Flextensions

Automated Flexible Extensions for Improving Student Learning Experience And Equity in Large Enrollment Computing Classrooms

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1 ABSTRACT

Flexible deadlines and their effect on students' learning have been used and documented by some educators, but are still not the norm in post-secondary classrooms. Prior work over the last two decades have studied the use of flexible deadlines in post-secondary classrooms, and they have shown that flexible deadline policies have the potential to result in better quality work under decreased stress. However, such studies do not address the added complexity and unique challenges present in large enrollment courses. In particular, widespread implementation brings administrative course management concerns, such as tracking and grading late work. A practical implementation of this policy in a large enrollment course thus requires both the simplification of the management of extension requests and the automated grading of assignments. This paper investigates a new strategy, an automated flexible extension policy, that has risen across several Computer Science and Data Science classes at UC Berkeley. Dubbed *Flextensions*, this policy is a response to pedagogical shifts in higher education where rigid and harsh deadlines are the norm, as it intends to provide sufficient accommodations to each student's unique learning needs and life circumstances to create equitable learning opportunities for all students. This paper examines the policy's impact on three UC Berkeley Data Science courses—how it streamlines course management processes, enhances the student course experience, and maintains educational quality—with particular focus on student learning experiences and perspectives.

2 INTRODUCTION

In principle, grades should reflect the extent of a student's learning and understanding of course content. Traditional classroom deadline policies bind students to rigid due dates, and award quality work that is submitted on time. However, while time management is undoubtedly a critical skill, during the semester students may face unexpected challenges beyond academic pressure, such as personal illness or a family emergency, that that impede their ability to fully devote time to their studies [18]. Students may also face other significant barriers towards the timely completion of assignments, such as academic burnout; in particular, instances of mental health crises of STEM students, often attributed to unmanageable workloads, notoriously difficult assignments, or unforgiving classroom policies, are major challenges in higher education [17]. Consequently, if student grades are defined in part by missing or late assignments, grades in rigid classroom structures that strictly do not accept any late work will not accurately reflect the extent of a student's learning or understanding of the material.

This issue can be exacerbated in large enrollment classes. With the explosive growth of the technology industry in recent years, enrollments in introductory Computer Science and Data Science classes at UC Berkeley have been rising and sometimes reach upwards of a thousand students [16]. Education research has identified the numerous challenges of teaching and learning at scale—the student perspective is feeling isolated and anonymous, with a resulting decrease in motivation and student retention, while the educator's challenge lies in engaging and interacting with students as individuals [7]. Anecdotally, receiving ample support in these classes has often been difficult to come by; students are often faced with long office hours queues and low instructor support due to staffing shortages. In addition to this feeling of disconnect, students may also face hesitation in asking instructors for academic support or assignment extensions due to perceived or

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actual stigma, even if it might positively contribute to better success or mental well-being [4]. It can be particularly challenging for STEM students to recognize inappropriate levels of stress and seek help due to a "STEM culture" of "this is supposed to be hard" [17]. This leads to the hypothesis that students faced with extenuating circumstances may opt to simply forego assessments when faced with strict deadlines, resulting in diminished learning experiences [10].

A new, alternate perspective on classroom structure aims to promote mastery-learning goals by allowing students an opportunity to achieve proficiency and earn any grade they are willing to put in the time and effort for [11]. One such strategy is flexible deadlines: the rationale behind this proposed strategy is to proactively identify and mitigate the barriers to timely assignment completion experienced by students faced with extenuating circumstances. By offering the opportunity for communication and flexibility, the strategy aims to foster an environment that promotes learning through encouraging the completion of assignments. Over the last two decades or so, several published studies describe the impact of the use of flexible deadlines on some post-secondary classrooms, and they have all shown flexible deadlines to be potentially beneficial in some capacity [15]. However, the studies are all done on a small classroom scale (e.g., tens of students) and do not address the added complexity and unique challenges present in large enrollment courses, such as late work being hard to track and cumbersome to grade. When managing a large computing course with weekly assignments and multiple coding projects, a practical implementation of flexible extensions requires both streamlining the management of extension requests and automating the grading of assignments to avoid requiring excessive staff effort.

A new strategy called *Flextensions* at UC Berkeley employs automated extension tools and is currently being experimentally deployed in several Computer Science and Data Science classes. This strategy streamlines staff workload and enhances personalized student support in large enrollment courses through automating the request, approval, and management processes of tracking student extensions [19]. This research paper studies the effectiveness of automated extensions in reducing the barrier towards the timely completion of assignments—representing a barrier to learning—to improve student learning experiences in large college classrooms. Given the broad scope of this goal, the focus of this work centers around analyzing the tool and policy's use and reception among students in the Fall 2023 semester of three UC Berkeley Data Science large enrollment courses. The following research questions will be explored: **RQ1)** How are flexible extensions being utilized and perceived by students? **RQ2)** What are the main reasons students request (or do not request) extensions? Analyzing extension request patterns, students' attitudes towards extension policies, and the reasons behind extension requests through survey and student data allows institutions to evaluate the effectiveness of existing policies and identify areas for improvement.

In this paper, we analyze extension request patterns, students' attitudes towards extension policies, and the reasons behind extension requests using a combination of survey and student data in order to evaluate the policy's effectiveness in fostering a more equitable learning environment by lowering the barrier towards asking for help and promoting learning, with a particular focus on student experiences and perspectives. The findings between the three courses will be compared and contrasted. The objective is to inform educators on the impact of flexible extensions in improving student learning experiences and ensure that enrollment size is not a barrier to equipping students with a more equitable system for increased success and well-being, to encourage a more widespread utilization of flexible extensions.

3 BACKGROUND INFORMATION

3.1 Data science courses at UC Berkeley

Data Science is a highly interdisciplinary field, consisting of the intersection of Computer Science, Statistics, and domain knowledge. The demographics of students who take Data Science classes at UC Berkeley reflect this diversity by coming from a variety of disciplines and perspectives.

The three Data Science courses examined in this work are Data 8 (Foundations of Data Science) [3], Data 100 (Principles and Techniques of Data Science) [1], and Data 101 (Data Engineering) [2], the former being a lower-division course and the latter two being upper-division courses. Each of the listed classes is more advanced than the previous, meaning that Data 101 students must have taken both Data 100 and Data 8, and Data 100 students must have taken Data 8, as they are required prerequisites. For this reason, students in these classes are all at different stages of their university careers and the student demographics of these three classes differ greatly.

