline for weekly learning content necessary for students to perform well on larger assignments such as projects and assessments? 3) Do flexible deadlines reduce stress and improve the course experience for both students and instructional staff?

We use data from the Fall 2022 academic semester to inform future implementation of a flexible deadline policy in large first-year courses. For Fall 2022, we piloted a flexible deadline structure such that if students submit past the initial posted deadline for specific types of assignments, the assignment will only incur a small grade deduction – students could still earn an 'A' on the assignment. We found that students submitting much later past the deadline (more than a couple of days) struggle more than those who submit assignments within a reasonable period (within a few days) after the first deadline. The students themselves reported some struggles with time management on some assignments because the flexible deadlines allowed them to fall too far behind with no external penalty. However, the students also greatly appreciate a few extra days leniency, especially on larger assignments like projects and assessments.

In general, it appears that a good compromise between timely learning and schedule flexibility is to have a short late submission grace period (1-2 days) for lower stakes assignments and a longer late submission grace period (1 week) for larger assignments. The late submissions can have a small grade penalty; students can still earn an A on the assignment.

In this paper, we describe our motivation for this research, analysis of student performance during Fall 2022 with flexible deadlines for various assignments, and detailed recommendations for implementing a flexible deadline policy for a large introductory computer programming course.

Introduction and Motivation

The topic of academic success and student well-being is of utmost importance in post-secondary education research and continues to receive significant attention. It is widely recognized that a key goal of educators and education policymakers should be to strike a balance between maximizing both of these critical measures. To that end, several studies [1] have been conducted to investigate the impact of flexible deadline policies on student academic success and well-being.

On one hand, flexible policies have been shown to have several positive effects on students. They have been shown to reduce student stress [1, 2], improve time management [1], increase equity in student performance [1, 3, 4, 5], and enhance the learning process [1, 6, 2, 7], especially in cases where courses are administered either partially or fully online [8, 5]. The key benefit of flexible deadlines is that they provide students with a greater degree of control over their own learning, enabling them to personalize their university courses to suit their individual needs [1, 5]. This is particularly valuable in large introductory university courses, where manual efforts to personalize the course for each student are often impractical [9, 10].

On the other hand, research has shown potential drawbacks to flexible deadline policies if they are not implemented in a systematic and well-considered manner. Studies have indicated that haphazard implementation of flexible policies can lead to increased stress [11, 12], poor time management practices [11, 13], and more difficult learning outcomes [2, 14].

Of particular interest is the impact of flexible deadline policies in large introductory STEM courses. In this context, the benefits of flexible policies must be weighed against the well-established advantages of spaced repetition for content mastery, as well as the natural variability in time and stress levels related to the completion of high stakes assignments, such as programming projects [15, 16].

In particular, many studies examine the effect of such deadlines for programming heavy courses. In general, it has been found that including no deadline whatsoever can lead to increased student stress [12] and increases the probability of plagiarism of programming assignments [13]. However, these same studies indicate that using flexible deadlines with added incentives for beginning assignments early improve student outcomes [12]. Additionally, grace periods with certain limits also improve such outcomes and reduce plagiarism without many of the negative effects of flexible deadlines without limits [17, 13].

In this study, we focus on the effects of flexible deadline policies in a large introductory programming course. This course traditionally had "hard deadlines" with no late submissions as it was assumed that first-year students did not yet have the time management skills necessary to handle flexible deadlines. However, the incoming students were coming from COVID-19 policies of extremely flexible deadlines in high school, and we worried that the shock of switching to hard deadlines would add to the already difficult transition to college. Therefore, we thought that we should switch to flexible deadlines to match what students' may be expecting for their coursework.

We specifically investigate the impact of differing levels of leniency in different assignments (low stakes content learning, and high stakes programming projects and content assessments). Our goal is to determine the impact of these policies on student time management skills, academic

performance, and overall stress levels. Additionally, the goal was that instructors would report a more positive teaching experience as a result of the policy.

