Learning about Deadlines from a Community of Learners

Naemi Luckner, Peter Purgathofer, Geraldine Fitzpatrick
{naemi,purg}@igw.tuwien.ac.at,geraldine.fitzpatrick@tuwien.ac.at
TU Wien (Vienna University of Technology)
Vienna, Austria

ABSTRACT

As we are regularly teaching university courses of 600-800 students, we are constantly looking for ways to create a meaningful educational experience for our students to counter the lack of individual mentoring. Therefore, we have been developing a learning platform customised to suit the needs of our students. Peer reviewing is a central component in this system where students hand in challenges and review the work of their peers to provide them with individual feedback. This paper reports on four designs regarding deadlines in this submission system. Our initial goal was an open submission system to allow for self-organisation; for the students to take responsibility of their own learning journey; and to foster a more self-directed and motivated learning culture. We discuss expected and unexpected repercussions caused by our design decisions from the perspectives of both the community of learners and the lecture staff. We evaluated different deadline designs, only to find that when we approached our 'ideal' design, the distribution of work throughout the semester had a highly negative impact on workload and stress levels for lecture staff as well as students. This insight led to a more traditional deadline design that still makes room for self-directed learning and promotes better input from the community of learners in the same deadline cycles.

CCS CONCEPTS

• **Human-centered computing** → *Empirical studies in interaction design.*

KEYWORDS

deadlines, design-based research, education, peer feedback, peer review, self-directed learning, community of learners

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1 INTRODUCTION

At the TU Wien, we conduct large lectures with 600-800 students in the first two semesters. While the challenges that come with such a number of students are often solved by using traditional teaching formats such as face-to-face lectures with singular or regular tests, we decided to try a different pedagogical approach.

Coming from a constructivist background, we want our students to take a more active part in their learning. Rather then making them passively listen to lectures and replicating what they heard, we want them to take responsibility for their own learning [16, 28, 44]. To facilitate that, we created a system [32] where our students hand in work regularly throughout the semester, combined with the necessity to provide peer feedback. This makes the students reflect their own work on a different level, and as a side effect supports us in providing them with individual feedback on their work.

Students' work is organised in so-called *challenges*. A challenge has an overarching theme and consists of two-four activities, called *tasks*, that build on each other. A final task allows for reflection of the overall experience and learning in this challenge. After completing each task, each student has to write three double blind peer reviews of work produced by their colleagues for the same task. Having worked on the task themselves just before writing reviews, students are already familiar with the requirements. Also, as they look at three alternative solutions to the same task they just worked on, they can reflect on their own work from a different angle. Due to the nature of the course where activities often share a *wicked problem*-nature, the students' task is not to judge their peers' work as right or wrong, but give structured and qualitative feedback. To hand in all their work in a challenge, students have to wait until they receive a sufficient number of reviews, and, if necessary, revise their work after the reviews are in. For a more detailed description of this process, please refer to Luckner and Purgathofer [33].

Double blind peer review is a well established process to deal with the large number of students participating in massive open online courses (MOOCs) [24]. After implementing double blind peer reviews in our teaching context, we found some flaws in the process that we consider systemic weaknesses that needed to be addressed to provide a better and more engaging learning environment for our students. For example, students interpreted reviewing as grading rather than giving feedback, and consequently hesitated to write honest reviews for their peers out of misunderstood solidarity; students did not trust feedback to be valuable or correct because it was not given by experts; and students did not trust themselves to be able to give valuable feedback and feared a backlash from their peers [33].

The process described above is complicated and requires a lot of coordination. In this paper we address the specific challenge of using deadlines versus giving students the freedom to plan and conduct work in their own time. We conducted a long-term study over five years, where we introduced different deadline mechanisms which are explained in detail in section 4. While we were working towards a distribution of work being equally spread throughout a

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semester, we discovered multiple organisational issues with the processes. Furthermore, we observed how our community of learners organised and coordinated their efforts to master the course under each of the different deadline regimes. Our insights and comparison of the different mechanisms is further discussed in section 5. We concluded that a mix of deadlines and choices worked better than enabling completely open submissions for the students, not only towards our goal of continuous learning throughout the semester, but also from a purely organisational perspective.

2 PEDAGOGICAL GROUNDING AND RELATED RESEARCH

Our pedagogical concept is based on constructivist learning interlaced with elements from other pedagogical approaches. As described by Piaget [38], learning should be an active process of constructing knowledge contrary to a mere repetition of facts. We see constructivism [27] as an explorative approach that is adaptable and flexible enough to accommodate the changing nature of knowledge and to prepare our students for a life of learning.