- **Data 8**:
  - An introductory-level course that covers foundational programming and statistics knowledge which serves as the basis for all the other Data Science courses. Because it assumes no computational or statistical background, it is also aimed at a broader audience and is open to students from both technical and non-technical majors.
  - Enrollment size in Fall 2023: 1263 students.
  - Previous policies: Students were awarded 2 lab and 2 homework drops to account for extenuating circumstances.
- **Data 100**:
  - An intermediate-level course that bridges Data 8 and other upper-division Data Science courses. It is often the first upper-division course that Data Science majors will take and assumes a background in one computer science course beyond Data 8, calculus, and linear algebra.
  - Enrollment size in Fall 2023: 1087 students.
  - Previous policies: 48-hour no penalty late work grace period, and an extenuating circumstances form available for students to communicate with course staff. No assignment drops.
- **Data 101**:
  - An advanced-level course aimed at Data Science majors in their last year of university, it assumes students have multiple semesters of experience in data science, programming, and data structures.
  - Enrollment size in Fall 2023: 283 students.
  - Previous policies: Students were directed to make a private post on EdStem to request for an extension. No assignment drops.

3.2 Current *Flextensions* pipeline

The flexible extensions pipeline is built into the course assessment structure in advance and is made accessible to all students. In the policy clearly outlined on the class syllabus, a Google form is available to students, where an opportunity to request an extension for a particular assignment remains open until the specified window is closed. Students are required to self-disclose the reasons for the extension unless they have the extensions to assignment deadlines accommodation through the Disabled Students Program (DSP). Students may fill out the form as many times as they wish, and there is no penalty for requesting an extension. However, students are made aware that a request does not guarantee an approval, and are encouraged to request extensions early in advance for requests to be most likely to be approved. Some students may request for only one or two days'

extension to complete assignments, whereas others may be experiencing more severe extenuating circumstances and need several extra days to complete assignments. Students who request for a longer extension due to extenuating circumstances may also need to have a support meeting with a member of course staff to discuss a plan to help them stay on track in the course.

Internally, a student's submission of the form is connected to their unique row on a Google Sheet backend, which serves as the primary interface for course staff to manage these requests. The Google Sheet automates the process of emailing each student and updating their due date on Gradescope, the main system in which students submit assignments at UC Berkeley [19]. Because the number of granted extension days is ultimately determined by course staff, it is up to the designated teaching assistants (TAs) to review the reason for the request, the requested number of extended days, and the time of the request to determine an appropriate accommodation. If a DSP student has the extensions to assignment deadlines accommodation, the extensions tool is configured such that requests are automatically approved by the extensions tool for up to two days; in the case of Data 8, the extensions tool was used to automatically generate two days' extension for all assignments for all DSP students at the beginning of the semester.

4 LITERATURE REVIEW

4.1 Diversity, equity, and inclusion in computing education

Washington (2020) argues that diversity, equity, and inclusion (DEI) efforts are often discussed, but not adequately addressed, in university computing departments nationwide. Many faculty lack the understanding of the challenges faced by their students from different backgrounds, enforcing class policies influenced by their own biases that affect their students negatively [20]. This presents the critical need for cultural competence as a required focus of university computing classes, to ensure that curriculums and class policies help foster, not hinder, a more equitable learning environment. Bornschlegl et al (2022) found that the implementation of academic support programs that are inclusive to students from diverse backgrounds, with differing learning styles and prior experience, increased student success and retention rates [4].

Traditionally, strict course deadline policies assume that all students face equal barriers to completing timely work. In reality, students may struggle to meet deadlines for a variety of external reasons, such as disability, physical and mental health, or family circumstances [15]. A flexible deadline policy presents itself as a strategy for tackling inclusive computing education by first acknowledging that students face unequal barriers and seeking to mitigate them [18]. Educators should further consider how requesting or advocating for flexibility represents a greater barrier for some. Research found that various background factors, such as age, gender, and personality, are related to psychological and academic help seeking [5]. For example, one study found that women experience disproportionately greater time stress than men and are less likely to ask for an extension, as they hold stronger beliefs that they will be penalized, and worry more about burdening others [21]. This paper addresses this by stressing the importance of extension policies being built into course structure, rather than being left to individual students' own devices.

4.2 Flexible deadlines in other classrooms

Newly published studies over the last two decades or so describe the impact of the use of flexible deadlines on student learning experiences in post-secondary classrooms. A study conducted at the University of Calgary demonstrated that a policy that allowed students in a third-year undergraduate biology course (n=43) to utilize up-to-one-week extensions with no penalty for all assignments resulted in better quality work under decreased stress, especially for those who would otherwise struggle with meeting assignment deadlines [15]. However, implementing this policy poses an

additional challenge when dealing with the added complexity of large enrollment courses at public universities––the aforementioned study was employed in an online, asynchronous course that only had 43 enrolled students and seven assignments, consisting of written reflections, short quizzes and one essay for the whole semester. At UC Berkeley, it is the norm for large technical courses to have weekly labs, weekly homeworks, and multiple longer coding projects throughout the semester. A practical implementation of this policy at UC Berkeley thus requires both simplifying the management of extension requests and automating the grading of assignments, to avoid requiring excessive staff effort. This paper explores how utilizing automation, especially in large enrollment courses, may be beneficial in lowering the barrier to requesting an extension.

Few studies have looked into the reasons why students use extensions, let alone in computing education. Chen and Ward (2023) investigate the value of assignment extensions in identifying students' abilities in a first-year and final-year programming course [8]. Their work showed that scheduling conflicts and underestimation of the coursework were the top two reasons why students submitted assignments late, and suggests the value that extensions can provide in giving educators a very early indicator of student abilities and those likely to need assistance. However, the researchers reported that a trivial number of students replied to an email seeking their reasons (79 responses) made it difficult to make meaningful connections when creating different themes of reasons. The survey and analysis conducted in this paper serve to synthesize the main reasons that students request, or are not comfortable requesting, an extension by analyzing even more data.

4.3 Teaching & Learning at Scale

While publications related to equity-based learning have been increasing, research conducted on large enrollment classes has been less frequent [7]. Previous work from UC Berkeley instructors has presented several strategies that have enabled the effective teaching of these large enrollment computing courses, including increased automation in autograders and infrastructure to provide instant feedback and minimize manual grading, as well as the expansion of TA staffing levels and student support networks [16]. This research presents a way to bridge these student support networks with the increasing prevalence of autograders and automation: when methodically tracked, automated flexible extensions have the opportunity to present students with even more flexibility in deadlines, while simultaneously reducing the emotional burden and workload on course staff in processing extension requests individually.

5 METHODOLOGY

5.1 Data collection

Data was collected from each course (Data 8, Data 100, and Data 101) during the Fall 2023 semester, which each included three datasets: student requests, student extensions roster, and course evaluations. The study, therefore, encompasses a total of nine datasets. During the semester, this data was only accessible to course instructors and lead TAs. All data used in this work was collected according to Institutional Review Board (IRB) protocols.