Methods

This large course is a blended first year engineering course that focuses on computer programming skills at a Midwestern doctoral granting institution. In the Fall 2022 semester, there were 649 students, 20 teaching assistants, and 2 instructors. The coursework consisted of asynchronous online learning assignments, lecture reflections, lab worksheets, four coding projects, and four online assessments.

Description of Flexible Deadline Policy

We implemented a generous flexible deadline policy during the Fall 2022 academic semester. The majority of assignments were eligible for submissions after the deadline through the last day of classes. Students could submit assignments eligible for the policy by the original deadline for up to 100%. Depending on the assignment eligible for flexible deadlines, submissions after the deadline could earn up to around 90%-95% of the original assignment's points. Since this was the first semester in which we piloted this policy, we informed students that if things were going poorly, we would adjust the policy and inform students about any changes to the policy. The complete breakdown of the grade caps before and after the original assignment deadlines, including for the assignments not eligible for the flexible deadline policy are shown in the Appendix on page 14.

The flexible deadline policy did not introduce a delay in the return of student work with feedback as most assignments in the course are autograded. A past study found that purposefully introducing a short delay in providing feedback produces negligible benefits in our particular course [18], so feedback is released immediately.

Design

We conducted short end-of-term student and teaching assistant surveys to investigate how students used the flexible deadline policy, how the policy impacted students and instructors positively and negatively during the term, and how we can modify the policy for future semesters. We also compared students' time of submission vs. grade for each of the course projects.

The student survey consisted of 5 Likert style questions and one open ended response (questions are listed in the Appendix on page 14). Students received extra credit for taking the survey.

The teaching assistant survey consisted of three questions about flexible deadlines and two general open ended questions about the positive aspects and improvements for the course (questions are listed in the Appendix on page 14).

Indicator 1: Time Management. A key driver for implementing a flexible deadline policy was to support students in their time management. This is especially important for a first year course in which students are developing their time management skills in a college setting for the first time. The survey gauged how the policy was effective for time management by assessing how it

helped them manage their time for specific assignments. For example, an agree/disagree question in the survey was, 'The flexible deadline policy helped me manage my time for...' for assignments such as projects, lecture reflections, lab assignments, and assessments. The hope was that this data and possible open-ended responses would show which assignments the policy would be the most effective for.

> *Hypothesis 1: Having extremely flexible deadlines would help students manage their time better for all assignments, regardless of the size of the assignment.*

Indicator 2: Academic Performance. With less rigid deadlines in place, the hope was that students would perform well academically in the course. For example, we collected the distributions of an agree/disagree statement, 'I feel the flexible deadline negatively impacted me at the end of the semester'. We then obtained parallel grade distributions of the respondents to this question for each agree/disagree response category. A key part of academic performance in computer programming is collaboration, which they are exposed to in the lab component of this course. We surveyed instructors on how students performed in lab generally once rigid deadlines were brought back at the term's halfway mark for weekly preparation work assignments specifically. We also looked at the complete grade distribution of all students in the course with the flexible deadline policy in place.

> *Hypothesis 2: Having extremely flexible deadlines would enable students to perform well academically since they are not restricted by rigid deadlines.*

Indicator 3: Overall Stress. Decreasing stress for students and instructors was an important goal with the flexible deadline policy. An open-ended question in the instructor survey was, 'What could improve the experience?', with the intention of making modifications to the deadline to improve the staff experience.

> *Hypothesis 3: Having extremely flexible deadlines would lessen student stress, allowing for deeper learning. It would also lessen stress for instructors.*

Analysis

We collected the student's submission data for the four projects throughout the semester. The submission date for each project was coded for either on time (submitted before the deadline or on the deadline), 1 day, 2-4 days, 5-7 days, or 7+ days past the submission deadline. If students resubmitted the project, then the last submission date was used in the analysis.

For the student survey, the quantitative survey data was analyzed in R using multiple packages. The open ended question was analyzed by two people outside the teaching team for themes and potential recommendations for policy changes.

For the teaching assistants survey, the quantitative survey data was analyzed in R using multiple packages. The open ended questions were analyzed by one person outside the teaching team for themes and potential recommendations for policy changes.

