The Impact of Omitting Deadlines, Examination and Grading on Student and Teacher Engagement
An Experience Report

Kris Luyten[1] and Jolien Notermans[2]

[1]Expertise Center for Digital Media, Hasselt University — tUL — Flanders Make
[2]Education Development, Diversity and Innovation, Hasselt University
firstname.lastname@uhasselt.be

Abstract

This paper presents an experience report of a master-level skill-oriented CS course in which deadlines, traditional examination and full grading were omitted. The course topic was on Human-AI Interaction, and while all students were master CS students there was a wide diversity in background on AI and ML among the students, ranging from no previous AI/ML courses up to students that took advanced ML courses. During the semester and before the examination period, students could pass the course (all students did) and were not obligated to continue putting effort in the course. We found this approach had a significant positive impact on both, and resulted in students to become self-motivated even when they were informed they passed the course. Of a total of 26 students, only 2 students ($< 8\%$) made no further meaningful effort after being informed they passed the course. All other students continued putting work in the course up until the end of the semester. In this paper we describe the iterative approach we took, with a specific focus on assessing both individual and student group evolution rather than result-oriented snapshot assessments, and ground this approach in existing literature.

1 A Human-AI Interaction course

We report on the organisation of a course on Human AI Interaction; a master-level course in computer science. For the course contents we first revised existing course materials from other universities and reused existing contents (with permission and clearly crediting the source) supplemented with our own materials. We highly appreciate the teaching staff of the Human-AI Interaction course at Carnegie Mellon University[1] sharing their teaching materials, as well as the Intelligent User Interface course[2] that was made available by its lecturers. Both

[1]`https://haiicmu.github.io`
[2]`https://iui-lecture.org/`

provide high-quality teaching materials. Our course reused parts of these materials and covered some basic machine learning skills, XP for AI, intelligible design, mixed-initiative interaction, natural language processing, chat bots and eXplainable AI.

Due to the structure and organisation of the computer science master, there were students enrolled that either took a basic AI course, a basic AI course and an advanced ML course, or had no prior experience with AI or ML. This might seem like a too diverse audience for an advanced topic such as Human-AI Interaction, but we found that this diversity triggered us to rethink our teaching approach. Twenty-six (26) students enrolled in this course, which is about half of the students that participate in our master in computer science. Both the professor and teaching assistant were teaching this course for the first time, and have prior research experience in intelligible design and eXplainable AI.

Our approach was to focus on skill development, and primordially train the students to apply what we taught them and to motivate their choices thoroughly, rather than reproduce knowledge. Furthermore, we needed to embrace the diverse backgrounds in AI/ML. To accomplish this, we required (1) students with high potential to do more challenging work while students with very little or no prior experience with AI and ML to show they can apply what they learned correctly with a very good understanding, and (2) collaborate on assignments in small groups. Feedback sessions were also organized per group, which lowered the threshold for questions significantly. The maximum group size was 4 people, to ensure the teaching staff also had sufficient time and opportunity to interact with each individual of the group.

2 Background

The design of the course relates to the model of High Impact Learning that Lasts (HILL) [5]. The HILL model consists of 7 elements of the learning environment that have an impact on the learning process and path of students: (1) urgency, (2) self-management and learner agency, (3) collaboration and coaching, (4) hybrid learning, (5) action and knowledge sharing, (6) flexibility and (7) assessment for learning and assessment as learning. We will discuss how these 7 elements of the HILL models are, to a greater or lesser extent, present in this course. We will elaborate further on the aspects of assessment as learning and motivation.