5.2 Data description

The students request dataset consists of submissions to each course's Extension Requests Google Form. The form may be slightly personalized across different classes, but generally contains questions that collect data on student identities (name, email address and student ID number), DSP enrollment, the reason for request, which assignment is requested to be extended, and the requested number of days. A student requests an extension on an assignment by submitting to the form; the form entry is then reviewed by course staff for approval, and possible follow-up conversations with

the student. There is one row in the dataset for each extension request made by students in the three courses.

The student extensions roster dataset is the course staff view of the extensions form; it contains a single row for each unique student who has an extension request. Aside from the columns containing identifiable data, each column represents one assignment—each cell therefore contains the number of granted extended days for a particular student's assignment.

The course evaluations dataset contains tailored survey questions that were sent out to enrolled students via Google Forms for the purposes of this study. Students were made aware that their responses would be used for student research on extensions and chose to opt-in. The survey included seven questions: one multiple choice question, three Likert questions and three open answer questions:

(1) Were you aware of the extension policy in this class?
(2) How comfortable do you feel making an extension request? 1-5
(3) If you do not feel very comfortable requesting an extension, why?
(4) Do you think our extensions policy was valuable to your learning? 1-5
(5) Do you think our extensions policy benefited your overall experience taking this class or managing your overall academic experience this semester? 1-5
(6) If you are comfortable sharing your experience regarding the previous two questions, please elaborate.
(7) Any feedback on our extensions policy for future semesters?

5.3 Data cleaning and deidentification

Preliminary data cleaning was performed on the datasets. Across datasets, column names were simplified for improved clarity, and any empty rows were removed. In the evaluations dataset, irrelevant columns pertaining to overall course feedback were filtered out, leaving only those relevant to extensions.

The process of de-identification was a pivotal step in this work to retain student privacy. De-identification entails the modification of personally identifiable information (PII) to prevent the identification of individuals through sensitive information. To maintain a consistent yet anonymized identifier for each student, a function was defined that inputs each student's email and outputs a new SHA-256 hash object (Secure Hash Algorithm). This transformation leverages the hashlib Python module, which offers a standardized interface to a suite of secure hash functions, including the SHA-256 algorithm. The hashed data serves as a unique identifier that irrevocably anonymizes the student's identity, ensuring that the data cannot be converted back into PII. This hashing was applied to all dataset entries, turning identifiable student information into a Research ID (RID) that is usable for analysis. Furthermore, all strings within written text that contained identifiable information (Name, Student ID, email) were found via Regex and replaced with a [redacted] string.

5.4 Visualizations

Data visualizations were primarily used to identify patterns and trends within the usage of the extensions tool and the results of the evaluation survey across the three courses to answer RQ1. Various relationships were explored through graphical representations, including the proportion of students who were granted an extension and the average granted extension days across assignments, repeated extension use across the semester, and student sentiments about extensions after one semester of its implementation.

5.5 Text analysis

Text analysis was used to explore qualitative data, particularly the reasons for extension requests to answer RQ2. Firstly, eight overarching themes were brainstormed by the author, based on their personal experience as a member of data science course staff who primarily handles and responds to student extension requests. Specific keywords or phrases were identified within the text that were indicative of these themes (Examples shown in Table 1).

Medical	illness, sick, ill, pain, covid, flu, hospital
Family/Personal Circumstance	family, personal, funeral, home, emergency
Mental Health	stress, mental, depression, anxiety
Workload	workload, exam, midterm, busy, interview
Extracurricular	competition, conference, athlete, sport
Technical Issues	technical, jupyter, kernel, crashing, wifi
Disability	disability, dsp
Catch-up Time	behind, material, understand, content

Table 1. Common themes and associated keywords

The Natural Language Toolkit (NLTK Library) was used to process the raw data: this included tokenization (breaking text into individual words), removing stopwords (common words with little semantic value), normalization (converting all words to lowercase), and lemmatization (reducing words to their root form). Topics were then assigned to student reasons based on the presence of predefined keywords associated with each topic. A function was created to iterate through the tokens of each reason, counting the occurrences of keywords associated with each topic and selecting the topic with the highest count as the assigned topic. In cases where no keywords matched, the reason was assigned to an "Other" category. A subset of documents were manually reviewed to assess whether keywords were capturing the intended topics effectively, and relabeled otherwise. This was an iterative process, as both the themes and their corresponding dictionary of keywords were refined based on repetitive words and common misclassifications. The subset of "Other" documents that were not captured by the keywords were manually reclassified in Google Sheets, either into one of the eight themes or back into the "Other" category.

6 RESULTS

6.1 Repeated usage of extensions policy

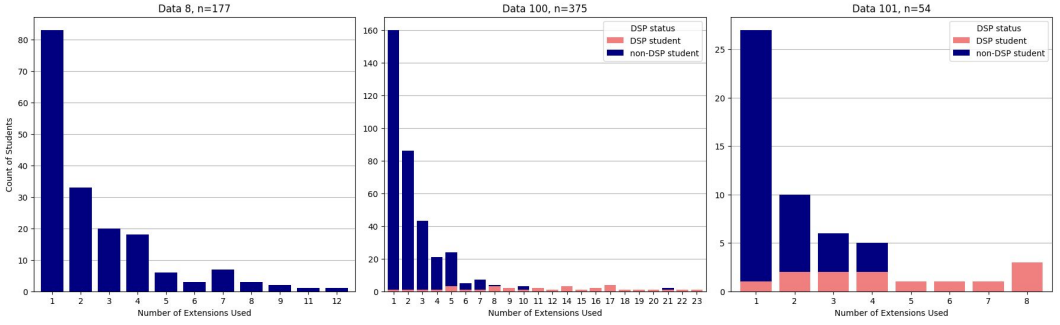

Fig. 1. Repeated Extensions Usage Among students

Data 100 students used the extensions policy the most (375 students, 34.4%), followed by Data 101 (54 students, 19.1%), then Data 8 (177 students, 14.1%). The data shows a heavy right tail: overall, a small minority of students (less than 4% of the class, for all three courses) used more than five extensions across the entire semester, which almost exclusively comprised of DSP students (see Figure 1).