Results

Here we discuss the results of the surveys in terms of the overall student experience with flexible deadlines (as perceived by the students), the effects of the flexible deadline policy on the different types of assessment in the course, and the student staff's experience with the policy as instructors.

Student Overall Experience

Overall, the majority of students (80%) that responded to the survey felt that the flexible deadline did not impact them at the end of the semester, as shown in Fig. 1. Around 75% of students gave positive feedback for the flexible deadline at the end of the semester.

I feel that the flexible deadline negatively impacted me at the end of the semester.
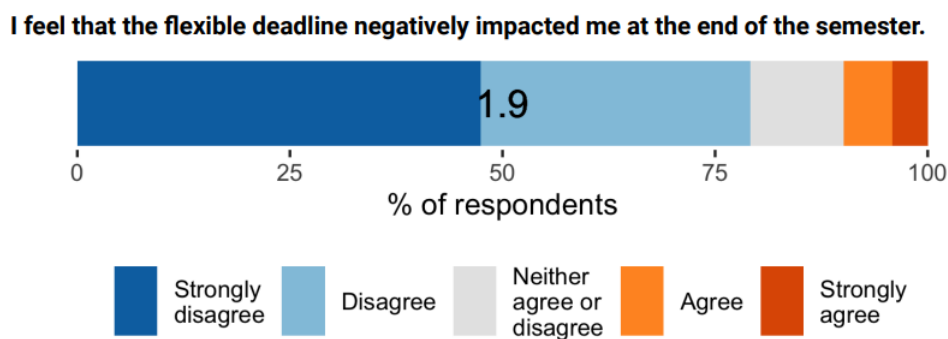

Figure 1: Likert scale question about whether the policy negatively impacted students.

Students described how the flexible deadline supported time management, learning and well-being. Around 20% of students described that the flexible deadline helped with time management. For example, one student stated "The flexible deadline policy made me feel much better about managing my time in this class, as well as other classes. It helped me to not feel to overwhelmed as assignments in all my classes piled up." Students (6%) described how the flexible deadline allowed them to focus on learning the material instead of rushing to meet deadlines. For example one student stated "As someone with little coding [experience], some of the coding took a little longer to get used to... I was grateful that the flexible deadline policy allowed me to really work through my understanding of coding and get through my projects with an overall better understanding...". Students described how the flexible deadline helped their well-being by either reducing stress or just giving them the piece of mind knowing it was there if needed. Students (11%) discussed having less stress throughout the semester and helping them when they were transitioning to college. One student stated that "The flexible deadline helped give me the breathing room I needed early on in the semester while I was being overwhelmed by the transition to U of M...". Other students (13%) just appreciated that the flexible deadline existed even if they did use it during the semester. One student stated "... [H]aving the flexible deadline policy made me less anxious about turning things in! For example, for the last project, although I turned it in on time, I definitely worried I wasn't going to - so it was nice knowing that I had this policy there in case."

Students either were undecided (10%) on the negative impact at the end of the semester or felt that it impacted their end of the semester (10%). Some students had mixed feedback about the

flexible deadline by describing pros and cons of the deadline (7%) or discussing the grade penalty for turning in the assignments past the due date (4%). One student described "As long as you don't procrastinate and abuse the flexible deadline, it is amazing." Another student stated "I thought it was really beneficial as there was enough punishment for incentive to do it on time but if i really struggled with something or was overwhelmed with other work at the time I had the choice to do it a little late". There were very few students (<1%) that gave feedback on the challenges with the flexible deadline.