The first component, *urgency*, relates to the assignments and individual project students made during the course, which set the students up for a challenge. The second component, *self-management and learner agency*, was realised by the iterative and incremental approach to the assignments. Students made choices regarding the approach of the assignments and were responsible for submitting and redoing the assignments (learner agency). This created the opportunity for students to continually adjust their learning process (self-management). The third component, *collaboration and coaching*, was an important part of the course. Students worked in small groups on 4 of the 5 assignments and students were even encouraged to help each other with the first assignment. The teaching staff took on the role as coach during the feedback moments with students. The fourth component, *hybrid learning*, was translated to a combination of asynchronous activities (e.g. assignments and project) and

synchronous activities (e.g. lectures and feedback moments). The fifth component, *action and knowledge sharing*, was a key principle of this course. Students were actively involved throughout the whole course and were provided opportunities to interact and mutually share knowledge with other students and the teaching staff. This also created a learning environment in which mistakes were seen as learning opportunities and just-in-time feedback was provided to further stimulate the learning process of students. The sixth component, *flexibility*, was present during the work process of students on the assignments, for which there was not one correct solution. Students had to motivate their choices. The last component, *assessment*, refers to assessment for learning and assessment as learning. Because of the large impact of assessment on the learning behavior of students [5], we will discuss this component more in depth.

A combination of 3 forms of assessment were present in the course: 1. assessment of learning, also known as summative assessment, of the individual project; 2. assessment for learning, also known as formative assessment, during the feedback moments with the groups of students and 3. assessment as learning through the iterative and incremental approach of the assignments. We will elaborate this concept of assessment as learning, which refers to a situation in which learning, teaching and assessment are intertwined [2, 5]. Exams and strict deadlines often create stress for students, which can block the learning process of students [5]. That is the reason strict deadlines, exams and grading were omitted in this course. The assessment of the assignments therefore focused on training students and stimulating their learning, motivation and self management by giving feedback and feedforward. The feedback and feedforward in order to get a pass on the assignment could differ between groups, since the focus was on the evolution of the group instead of on a fixed norm. Not only the teaching staff but also their peers were important sources of feedback which students could use to get insight in their learning process and therefore self manage it. That way, students were able to monitor and adjust their work and their own learning process [1, 2, 5]. Students therefore took up a more active role in their own learning, which also required a shift in the role of the teacher: instead of merely teaching content we wanted to create learning opportunities for students to become more autonomous learners [1].

This approach to assessment stimulated the motivation of students, which subsequently positively influenced the learning of students. The motivating aspects of the approach to assessment can be explained by the principles of the self-determination theory (SDT) by Deci and Ryan [4]. The SDT states that autonomous forms of motivation have positive effects on the learning process, engagement and wellbeing of students [9]. Autonomous motivation "comprises both intrinsic motivation and the types of extrinsic motivation in which people have identified with an activity's value and ideally will have integrated it into their sense of self" [3]. Autonomous forms of motivation are characterised by experiencing volition or self endorsement. Teachers can stimulate autonomous motivation of their students by supporting three basic psychological needs [9]. The first basic psychological need is autonomy, which refers to "a sense of initiative and ownership in one's actions." [9]. In this course the autonomy of students was stimulated by the ownership and choices students had during working on the assignments. The second basic psychological need is relatedness, which refers to "a sense of belonging and connection" [9]. This was realised by the collaborative learning between students and with the teaching staff. The third basic psycho-

logical need is competence, described as "a sense that one can succeed and grow" [9]. The feeling of competence was stimulated by the unlimited opportunities to redo or fix the assignments, followed by the differentiating feedback and feedforward that helped students to continue their work. Based on this theoretical background we can assume that students were motivated to finish the course, which positively impacted their learning.

3 An Iterative and Incremental Approach without Deadlines

We implemented the HILL model in our course by applying an interactive and incremental training and assessment approach focused on skill development and collaborative learning. In the previous section we outlined the HILL model, the reference model for our approach. In this section we present the concrete implementation of this model: the blueprint for our course, the assessment and schedule. Due to the COVID pandemic, all teaching was done remotely during the academic year which was a new and uncommon situation for the students that took our course. Although this was an additional trigger to carefully consider the teaching methodology, our choices can be applied for both remote as well as in-person teaching. To facilitate teaching and course-related communication, we used a course Discord server, and for teaching, feedback, group sessions and communication tools we used the Blackboard virtual learning platform. The Blackboard environment supports the creation of separate sub-groups and offers team-based collaboration tools such as video conferencing, screen sharing and chat facilities. Blackboard allows the teaching staff to join the group sessions, while students can not join other groups than the ones they are allocated to.