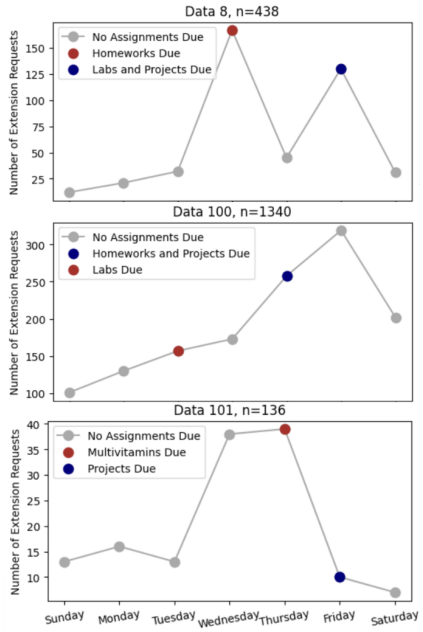

Fig. 2. Number of extensions requests per day of the week

Peaks of requests were found to occur on the days that assignments were due for Data 8, the day after the assignments were due for Data 100, and the day before assignments were due for Data 101 (see Figure 2).

6.2 Use of extensions across assignments

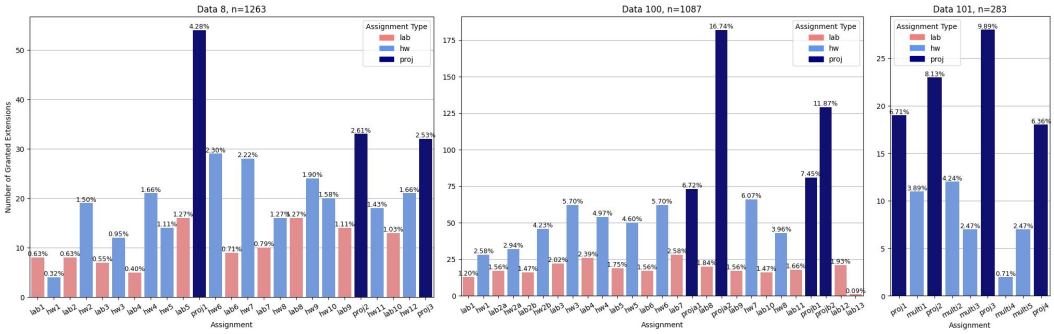

Fig. 3. Granted extensions per assignment

Across all three courses, extensions were granted most frequently for projects, followed by homeworks/multivitamins (short written assignments, equivalent to a homework assignment), then labs. The most extended assignment for each class was the first project for Data 8 (4.28%), the second project for Data 100 (16.74%), and the third project for Data 101 (9.89%), and the third project for Data 101 (see Figure 3).

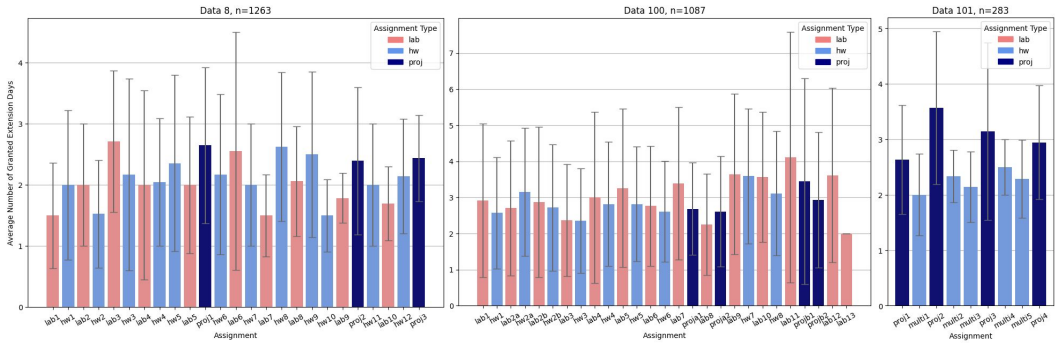

Fig. 4. Average granted extension days per assignment

The average number of granted extension days across assignments tended to fall in between a range of two days. Other than Data 101, where the average granted extension days were consistently higher for projects compared to multivitamins, no correlation was found between assignment type and average number of granted extension days for the other classes (see Figure 4).

6.3 Student perceptions

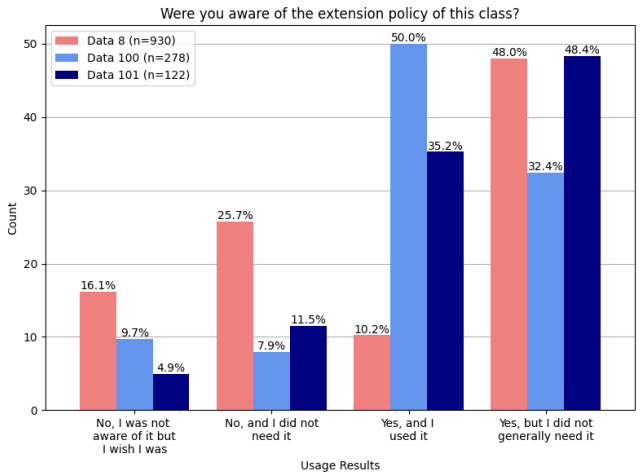

Fig. 5. Survey results regarding policy awareness

Across the three courses, 1376 students (52%) responded to the survey. This consisted of 930 students (74%) from Data 8, 290 students (27%) from Data 100, and 156 students (55%) from Data 101. Overall, the students who reported being aware of the policy outweighed those who were

unaware. However, a significant percentage of Data 8 respondents (41.8%) reported being unaware of the policy, compared to the upper division courses (17.6% for Data 100, 16.4% for Data 101). Out of those who were unaware, a notable percentage of students (ranging from 4.9% to 16.1%) were not aware of the policy but wished they were (See Figure 5).

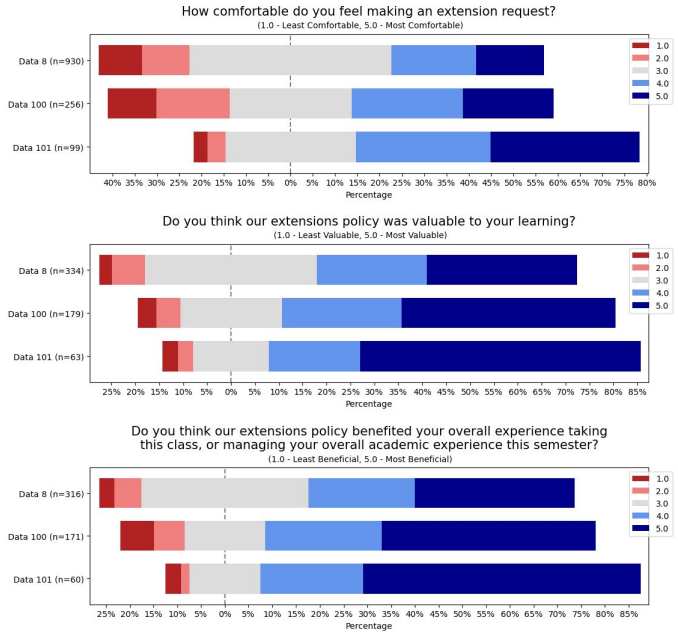

Fig. 6. Survey results regarding policy sentiment

Overall, a positive correlation can be observed between positive sentiment towards the policy and course level. Data 101 students have the highest percentage of positive sentiments towards the policy, while Data 100 students have the highest percentage of negative sentiments towards the policy, both in terms of comfort in requesting an extension, and their beliefs surrounding the benefits of the policy to learning and academic experiences (See Figure 6).