Effect on Assessment Types

Most students indicated that having flexible deadlines helped them to manage their time, as shown in Fig. 2. However, there was some interesting feedback that came from the students that did not agree that the flexible deadlines were helpful.
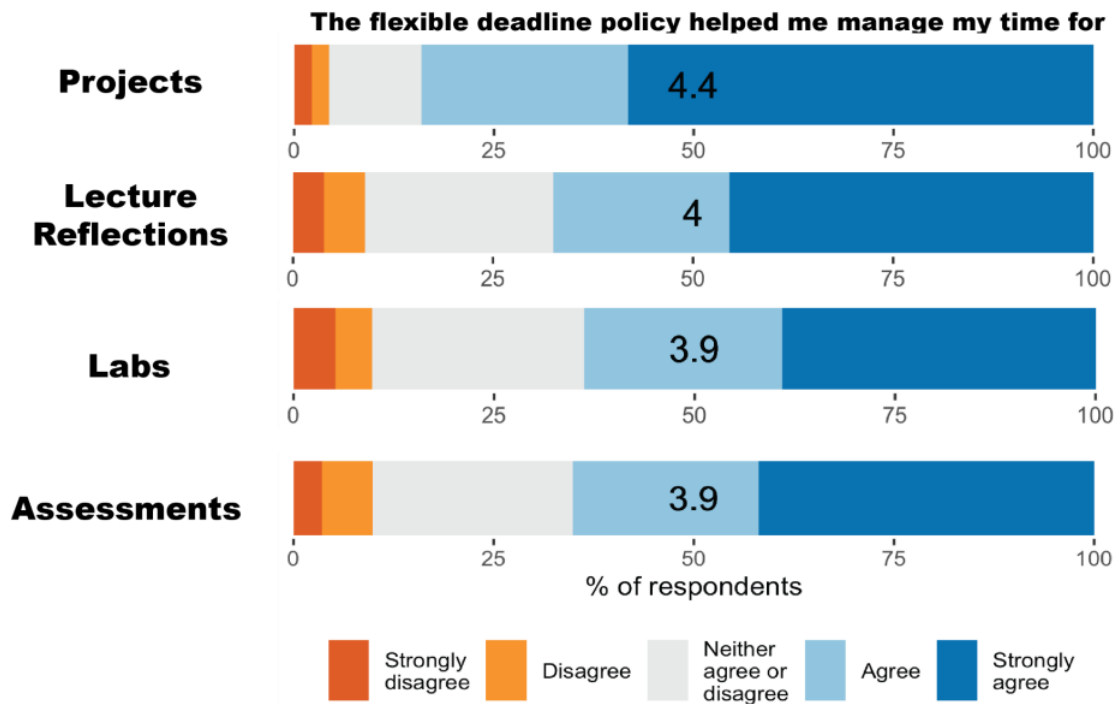

Figure 2: Distribution of which assignments students found the policy helped with time management.

When the students responded about time management for different assessments, over 75% of the students responded that the flexible deadline allowed them to manage their time for projects. Around 7% of students gave feedback on the benefit of the flexible deadline to complete projects. One student stated "I only used the flexible deadlines on one project, but it helped so much since office hours can get so busy right before the deadlines. I was able to get all the help I needed without the extra stress of ruining my grade.". The majority of students (70 to 90%) turned in their coding projects on time or within 1 day of the deadline except Project 4 (Fig. 3). Around 40% of the students submitted Project 4 on time with around 30% of students submitting their project 7 days past the deadline.
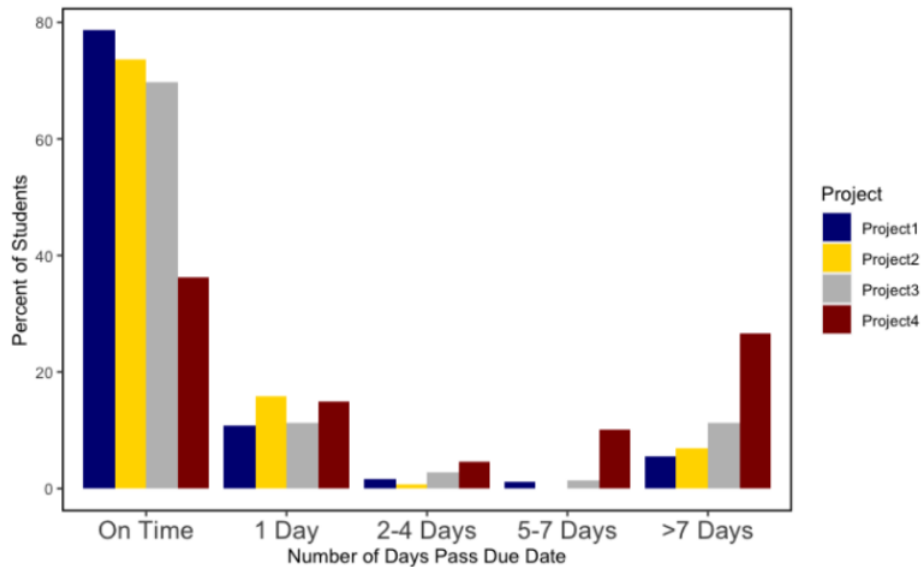
Figure 3: Distribution of percentage of student submissions across the number of days after the deadline.