We had 6 groups with 4 students and one group of 2 students. The students were allowed to from their groups amongst themselves. Each group collaborated on four out of five assignments. The first assignment was an individual assignment focused on introducing the main tool to process data, Google Colab notebooks, and allowed the students to assess their basic understanding of ML. There were also 8 lectures covering (1) a basic intro to ML (e.g. terminology, pipeline, assessing performance, models, classes of ML, evaluation metrics), (2) some context and history of AI and the challenges and dangers of using AI, (3) mixed-initiative interaction, (4) ML and UX, (5) eXplainable AI, (6) Intelligibility, (7) Intelligent User Interfaces, and (8) chatbots and natural language processing. Students were informed all course materials were meant to be "mastered" and that there would be no final examination for this course.

Grading (on points) was not completely omitted: there were five assignments that were all graded with pass or fail, and one project that could earn them a score on 8 points. Our courses are always scored on 20 points by default at the university, also since grades our used to categorize students which is often required when applying for funding. For this reason, we translated five passes in 12 (out of 20) points. To pass the course, the students are required to pass all assignments. Although they do receive an explicit score for the project, the approach was the same: they were informed during the feedback sessions what was needed to pass (score 4–5) and how they could top this further for an even higher grade (score 6–8).

There was no oral or written examination during this course. The feedback sessions in which students explained and motivated their solutions were used to assess the students and monitor their progress, efforts and results. Special attention was given to how students referred to what they learned during the lectures and how they used the sources we gave them to motivate their work.

A1 For the first and only *individual* assignment they had to follow part of the introductory TensorFlow tutorial[3] with Colab notebook. They were asked to create a more extensive tutorial and explain all steps in their Colab implementation.

A2 Assignment two had two parts, for which students had to *collaborate*. Students performed a one week diary study logging their use of intelligent software. Next they had to select three applications and create an improved design for their interface. The new design had to make the system more accountable, intelligible and scrutable. It also had to provide additional means for users to take control over whatever intelligent processing was done at the application back-end. Students were required to explain and motivate all their choices.

A3 For assignment three, students were asked to *collaborate* and create an interactive explainable AI interface for K-Means clustering. The user interface had to explain why an item was included in a cluster, how the item could move between clusters in various iterations of the clustering algorithm and why and how the clusters were defined. Students were required to explain and motivate all their choices.

A4 Assignment four made use of a dataset listing various causes of death. Students were required to *collaborate* and first wrangle the data, then explore the dataset with simple visualisations and finally apply the dataset to build an interactive interface for personal recommendations (the most likely causes of death for a given profile). Students were required to explain and motivate all their choices, and to design the personal recommendation interface so users can fully grasp why recommendations were given and to provide additional context on the trustworthiness of the recommendation.

A5 Assignment five covered building a predictive model based on the Titanic dataset[4], and implement various eXplainable AI approaches for this predictive model including readable and easy to understand visualisations. Students were required to explain and motivate all their choices.

P1 Finally, students could earn up to 8 points on an individual project. The project assignment was to create a chat bot that interfaces with an intelligent algorithm processing a complex, dynamic, and/or big dataset. The primary user interface was a conversational user interface using natural language mixed with visual explanations. Further refinement of the project assignment was done in iterations, and although students had individual projects, feedback and discussion on their project progress was still done in the same group setting as the one that was used for the assignments.