The results presented in Table 2 present the five general themes that emerged while analyzing the qualitative data from the survey responses, written by students who chose to share their perceptions on the policy's benefit to learning in the course or in managing one's overall academic experience. Some responses were categorized under more than one theme.

Theme	Count	%
Support during personal challenges	37	46.25
Relief from stress and pressure	25	31.25
Increased learning	25	31.25
Empowerment and accessibility	4	5.00
Insufficient leniency	6	7.50

Table 2. Student perceptions on policy's benefit to academic experience

Overall, most responses (87.80%) were positive, and a majority of students expressed gratitude for the extension policy. 46.25% of responses mentioned how the policy allowed them to feel

supported by the course and gave them the flexibility to address external life circumstances, without compromising their academic progress.

> I'm aware Data 100 is a popular class and often the first upper divs for many students. Inevitably, some students will be overwhelmed and having an extension can ease their stress and potentially deter them from thinking STEM is too hard. These days, even in industry, not being able to meet deadlines especially due to circumstances is understandable and can be worked with. This encourages communication, which is the most important element to situations like this. I'm also pretty sure there are many students of different backgrounds who are in this class and benefited from the policy, such as parents, working students, minorities, or students with personal problems.

> The extension policy in this class in the only one that made me feel like this class understood what it was like to be a student. When a policy is lenient and is made to make students feel understood, students don't feel the need to abuse it. I found myself at most needing 1-4 days extra on any given assignment, the longer time being when I found myself in a very unexpected situation that totally disrupted my campus life. The reality is, students are going through a lot and are taking classes that are not so understanding of this.

31.25% of responses highlighted how it alleviated stress associated with deadlines, enabling students to manage their time more effectively and maintain their mental well-being.

> Extensions saved my life and mental health. Thank you for granting them and being generous about doing so.

> The course extension policy was fantastic as it severely reduced stress around deadlines and made me feel confident that the course cared about my well being as a person not just a student.

> There were many times where I was facing personal issues (sickness or stress) and I very much benefited from the extensions. The people who handled my extensions were very accommodating and not accusatory at all, I felt very supported.

31.25% of responses also emphasized the impact that the policy had on learning opportunities, mentioning benefits such as increased motivation to turn in assignments, stay enrolled in the class, and learn the material more effectively.

> I really commend this class for making such a policy, because of the way in which I felt this class supported me, I felt so much more drawn to actually learning the content instead of just getting a grade.

> These policies have helped me stay afloat, continue my learning, and develop even as I had some things going on in the background. I appreciate these extensions because they help us students feel cared for, which in all honesty encourages me to work even harder.

> Allowing extensions helps students to learn better instead of just googling answers to meet a deadline.

> Once I find out I won't get credit, I won't finish the assignment, but I think giving the extension would motivate me to finish and learn from it.

> I was able to get through the course, learn the material despite very difficult personal circumstances because of the extension policy. In other courses, I usually would have just dropped the class, but I was able to continue to grow and learn the material because of the extension policy.

5.00% of responses mentioned the benefits of the policy's effectiveness in prioritizing empowerment and accessibility and lowering the barrier towards asking for help without shame or judgment.

> To have an upper div class that made it so comfortable and destigmatized to ask for extra time made me feel supported, and I only found myself asking for time when I really needed it. I also feel like its an important skill for us to learn how to ask for help when we need it in the real world as well.

> I would have certainly failed if it were not for the extensions being so accessible, prompt in response, and effective in providing appropriate support. It's not even so much that extensions were granted, but that I felt empowered to ask without shame or judgment. I love that there was an option to have a meeting with a staff member. That really helped when things got tough for me [...] The extension resources in this class helped me have a fighting chance not only logistically, but through moral support.

While many students praised the extension policy, 7.50% of responses suggested areas for improvement, such as decreasing the approval time and providing more flexibility. Some students expressed dissatisfaction with specific interactions or experiences related to extension requests.

> The one extra day on top of Friday is not necessarily as helpful as a longer day extension would be.

> When I did finally reach out for extenuating circumstances, I felt the TA assisting me was not sensitive to my situation.

6.4 Reasons for requesting or not requesting an extension

The results presented in Table 3 illustrate the distribution of requests among various reasons for extension requests. The table showcases the proportion of requests attributed to each theme, expressed as a percentage of the total number of requests.

Theme	Count	%
Medical	521	38.00
Family/Personal Circumstance	268	19.55
Workload	192	14.00
Catch-up Time	143	10.43
Mental Health	77	5.62
Technical Issues	86	6.27
Disability	34	2.48
Extracurricular	13	0.95
Other	37	2.70

Table 3. Count and proportion of requests under each reason

Medical-related reasons emerged as the most prevalent theme, constituting 38.00% of all extension requests. Following this, requests stemming from family or personal circumstances that involved unforeseen familial obligations or personal crises that prevented students from being able to complete an assignment on time accounted for 19.55% of the total. Reasons pertaining to workload represented a smaller yet significant portion (14.00%) and included factors such as high academic workload, exams, or midterms. Another notable portion of requests (10.43%) fell under the category of "Catch-up," which were requests made by students simply needing extra time to complete the assignment due to falling behind on the material. Technical issues–such as Wifi or DataHub or problems–,mental health-related reasons, and extracurricular commitments–such as sports competitions or conferences–, were found to be less commonly cited as reasons for extension requests, representing only 6.27%, 5.62%, and 0.95% of the total requests, respectively. Requests attributed to disability accounted for 2.48% of the total. Any requests that did not fall under the given themes were categorized as "Other" and constituted 2.70% of the total. Reasons for being classified in the "Other" category included forgetting about the assignment, broadly mentioning an extenuating circumstance but not elaborating on it, or writing text that generally lacked coherence or was unintelligible.

The results presented in Table 4 present the five general themes that emerged while analyzing the qualitative data from the survey responses, written by students who chose to share why they were not comfortable requesting an extension.