A little over 60% of students responded that flexible deadlines helped them manage their time for lecture reflections, labs, and assessments. There was a small percentage of students who reported that the policy did not help them manage their time. Another student stated "It makes [me] more procrastinate more than it helps me 'manage my time'.". Around 30% of students were undecided on if the flexible deadline policy helped them manage their time for all assignments. Some students (7%) had mixed responses for the flexible deadline policy and felt needed concrete deadlines for smaller assignments. One student stated "Useful for projects and labs, but made it easy to fall behind on lecture reflections."

Students (8%) commented that the weekly asynchronous learning assignments should have stricter deadlines. One student stated "...I think the flexible deadline policy should be shortened to it can be late up to a week, for lecture reflections and labs. [Asynchronous learning assignments] should have a strict deadline, because its really hard to learn/practice in lab when you have to teach part of your group what they should've learned from [asynchronous learning assignments]. It just becomes a burden to other students that are keeping up with the work.".

Instructor Experience

Overall, almost all of the staff (80%) agreed that the language in the syllabus about flexible deadlines was clear with around 20% either not sure or did not feel the language was clear. The majority of the staff (90%) felt prepared for office hours when students would have questions on a range of topics and labs. Three staff members suggested that office hours were challenging towards the end of the semester due to flexible deadline policy. One instructor stated "I think the flexible deadlines made office hours significantly more challenging for staff. It was difficult to have so many people consistently at the end of the semester with normal office hours staff levels (not project office hour staff)."

The instructional staff (90%) also responded in the end of term survey that after the flexible deadline for the asynchronous learning assignments was removed that they perceived students were more prepared for the lab (Fig. 4). Only 10% of the instructional staff responded with unsure about students being more prepared for the lab.
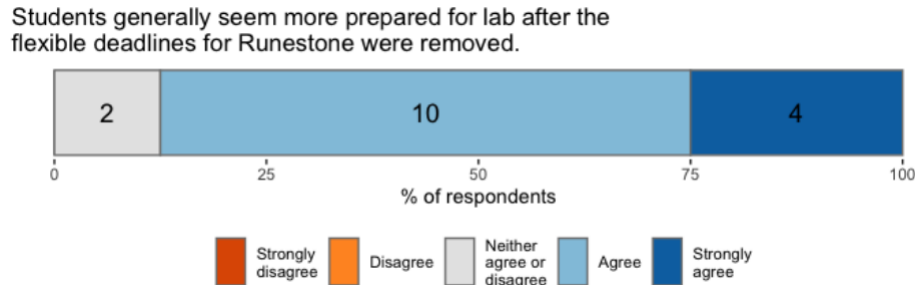

Figure 4: Instructor response to student preparedness in lab after removing flexible deadlines for weekly preparation work.

Discussion

Here we offer some discussion of general trends and patterns of the data.