This approach in a learner-centred setting [37] results in more inquiry-based [19], problem-based [8], or experiential [29] types of learning. We are trying to engage our students by exposing them to exercises that resemble wicked problems [10, 41] and guiding them through a step-by-step learning activity to find their own answers. Especially at a university, it seems that an inquiry-based learning process should be introduced at an early stage, since it clearly reflects scientific approaches to knowledge creation [18].

While we employ this inquiry-based method in a lot of solo exercises, we also see great potential in a cooperative, constructive approach of learning as described by Vygotsky [45]. Ideally, we try to create an environment where students can form a community of practice [46] and learning [47] around exercises that necessitate knowledge gathering and knowledge creation within our courses.

As raised by Norman and Spohrer [37], this type of learning requires a high amount of motivation and engagement from the students. Our goal is to keep students in a state of flow in their learning [12]. This flow is best supported when students are intrinsically motivated [42] to work towards an individual goal. However, such intrinsic motivation is challenging to create in university courses, since it is often overshadowed by extrinsic motivators such as evaluations or grades. We are basing our understanding of motivation on Deci and Ryan's self-determination theory [13, 14], in which they argue that three needs have to be met to foster intrinsic motivation: competence, relatedness, and autonomy.

To foster a culture of self-directed, self-motivated and organised learning among our students, we also have to reflect on the students' learning background and how this can affect their behaviour [20, 26]. Self-directed learning is often viewed as an essential skill for the next generation, working in an environment that increasingly demands continuous, life-long learning [44]. However, students need to first develop this skill so that it can be applied effectively [7, 28], which can be facilitated by instructors [16, 22].

Studies into the effect of deadlines on motivation show that they can have a negative impact on intrinsic motivation. Amabile et al. [1] showed that study participants who worked in their own pace and study participants with externally imposed deadlines would finish a task within the same time, however, intrinsic motivation declined for participants with deadlines. Ariely and Wertenbroch [4] studied the impact of self-imposed deadlines on procrastination and performance and found them to be helpful towards finishing tasks, however, not as effective as externally imposed deadlines.

The process of peer reviewing itself is well established in modern learning environments [25, 30, 31] and has been found to positively impact students' learning, for example by creating new insights [36] or identifying mistakes earlier than in other evaluation systems [21]. However, the success of peer reviews is dependent on factors such as the quality [31, 34] and objectivity [36] of the feedback, as well as the timeliness of its arrival [23].

3 METHODOLOGY

We employ a design based learning approach [17, 35] to develop an environment geared at creating a collaborative learning community for our students. Design based learning describes an iterative design process [11] characterised by a highly contextualised, real-life setting [6, 39], where design artefacts are developed and used [2] to better understand the design space. Design based research is usually a long-term commitment [40, 43] with the goal to understand how learning occurs and how education in general can be improved by using technology [3, 5, 15].

Our work on this particular learning environment has spanned many years, starting in 2006, in which the system has been continuously redesigned and put into practice. Research in such a complex real-life setting is highly sensitive as students' studies and lives can be affected by problematic design decisions, and there is little margin for changes in the system during a semester. Additionally, the research setting does not allow for comparative studies [11] within one course, since we cannot ethically justify treating groups of students differently within one semester; nor does it easily lend itself to comparative studies between courses, since the redesign usually affects too many different parts of the system simultaneously and results might be influenced by other changes in the system, also known as the systemic whole [9].

This study is the result of comparing data from five consecutive years of using four different deadline mechanisms and hand-in processes, and drawing conclusions based on work flows used at the time. We evaluated hand-in patterns throughout each semester, given various degrees of freedom in timing and frequency of handing in. All data was anonymised prior to its evaluation. For this work, we are not looking at single student's patterns, but rather at visible trends across each semester. Additionally, during the last four iterations, we used the system in two courses simultaneously with the data showing very similar trends according to which deadline design was used.

4 DESIGNING WITH/OUT DEADLINES

We pursue the goal of creating a learning community, in which students are invited to take collective responsibility for their learning. We aim at providing enough choices for each student to find meaningful challenges to work on and interact with. However, as our course is part of a university degree, we are obliged to assign grades to each student at the end of a semester which we can only

do if they meet certain requirements: complete at least one challenge per chapter, reach a certain number of points throughout the semester and write three reviews of an adequate quality for task they hand in.

Apart from Design I, the students work was organised in a task-challenge system. Each challenge consists of 3-5 tasks and one final task, which has a bigger scope and is based on the previous work in the challenge. While the majority of reviews is written by students, we included a safety net for students to get timely feedback: if a student's work did not receive enough reviews from peers after three days, the lecture staff will write substitute reviews. The content of some chapters was cross-sectional, so that challenges for each chapter could be issued at any time during the semester.