Theme	Count	%
Feelings of doubt, shame or being undeserving	36	25.71
Fear about being rejected, perceived as lazy or not hardworking	29	20.71
Negative sentiment due to past experience/syllabus wording	29	20.71
Uncertainty or lack of awareness	26	18.57
Personal desire to stick to assignment deadlines	20	14.29

Table 4. Count and proportion of non-requests under each reason

The top two identified themes, which constituted approximately 46.42% of the reasons, revolve around psychological barriers that prevented students from seeking additional time to complete their work. Students across all three courses who reported being uncomfortable asking for an extension wrote about feeling "guilty," "ashamed," "embarrassed," "awkward," "undeserving," "intimidated," or that their circumstances would not be "good enough," "believed" or deemed as "qualified" for an extension. For others, it was a "matter of pride," "irrational inner judgment," "a feeling of personal failure" if they ask for help, or "a feeling that no one else is taking extensions so [they] shouldn't either." Students were also concerned about how extensions would reflect negatively on their character, saying they "did not want to be mistaken as not hardworking," "wouldn't want it to reflect on [their] overall attention and care for this class" or feared it would "lower [their] grade." Many students also mentioned being "scared," having a "fear of rejection" or a "fear of confrontation," assuming their request would not be approved or that there would be a "lack of understanding from instructors."

Reasons pertaining to negative sentiment due to past experiences or syllabus wording represented 20.71% of the responses, of which Data 100 students almost unanimously comprised. Students in Data 100 noted that the harsh wording about extensions on the syllabus made them assume that extensions were "very strict," "unlikely to be granted," and "unaccommodating." Students who requested an extension once noted that the "barrier to an extension was high," the process was "difficult" and "harsh," and they felt "overlooked" and "seen as bothersome" by course staff. A Data 101 student mentioned that having "bad experiences in previous Data Science classes with respect to extensions" made them uncomfortable asking for an extension in their current classes despite generous policies.

Having uncertainty or a lack of awareness about the policy (18.57%) was mostly Data 8 students, which aligns with the results from Figure 5. Students reported that they "did not know it existed," "forgot about it," "wasn't sure how to do it," "did not know who to ask," or had a general "lack of knowledge about it." Lastly, 14.29% of students reported not using extensions due to a personal desire to stick to assignment deadlines; some students explained that they used deadlines as a means to not "fall behind," or get "extra credit for early submission," while others expressed a desire to "respect deadlines" or a "responsibility to organize [their] time and submit assignments" on time.

7 DISCUSSION

We consider parts 1 (utilization) and parts 2 (perception) to RQ1 separately, which are respectively addressed in subsections 7.1 and 7.2. The results to RQ2 and its implications are discussed in subsection 7.3. Overall discussions and future work are discussed in subsection 7.4.

7.1 RQ1: How are flexible extensions being utilized by students?

Across 2633 students, 25 Data 8 assignments, 27 Data 100 assignments, and 9 Data 101 assignments, there were 160,613 ($2633 \times (25 + 27 + 9)$) opportunities to request for an extension. Through summing all extension requests across all three courses, a total of only 1914 requests were made. With the fact that only 1914 out of 160,613 extension opportunities (less than 2%) were used, and that a majority of students who used the policy used it on only one assignment (see Figure 1), the results suggest that most students were not requesting extensions frivolously just because they were given the opportunity to do so. Students' disclosed reasons and experiences with the policy that they shared on the feedback form further indicate that students were more often than not employing extensions out of necessity, due to external life circumstances. This aligns with previous work that found that increasing deadline flexibility does not encourage students to treat available extensions as the "new deadline" and make redundant requests that some educators that oppose providing extensions have expressed concern about [18], with 50% of students reporting they rely on deadlines to stay motivated and on track [9].

As shown in Figure 2, the surge in extension requests on the day assignments are due for Data 8, compared to the preceding day for Data 101, suggests a tendency among first-year students to seek last-minute extensions, despite class policies advocating for early requests. Anecdotally, TAs who have managed the extensions tool for both Data 8 and Data 101, have seen similar trends in the tendency of first-year students to ask for last minute accommodations and extensions compared to senior students. This result could be attributed to the relative academic inexperience of many first-year Data 8 students, who have not yet fully acclimated to university rigor compared to the predominantly third and fourth-year students in Data 101 and lack the insight to proactively ask for assistance or extended time [13]. The peak of requests on the following day that assignments are due for Data 100 could be attributed to the 24-hour grace period policy. Although the grace period is designed to account for unexpected emergencies or assignment submission errors, submissions within this period are not penalized; this may indicate that students who utilize the extension policy often do so after they have realized that they will not be able to finish the assignment within the grace period.

As shown in Figure 3, the variations in extension use across different assessment types (projects, homeworks/ multivitamins, and labs) within each course are unsurprising. This pattern aligns with the progression of assignments throughout the semester: labs typically offer an initial exposure to the material, homeworks involve tackling more complex problems, and projects serve as an overall synthesis of various course topics. Since projects tend to be lengthier and more difficult compared to labs and homeworks, more students may require additional time for these more challenging assignments. Secondly, although later assignments in a course are typically longer and more challenging, the first Data 8 project was the most extended assignment, compared to later projects for the two upper division classes; this may be because in an introductory course, first-time programmers are more likely to be unfamiliar and overwhelmed with the difficulty of coding projects, and thus more students would request for an extension for the first project. As students progress in their coursework, familiarity with project rigor is expected. Prior studies have found that most novice programmers have not yet developed the strengths needed for efficient coding, often leading to "stoppers" (those who are unable to proceed when confronted with a problem), "tinkerers" (those who make inefficient changes at random), or students who simply abandon attempts to learn programming at all [12].

The average number of granted extension days ultimately depend on a courses' internal policies on how extension days are granted, rather than how many days students request for. This is expected as granted extension days under the policy are ultimately decided by course staff, and

are therefore contingent on the release of assignment solutions—for example, in Data 8, solutions are usually released to students around three days after the assignment deadline, which would make it impossible to grant longer extensions while guaranteeing academic integrity. Evidently, no Data 8 assignment has an average number of granted extension days greater than three days. On the other hand, the solution release timeline of Data 100 is about seven days, and assignment solutions are not provided at all in Data 101, which both allow for greater flexibility in granting longer extensions compared to Data 8.