Time Management
Visually inspecting the survey results for time management in Fig 2, we see that the flexible deadline policy helped most students manage their time across four major assignment categories. On a 5-point scale (with 5 being that all students felt the policy helped manage time for a particular assignment), projects received the highest score of 4.4, lecture reflections received a score of 4, labs received 3.9, and assessments received 3.9. The scores do not necessarily show that the policy helped students manage their time for assignments that make up more of their grade (projects and assessments) compared to other assignments that made up a smaller percentage of their grade (lecture reflections and labs). It doesn't appear that there is a relationship between an assignment's percentage of the final grade and how much the flexible deadline helped students manage their time. It is likely that students perceived projects to be higher stakes than assessments since programming projects are not assignments students have typically seen before. The switch to lower stakes exams, as demonstrated by a previous work [19], combined with the fact that students can retake an assessment for a small grade reduction, may have impacted their perceptions about whether the policy helped them manage their time for assessments.

From the qualitative results of the student survey, we see that about 20% of respondents suggested that the policy helped students manage their time, especially as they were learning to manage their individual course loads as first semester college students.

The results from the student survey support Hypothesis 1 since a majority of students reported that the policy helped them manage their time across the majority of assignments in the course. It is possible that instructors may recommend otherwise.

Academic Performance

An important part of academic performance in this course is group collaboration in synchronous labs run by undergraduate and graduate instructors. Visually inspecting Fig. 4, we see that overall instructors report that students were better prepared for labs after the flexible deadline policy was removed for weekly preparation work. A respondent in the student survey also reported that weekly preparation work should have a strict deadline and that when students from lab groups do not keep up, it becomes a burden on those who are keeping up with the preparation work. There is no indication that removing the policy for weekly preparation work had any quantitative effect on academic performance.

From Fig. 1, most students did not feel the policy negatively affected them at the end of the semester. This may indicate that students felt it did not negatively affect their final grade in the course. We cannot reliably conclude that there is a correlation between students who received lower grades as shown in Fig. 5 and their recorded response that the policy negatively affected them. This means that there are a number of factors that could have affected their grades besides the flexible deadline policy.

Visually inspecting Fig. 5, most students received an A in the course. There was a majority of students that earned an A even when submitting after 7 days. This means that implementing a flexible deadline policy did not appear to lower grades for the overwhelming majority of students in the course.
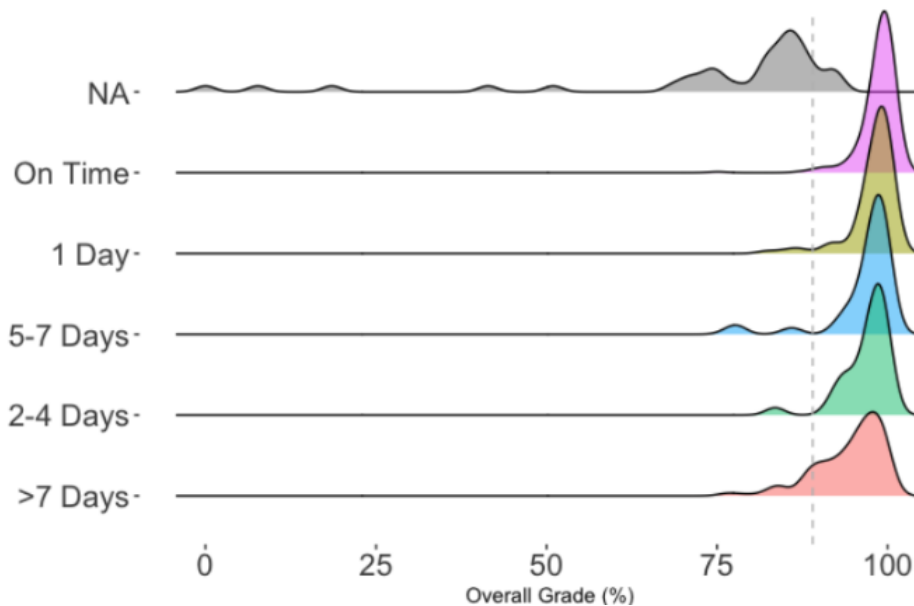

Figure 5: Overall grades in the course for all Fall 2022 students.

We cannot reject nor accept Hypothesis 2 because the results do not reliably isolate the flexible deadline policy as a primary driver for higher or lower grades. There may be a variety of effects that can impact grades outside of the policy.