Within each chapter there are at least two different challenges offered to give the students a choice of how they want to work with the content. While students have to hand in a certain number of exercises to receive a positive grade, we tried out different organisational designs with or without deadlines to scaffold their work throughout the semester.

4.1 Design I: No deadlines

In this open submissions design, students had the least regulation of timing and structure. We had not yet introduced the more structured task-challenge system, so students could freely choose their work from a large pool of tasks and hand them in in their own time. Students had free choice of timing their work throughout the semester, however, we regularly reminded them to keep working in order to avoid stress in the end of the semester.

Impact. Even so, the overall trend of handed in work accumulated towards the end of the semester. Many students waited until the last possible moment to start with their work and a considerable number of incomplete or low-quality elaborations was handed in.

With this lack of structure, students struggled to find a rhythm in their work and accumulate enough points throughout the semester so as not to get stressed towards the end. Having a very high workload towards the end of the semester affected not only their work for this lecture but their stress level to finish other lectures in this semester.

4.2 Design II: Mid-term waiting period

For the next year we then introduced challenges to give students more structure within their choice of tasks. For the first half of the semester, students could freely hand in as many challenges as they liked. However, six weeks before the end of the semester we activated a setting that would restrict students to only be able to hand in one final task every ten days. This means, as each challenge is organised by multiple tasks, which could still be worked on independent of this restriction, the last task of a challenge could only be handed in every ten days. While this restriction was only activated six week before the end of the semester, students were informed about this limitation at the beginning of the semester and had the opportunity to plan ahead. As challenges could be issued at any time during the semester, students could potentially hand in a challenge from the very beginning to the last week.

Impact. For the first half of the semester, we observed very similar hand-in patterns as in Design I. The lack of any deadline did not seem to be motivating enough for students to work at their own pace. Only the upcoming change of structure six weeks before the end of the semester seemed to make them understand the necessity of handing in their work. For the second half of the semester we saw a similar trend, however, curated by the restriction of only being able to hand in final tasks every couple of days. Additionally, due to the double blind peer review design, we observed two issues with the reviewing process. Early in the semester, too few people worked on tasks simultaneously, so it was difficult to receive enough reviews; towards the deadline and the end of the semester, many students were stressed because they forgot that waiting for reviews had to be accounted for when planning their work, because they could only hand in the challenge after receiving enough reviews.

The community reacted in a way we did not anticipate. During the first half of the semester, many students worked according to their capacities and interests. As the mid-term deadline neared, discussions among students started to focus on the question of how much of the allocated work had to be finished before the mid-semester deadline to successfully complete the course. Soon somebody implemented a web-based tool where you entered the number of hand-ins you still have to do, and it told you the latest point in the semester where you have to start working to be able to finish the course with a passing grade. With this tool, the community created a way to introduce deadlines in an environment that was designed to abolish deadlines. In the end, a considerable number of students found that they had underestimated the necessary workload, especially since the tool did not properly account for review waiting times, which led to a hand-in stampede in the days before the deadline, with many elaborations being low quality to the degree that some were almost blank. Also, as most students used the aforementioned tool to calculate the minimal amount of work they have to do before the mid-term deadline, they had to work on a very tight schedule after this date.

4.3 Design III: Waiting period

For two consecutive years, we expanded Design II to be effectual throughout the semester. Students could still choose challenges freely as long as they adhered to the one challenge per chapter rule, but had to keep in mind that they had to calculate in ten-eleven days between being able to hand in final tasks of a challenge.

Impact. Due to the observed change in behaviour in the second half of Design II, we expanded the restricting time between deadlines to the whole semester. While this led to a trend of hand-ins very close to what we thought optimal for our teaching and learning goals, the number of students dropping out of the course was higher than in any other year. Unpacking the data in more detail showed another problem arising from the long tails of the distribution of individual challenges. The distribution of work done in single challenges is spanning over the whole semester, however, they are always trending right after they are published and then only register sparse activity for the rest of the semester. This led to an unprecedented number of substitute reviews we had to provide, which contributed substantially to the workload of the lecture staff.

Students continued to discuss the latest possible hand-in times and partly used the aforementioned tool with similar effects. There was a high stress factor among students as well as staff to keep

up with the resulting, self-imposed last minute deadlines, rather than students choosing to start and finish their work in a timely fashion, which could have freed up their time towards the end of the semester to have more time for other courses.