7.2 RQ1: How are flexible extensions being perceived by students?

Student feedback about the value of the flexible extensions was generally positive: Amongst those who chose to elaborate on their experiences in the survey, the qualitative data underscores the positive impact that the extension policy had on student well-being, learning outcomes, and overall academic experience. A significant proportion of respondents emphasized how the policy made them feel valued as individuals, not just students, and appreciated the leniency and flexibility it offered. These observations suggest that flexible deadlines do not lower educational standards, contrary to what some educators who advocate for rigid deadlines are concerned about; rather, they enable students–especially those struggling with juggling coursework with external life circumstances–to engage more deeply with course material and submit higher-quality assignments while simultaneously maintaining their mental well-being, which is similar previously published work [15]. Additionally, the praise towards the policy's accessibility suggests the positive impact of the form on streamlining extension processes and creating accessible avenues for seeking assistance, thereby enhancing the overall student experience. However, the discrepancy in the usage (Figure 2), knowledge (Figure 5), and perceptions (Figure 6) surrounding extensions between lower and upper-division courses, as observed from the survey results, may stem from a combination of factors related to student experience, perception, time management, and external influences. Lower division students, especially freshmen, may be less familiar with university expectations or overwhelmed by the transition to college, and may not fully understand the importance of reading the syllabus to understand the policies [13].

7.3 RQ2: What are the main reasons students request (or do not request) extensions?

The findings illustrate the diverse array of challenges that students in higher education encounter that present a barrier toward completing assignments on time. Contrary to previous work, which reported that the top two reasons for extension requests in a computing class were conflicting obligations from other curricular requirements (e.g., an assignment due in another course) and under-estimation of the assignment requirements (e.g., starting late, assignment took longer than anticipated) [8], the most significant proportion of requests in this study (38.34%) stemmed from unexpected circumstances, such as medical emergencies, chronic health conditions, or family or personal crises. This instead highlights the necessity for compassionate and inclusive approaches to student support that recognize the diverse and sometimes unpredictable challenges students may encounter outside of academia, ensuring that students are not penalized for circumstances beyond their control.

Workload-related reasons, including "Catch-up" requests, constituted the next significant portion of extension requests (24.43%), aligning more closely with the prior work, indicating that a non-trivial amount of students struggle to manage competing academic demands within the constraints of traditional deadlines. This finding suggests that while flexible extensions may alleviate some academic pressure, underlying systemic issues within academia contribute to students' need to request an extension in the first place. Instructors should thus consider strategies for workload distribution and assessment design to reduce intensive workloads and promote a more balanced

and manageable academic experience for students. Mental health-related reasons were a less commonly cited reason (5.62%), which could be attributed to the stigma surrounding mental health issues. Students may feel too vulnerable to share mental health struggles with course staff, instead choosing to disclose medical or workload reasons, which were observed to be much more common. Anecdotally, TAs have observed that students with mental health challenges tend to rely more on email, rather than the extensions form, to ask for broader course support, and express strong hesitation in regards to reaching out for help.

Likewise, student hesitation to using the extension policy highlights the prevalence of psychological barriers, negative past experiences, uncertainty, and personal preferences in shaping their opinions and behaviors. The significant proportion of students who expressed negative feelings of guilt, shame, embarrassment, and inadequacy surrounding requesting assistance shows the complex interplay between personal identity and academic performance, reflecting a deeply ingrained societal pressure to uphold high academic standards or expectations in higher education [17]. With one student writing, "I have this perspective that asking for an extension is almost stigmatized," students may internalize pressure to excel academically and view extension requests as an antithesis to success, making advocating for their own well-being difficult. The negative sentiments stemming from past experiences or syllabus wording demonstrate the critical role that the instructor's language and tone play in shaping students' openness to using the policy. These findings suggest that course syllabuses should be amended to improve transparency and sentiments surrounding extension requests to help reduce the stigma often associated with seeking assistance. Prior work similarly found that syllabuses written in a friendly tone evoked more approachable perceptions of the instructor and positively impacted what students learned [14].

Fear of being judged by instructors or course staff can deter some students from seeking assistance. The presence of undergraduate student instructors (uGSIs) in these courses further complicates the dynamics, as students may feel hesitant to seek extensions from their peers for fear of judgment or preferential treatment. For example, a Data 101 student writes they sometimes hesitate to reach out for an extension because "some of the uGSIs are my peers." The implications of the extensions policy and its potential risks associated with relying solely on TA judgment for extension approvals therefore need to be carefully considered.

7.4 Limitations and future work

The usage of the extensions tool establishes a new channel of information flow between students, TAs, and instructors. In UC Berkeley, TAs often possess a high degree of autonomy and decision-making authority in the course, which raises questions about whether the responsibility of granting extensions should solely rely on TA–especially undergraduate TA–judgment. Different TAs may have different thresholds for granting extensions or personal rapport with certain students, which could lead to unequal treatment of students and perceptions of unfairness; robust internal policies need to be developed for dealing with extension requests fairly. Granting TAs sole responsibility for extension approvals could place undue emotional burdens, exacerbated by the lack of counseling training, especially in large classes with numerous extension requests.

Furthermore, this approach, which requires students to disclose a reason for a request, may encourage some students to fabricate an excuse in order to be more likely to receive an extension [6]. There is also concern that individuals with stronger writing abilities may be more likely to receive extensions, potentially introducing bias into the process. Some UC Berkeley computer science classes do not require students to disclose a reason for needing an extension, the impact of which could be studied in the future.

A limitation of the perception part of the study is that students self-selected to participate in the survey and self-reported their perceptions. 46.4% of all survey respondents reported using the

policy, compared to the 22.5% of overall students that actually used the policy during the semester. This indicates that students who used the policy are more likely to participate in the survey, which may overemphasize the impact of the policy compared to its actual effect on the student body. Students who feel strongly about the policy may also be likely to participate in the survey, which may lead to an over-representation of extreme opinions in the survey results.

Future research could include the analysis of student demographic data to better understand the impact of the extension policy across different student populations. It is also important to integrate relevant student feedback into the extension tool and future policies to continue improving courses to better student learning experience.

8 CONCLUSION

The introduction of equity-based class policies such as Flextensions represents a promising step towards creating more inclusive and supportive learning environments in higher education. Through studying student experience, I sought to gain an understanding of approaches or techniques that focus on fostering positive experiences in computing education to increase students' success, mitigate experienced difficulties, and increase retention in computing courses. The overall positive sentiment suggests the benefits of this policy in benefiting student learning experience and equity in large enrollment computing classrooms, which is similar to the results of previous studies done in smaller classrooms. However, it is essential to acknowledge that implementing flexible policies alone may not fully address the systemic issues contributing to unmanageable student workloads and stress, leading to the need to ask for extensions in the first place–future research and institutional efforts should explore comprehensive approaches to fostering student success and resilience in higher education. As researchers continue to assess the effectiveness of Flextensions and similar initiatives, I am hopeful that they will not only reduce barriers to student success but also contribute to shaping courses that value learning over grades, destigmatize asking for help, and promote students' independence in managing their academic career long-term. By first acknowledging and addressing the diverse needs and challenges faced by students and prioritizing flexibility through personalized support, academic institutions have the opportunity to foster a culture of empathy, understanding, and collaboration where students feel empowered to advocate for academic help and their own well-being to meet their learning goals.