[3] `https://www.tensorflow.org/tutorials/quickstart/beginner`
[4] `https://www.kaggle.com/c/titanic/data`

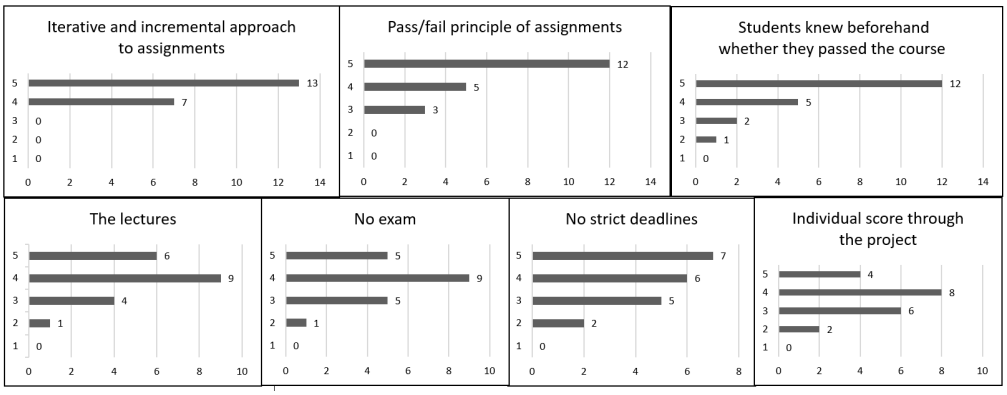

Figure 1: Responses on the potential positive impact of various aspects of the teaching approach on the learning process. Horizontally the number of responses is shown, while vertically the various response categories are presented (ranging from 1 "fully disagree" to 5 "fully agree").

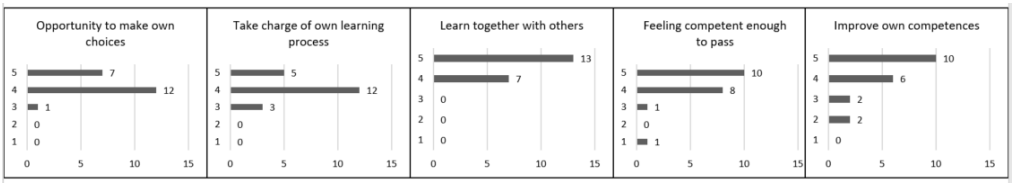

Figure 2: Responses on the questions about the positive effects on motivation. Horizontally the number of responses is shown, while vertically the various response categories are presented (ranging from 1 "fully disagree" to 5 "fully agree").

All assignments (A1–5) were pass/fail, and could be retried as many times as they needed before the end of the semester. On a weekly basis, 30 minutes per group was allocated in which they orally explained the results of their assignments. The teaching staff informed them whether they got a pass for an assignment. In case no pass was granted, the teaching staff told them what they needed to update, redo, explain better or correct in order to get a pass. The maximum number of iterations over an assignment before a pass was obtained was three. Depending on the evolution and the performance of the student group, the feedback could differ: some groups got more challenging updated requirements than others. This turned out to be appreciated by the students: while students were aware of the differences in difficulty, they were happy to proceed and do more challenging work. We think this was due to the fact that working on the assignments felt more like training to improve their skills, and they would earn a pass when demonstrating their skills.

4 Course Effectiveness and Student Feedback Analysis

In order to get feedback on the unique approach of the course and how this impacted the learning process of students, we asked students to fill in a questionnaire after the results were announced. The questionnaire was filled out by 20 of the 26 students that followed the course and consisted of 4 parts.

In the first part students had to indicate which courses they had followed before or together with this course: 6 students did not follow a related course, 4 students followed a course on artificial intelligence, 3 students a course on machine learning, 7 students the course on artificial intelligence as well as machine learning. This implies a great diversity in the prior knowledge of students. We asked the students how their prior knowledge impacted the results for this course. This did not show a correlation with the courses they had followed, which may indicate that the approach effectively dealt with the diversity in prior knowledge of students (e.g. by differentiating feedback). Furthermore, all students indicated that the approach of this course matched with the way they like to learn and study. This positive feedback was also confirmed by the answers collected from the standard student surveys that our university conducts after each course.