4.4 Design IV: Chapter deadlines

Due to diverse issues with the degree of choice previously offered, we reintroduced fixed deadlines throughout the semester. With the deadlines, we reorganised the challenge structure so that all challenges from one chapter could be issued simultaneously, which meant that they also shared a common deadline. Thus, these deadlines were not implemented as a defined date when to hand in each challenge, but were depending on the allocation of challenges to chapters. Each chapter was only available for a certain time span and, since challenges were attached to chapters, this availability effectively constituted hard deadlines.

Impact. This design implemented what we had learned from the previous designs: students wanted deadlines. While we are not convinced that this is necessarily beneficial for the kind of learning we wanted to encourage, we followed the trodden path and restructured the course. The chapters were ordered sequentially and evenly over the course so that challenges could be issued in preset intervals, leading to evenly distributed deadlines that spread out the workload over the whole semester. The immediate benefit was that we achieved the lowest drop-out rate in the history of the course. As this organisation followed the pattern of other courses more closely, we had fewer discussions and complaints about the modus operandi, but we also received much less praise.

5 DISCUSSION

The data collected shows how different designs of deadline processes can impact students hand-in behaviour. While the overall trends are fundamentally different, we cannot see much actual impact on the students' motivation to self-direct and organise their learning processes. Their general behaviour adapts to rules established by the system and they still seem mostly driven by extrinsic motivation in the form of deadlines, be it the single deadline at the end of the semester, or the externally imposed deadlines forcing a certain rhythm of work throughout the semester. Neither the learning design nor the learning content seem to provide a source for the intrinsic motivation reportedly required for self-directed learning [37]. While the system provides ample autonomy, it seems to fail to create a feeling of competence and relatedness [13].

The only design that shows actual promise towards a more continuous self-organised working rhythm among the students turned out to be unmanageable for staff and students alike. The workload by far surmounted the staff's resources even though a high number of students dropped out over the course of the semester, effectively lowering the number of students that needed to be attended to. This resulted in delayed feedback to students work, which is seen as less effective [23] and had a negative impact on students' overall motivation. This result especially shows the need to not only design a system to support self-directed learning for each individual student, but also to account for the importance of a community of learners syncing their hand-in rhythm across a semester. Since this tension between self-directed and community-engaged learning is unlikely to solve itself, it needs to be addressed and structured by the learning design and the technology used to support it.

In one way, our goal to create a community of learners was successful. Stripping away the externally imposed deadline structure united students in a common goal to collectively recreate a framework in which they felt more secure, more at home. Students collaborated actively, discussed and analysed requirements and found creative solutions to deal with a learning situation they felt uncomfortable with. This did create a sense of a supportive learning community in an otherwise largely anonymous environment. Some of these characteristics directly mirror Wilson and Ryder's [47] definition of what constitutes a distributed learning community. The community's agenda, however, vastly deviated from our core idea of bringing them together through common learning goals, but focused on disrupting the learning design itself and so did not yield desired results.

One general conclusion could be that upholding pedagogical ideals sometimes leads to unpredictable conditions that create additional challenges for students as well as staff. What we as instructors regard as valuable teaching design might not be understood as such by students [26]. Dealing with such a number of students with different learning preferences and at the same time wanting to provide a meaningful learning environment results in cross-over effects driving the amount of work to unforeseeable heights.

6 CONCLUSION

In designing a more meaningful teaching and learning environment for large university courses, we regularly stumble across design challenges that need multiple approaches to solve. In this paper we have reported on the unexpected factors arising from trialling four different design solutions for deadlines and peer feedback.

In this case, having underestimated the organisational impact of certain design decisions had real-life consequences for students and the lecture staff alike. Students had to wait longer for their feedback, which delayed their learning progress and had an impact on their time management and satisfaction within the course, whereas the lecture staff had to deal with a larger amount of work as expected, which led to highly stressful and invidious semesters. Even though we are still striving towards a more balanced trend of students handing in their work throughout the semester as experienced in Design III, we appreciate the more predictable workload provided by the current iteration of regular chapter deadlines.

We have learnt that providing students with the means to engage in self-directed learning does not automatically make them a community of self-directed learners. In our school system, students are often not trained and prepared to take responsibility and initiative for their own learning. The fact that they are now studying at university does not magically change the way they were taught to learn. If we want students to adapt to different types of learning and knowledge creation, we have to scaffold their journey there.

This work leads to intriguing future work concerning the way individual students as well as the community of learners interacts with different deadline designs. We will further unpack the data, looking in particular at dropout rates, distribution of grades as well as qualitative data of students opinions about the different designs to inform and adapt the next iteration of our learning design.

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