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REFERENCES

[1] 2023. Data 100 Fall 2023 Extenuating Circumstance Policies. https://ds100.org/fa23/syllabus/#extenuating-circumstances.
[2] 2023. Data 101 Fall 2023 Late Policies. https://fa23.data101.org/syllabus/#late-policy.
[3] 2023. Data 8 Fall 2023 Late Submission Policies. https://www.data8.org/fa23/policies/#late-submission.
[4] Madeleine Bornschlegl and Nerina Jane Caltabiano. 2022. Increasing Accessibility to Academic Support in Higher Education for Diverse Student Cohorts. *Teaching and Learning Inquiry* 10 (March 2022). https://doi.org/10.20343/teachlearninqu.10.13
[5] Madeleine Bornschlegl, Kathryn Meldrum, and Nerina J. Caltabiano. 2020. Variables Related to Academic Help-Seeking Behaviour in Higher Education – Findings from a Multidisciplinary Perspective. *Review of Education* 8, 2 (2020), 486–522. https://doi.org/10.1002/rev3.3196 arXiv:https://bera-journals.onlinelibrary.wiley.com/doi/pdf/10.1002/rev3.3196

[6] Mark D. Caron, Susan Krauss Whitbourne, and Richard P. Halgin. 1992. Fraudulent Excuse Making among College Students. *Teaching of Psychology* 19, 2 (1992), 90–93. https://doi.org/10.1207/s15328023top1902_6 arXiv:https://doi.org/10.1207/s15328023top1902$_6$

[7] Ceilidh Barlow Cash, Jessa Letargo, Steffen P. Graether, and Shoshanah R. Jacobs. 2017. An Analysis of the Perceptions and Resources of Large University Classes. *CBE—Life Sciences Education* 16, 2 (2017), ar33. https://doi.org/10.1187/cbe.16-01-0004 _eprint: https://doi.org/10.1187/cbe.16-01-0004.

[8] Huanyi Chen and Paul A.S. Ward. 2023. The Value of Time Extensions in Identifying Students Abilities. In *Proceedings of the 2023 Conference on Innovation and Technology in Computer Science Education V. 1 (ITiCSE 2023)*. Association for Computing Machinery, New York, NY, USA, 512–518. https://doi.org/10.1145/3587102.3588847 event-place: <conf-loc>, <city>Turku</city>, <country>Finland</country>, </conf-loc>.

[9] Colleen Flaherty. [n. d.]. Students Define Flexibility in the Classroom. ([n. d.]). https://www.insidehighered.com/news/2023/04/07/survey-what-flexibility-means-college-students

[10] Armando Fox. 2023. Flextensions. https://acelab.berkeley.edu/projects/flextensions/

[11] Dan Garcia, Connor McMahon, Yuan Garcia, Matthew West, and Craig Zilles. 2022. Achieving "A's for All (as Time and Interest Allow)". In *Proceedings of the Ninth ACM Conference on Learning @ Scale (L@S '22)*. Association for Computing Machinery, New York, NY, USA, 255–258. https://doi.org/10.1145/3491140.3528289 event-place: New York City, NY, USA.

[12] Sandy Garner, Patricia Haden, and Anthony Robins. 2005. My program is correct but it doesn't run: a preliminary investigation of novice programmers' problems. In *Proceedings of the 7th Australasian Conference on Computing Education - Volume 42* (, Newcastle, New South Wales, Australia,) *(ACE '05)*. Australian Computer Society, Inc., AUS, 173–180.

[13] Vanessa H. Gilyard. 2022. *Experiences of College Freshmen Transitioning to College During Their First Year: A Generic Descriptive Study*. Ph. D. Dissertation. https://www.proquest.com/dissertations-theses/experiences-college-freshmen-transitioning-during/docview/2723139652/se-2

[14] Richard J. Harnish and K. Robert Bridges. 2011. Effect of syllabus tone: students' perceptions of instructor and course. *Social Psychology of Education* 14, 3 (Sept. 2011), 319–330. https://doi.org/10.1007/s11218-011-9152-4

[15] Melissa Hills and Kim Peacock. 2022. Replacing Power with Flexible Structure: Implementing Flexible Deadlines to Improve Student Learning Experiences. *Teaching and Learning Inquiry* 10 (July 2022). https://doi.org/10.20343/teachlearninqu.10.26

[16] Kevin Lin. 2019. *A Berkeley View of Teaching CS at Scale*. Master's thesis. EECS Department, University of California, Berkeley. http://www2.eecs.berkeley.edu/Pubs/TechRpts/2019/EECS-2019-99.html

[17] Christian W. Pester, Gina Noh, and Andi Fu. 2023. On the Importance of Mental Health in STEM. *ACS Polymers Au* 3, 4 (2023), 295–306. https://doi.org/10.1021/acspolymersau.2c00062 _eprint: https://doi.org/10.1021/acspolymersau.2c00062.

[18] Joseph M. Ruesch and Mark A. Sarvary. 2024. Structure and flexibility: systemic and explicit assignment extensions foster an inclusive learning environment. *Frontiers in Education* 9 (2024). https://doi.org/10.3389/feduc.2024.1324506

[19] Jordan Schwartz, Madison Bohannan, Jacob Yim, Yuerou Tang, Dana Benedicto, Charisse Liu, Armando Fox, Lisa Yan, and Narges Norouzi. 2023. Developing a Tool to Automate Extensions to Support a Flexible Extension Policy. arXiv:2311.00152 [cs.CY]

[20] Alicia Nicki Washington. 2020. When Twice as Good Isn't Enough: The Case for Cultural Competence in Computing. In *Proceedings of the 51st ACM Technical Symposium on Computer Science Education (SIGCSE '20)*. Association for Computing Machinery, New York, NY, USA, 213–219. https://doi.org/10.1145/3328778.3366792 event-place: Portland, OR, USA.

[21] Ashley V. Whillans, Jaewon Yoon, Aurora Turek, and Grant E. Donnelly. 2021. Extension request avoidance predicts greater time stress among women. *Proceedings of the National Academy of Sciences* 118, 45 (2021), e2105622118. https://doi.org/10.1073/pnas.2105622118 _eprint: https://www.pnas.org/doi/pdf/10.1073/pnas.2105622118.