Overall Stress
The qualitative staff survey results for the question, 'What could improve the experience?', shows that the flexible deadline policy may have increased stress for instructors during office hours at the end of the semester. This means that with this flexible deadline policy in place, more students attended office hours at the end of the semester. However, less staff were scheduled for office hours in certain periods when there was not a project deadline approaching. Without the flexible deadline policy in place, there are more staff in office hours during the days approaching the deadline and less otherwise. Since office hour scheduling did not change, it is possible that having more students in office hours when there were less instructors increased stress for instructors. It is unclear whether this is the overall consensus across instructors since not all respondents answered this question. As a result, Hypothesis 3 cannot be completely rejected.

A direct question was not directly asked in the student survey about overall stress, but 12 responses to the question, 'What other thoughts, if any, would you like to share about the flexible deadline policy?', indicate that flexible deadlines helped reduce overall stress for students. Students reported worrying less about their grades in the course and having lower stress as they were transitioning to college. The responses support Hypothesis 3 and suggest that some form of a flexible deadline policy in future semesters would decrease student stress.

Overall Interpretation
The results indicate that implementing a flexible deadline policy helps first semester college students in a large introductory programming course with time management and decreases overall stress. There is no clear indication of whether having an extremely flexible policy correlated with lower academic performance in a quantitative sense (grades). Observations by students and instructors in the synchronous lab part of the class show that having extremely flexible deadlines for weekly preparation work hinders student learning in the course in a qualitative sense.

We are satisfied with the results that flexible deadlines help with time management for the majority of course assignments, especially for projects since students are typically new to such assignments in their first semester of college. It is reasonable to apply some form of flexibility to deadlines across course assignments.

Based on the project submission data in Fig 3, a more rigid policy may be necessary for future semesters. Without regards to the scores that students received on the projects in comparison to previous semesters, applying a flexible approach to project deadlines means that students can finish projects on their own time. The fact that the majority of students submitted within a day of the deadline for projects 1-3 shows that students may not need the same amount of flexibility we gave them in the Fall 2022 semester. It is reasonable to allow students to submit up to a day or a week after the deadline, but not more than that or they could fall behind. For more challenging assignments, such as the final project in this course, allowing students more than a week may be reasonable since a third of students submitted more than 7 days after the original deadline.

Overall, these results show that allowing students some flexibility with regards to when they submit an assignment is promising. Our findings are consistent with the established understanding that flexible deadlines improve the overall student learning experience.

Limitations

There are various limitations to this study that may decrease its validity.

Firstly, students were not required to complete the end-of-term student survey and the response rate was 30%. As a result, the sample size relative to the rest of the course may not accurately represent the experiences of the overwhelming majority of students in the course.

Since this policy was only piloted for one first year programming course at a large university, the recommendations resulting from this study may not apply to smaller institutions or courses beyond the first year of study. Students in upper level undergraduate courses or graduate courses may benefit from a different flexible deadline policy than what is recommended as a result of this study.

Finally, there are many factors that can impact a student's academic performance, many of which are unrelated to implementing flexible deadlines to accommodate students. Therefore, we are unable to directly correlate possible changes to students' academic performance with changing the flexibility of course deadlines.

Conclusions and Recommendations

In this paper, we examined the effectiveness of piloting an extremely flexible deadline policy in a first year introductory computer programming course at a large, public research institution.

We identified and analyzed three indicators of effectiveness of the policy (time management, academic performance, and overall stress) in the Fall 2022 semester. Our data consisted of quantitative and qualitative feedback from end of term student and staff surveys, grade distributions, and project submission data.

We observed that the majority of students reported that flexible deadlines helped with time management and reducing overall stress. However, students also reported that the flexible deadlines resulted in group members being unprepared to participate in lab. The course's teaching assistants also observed this negative effect of the flexible deadlines, which was pronounced enough that the flexible deadline policy was revoked for the asynchronous learning assignments. In general, the flexible deadlines were more successful for the higher stakes assignments (projects, assessments) than the lower stakes assignments (weekly asychronous learning, labs, lecture reflections).

There was no clear indication from our data about whether the policy positively or negatively impacted students' grades with regards to their academic performance. This is in part due to the historic grade distribution in the course: most students earn an A or A+.

The results of this analysis on generous flexible deadlines supports our concurrent observations that this large course, primarily consisting of first-year students, appears to need a balance between flexibility in deadlines and a firm course structure to help reinforce good time management skills. We recommend that:

- **Weekly assignments have a short late submission period (1-2 days) during which students can earn up to 93-95% of an assignment's points.** This category includes

assignments that are primarily individual, lower stakes assignments such as asynchronous learning assignments, pre-readings, labs without accompanying reports, lecture questions, etc.

- **Multi-week assignments have a longer late submission period (1 week) during which students can earn up to 93% of an assignment's points.** This category includes assignments that are higher stakes such as projects, labs with major reports, assessments, etc.

We recognize that these recommendations will not work for all situations and courses, and that is to be expected. We also stress that the success of flexible deadlines / late submissions is dependent on the ease of providing timely grading by the course instructors. Courses without the ability to autograde student work may not be able to implement anything other than hard deadlines, despite every desire by the instructors to do otherwise.

The findings and conclusions from this study lead to several new potential research questions for the future:

- Do students report better time management with a more structured flexible deadline policy in place compared to the policy from Fall 2022?

- Would an extremely flexible deadline policy be better suited for upper-level undergraduate or graduate students who are more established into their academic studies?

- How does applying this flexible deadline policy on first semester college students affect how they manage their time and their stress levels in a follow-on computer programming course?

Flexible deadlines and/or late submission policies are a critical component of supporting equitable student instruction, and we must all continue to evaluate how these policies actually play out in our learning environments.

Acknowledgement

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Appendix

This Appendix includes details about the flexible deadline policy used in Fall 2022 and the survey questions used to evaluate the effectiveness of this flexible deadline policy.

Implementation of Flexible Deadlines

Table 1 shows how the flexible deadline policy was applied to the different assignments in this course.

Table 1: The assignments and how much students could earn after the deadline.

Assignment	Grade Cap Before Deadline	Grade Cap After Deadline	Notes
Asynchronous Learning	100%	95%	Halfway through the semester, this was changed to 0% grade cap after deadline
Lecture Reflection	100%	95%	
Labs	100%	90%	
Projects	100%	93%	
Assessments	100% for first take	93% for first take 90% for retake	You can retake an assessment even if your first take was after the deadline.
Extra Credit	100%	N/A	

Since submissions with minimal penalties were allowed for all assignments and lectures were recorded, assignments that could be completed asynchronously (outside of class time) were not eligible to be dropped from any given student's course grade. The reasoning behind this was to emphasize that all components of the course are important. Due to the collaborative nature of labs and since it is hard to complete the lab assignment outside of class time, students could drop one lab assignment during the course except the first and last lab of the semester.

Student Survey Questions

Statements with a 5-point Likert scale (*Strongly agree, Agree, Neither agree or disagree, Disagree, Strongly disagree*):

1. The flexible deadline policy helped me manage my time for a) Projects, b) Lecture Reflections, c) Labs, d) Assessments

2. I feel that the felxible deadline negatively impacted me at the end of the semester.

Note: The survey did not ask about the asynchronous learning assignments because the flexible deadline policy had already been revoked for that assignment type.

Open-ended question:

1. What other thoughts, if any, would you like to share about the flexible deadline policy?

Instructor Survey Questions

Statements with a 5-point Likert scale (*Strongly agree, Agree, Neither agree or disagree, Disagree, Strongly disagree*):

1. Students generally seem more prepared for lab after the flexible deadlines for [asynchronous learning assignments] were removed.

2. The flexible deadline wording on the syllabus for Fall 2022 was clear about the policies for each assignment.

3. I felt prepared for office hours even when students have questions based on a wide range of projects and labs.

Open-ended question:

1. What could improve the experience?