The second part of the questionnaire asked the students about the impact of specific elements of the course on their learning process. An overview of the responses is presented in Fig. 1. Learning process was described to students as "the degree to which you feel that you have effectively learned". All students indicated that the iterative and incremental approach to the assignments positively impacted their learning process. The majority of the students indicated that the other elements also had a positive impact on the learning process: the pass/fail principle of the assignments (17 out of 20 students), the fact that students knew whether they passed the course before the start of the exam period (17 out of 20 students), the lectures (15 out of 20 students), no exam (14 out of 20 students), no deadlines (13 out of 20 students) and the opportunity to obtain an individual score through the project (12 out of 20 students). Although we rely on the self-rapport of students, this implies that the unique approach of the course led to gains in the learning process of students, in other words that this led to high impact learning.

The third part of the questionnaire was about the project. All students, except one student, that filled out the questionnaire made the project. The majority of the students (13 out of 19 students) felt motivated to work on the project. This is remarkable, because the students knew that they had already passed the course. 12 out of 19 students felt that the score they got on the project was consistent with their expectation. This may indicate that students were able to estimate themselves and their work well. We may conclude that the students were self-motivated to do the project, and to further develop their skills even though they were sure of a pass for the whole course. The project assignment also provided an opportunity to differentiate between students.

The fourth part of the questionnaire focused on the motivational aspects of the course. An overview of the responses is presented in Fig. 2. The questions in this part referred to the basic psychological needs as mentioned by the SDT. Regarding autonomy, the majority of students indicated that they had

the opportunity to make their own choices (19 out of 20 students) and to take charge of their own learning process during the course (17 out of 20 students). About relatedness, all students indicated that they had the opportunity to learn together with others. Regarding competence, the majority of the students felt competent enough to pass the course (18 out of 20 students) and felt that they could improve their competences (16 out of 20 students). This fourth part confirms that the design of the course had a positive impact on the motivation of students.

The last question was about the pressure students experienced during the course. Almost all students (18 out of 20) indicated that they felt less pressure during the course when compared to courses with a more traditional approach. This is striking because we could observe students spent more time on the course than the budgeted study time. Student groups contacted and met with the teaching staff outside of the planned course hours, and some groups showed their progress multiple times per week. This may mean that it is mostly strict deadlines and exams that can lead to increased pressure and stress for students.

To conclude, this questionnaire confirms that the design and approach of this course positively influenced the learning process, motivation and satisfaction of students.

5 Lessons Learned and Conclusions

By moving away from single assessment and individual scoring, and introducing an incremental and iterative approach based on the HILL principle [5], we could observe students becoming more self-motivated and more engaged to further develop and refine their skills. Both for the teaching staff and students this approach was very different than other courses: traditionally projects, assignments and examinations are scored at one specific time in a semester and can not be iterated upon for further improvement.

One could argue our specific implementation of the HILL model will result in nearly all students passing the course given they can repeat. However, all students demonstrated they mastered the course materials and knew how to apply this new knowledge correctly and appropriately in practical assignments. With the various assignments students had to work on in groups, our approach has similarities with Project-Based Learning [8]. Our approach assisted students in assimilating the required skills through practical assignments [7], while stimulating them to collaborate, and offer the groups a sense of ownership over both their work and progress. Using a pass/fail grading system in combination with personalised feedback to the student groups had a positive effect on the student motivation and on the quality of the results that were delivered.

The course recently finished, and the question remains whether this approach achieves a higher degree of retention over time with respect to other approaches. Due to the fact the course was taught recently, we were not able to verify this formally. Existing literature does provide us with some insights in the possible effect on retention. Giannakos et al. [6] showed that, among others, high personal value, a lack of stress and usefulness contribute positively to retention. The respondents to our questionnaire answered positively on these aspects and indicated they would like to see more courses use a similar approach. A single educational approach is not suitable for all types of courses, but courses that

focus on training skills could benefit from applying this iterative and incremental approach and removing explicit grading.

Finally, a similar positive effect was also observed by the teaching staff (one professor and one teaching assistant). There was a feeling of satisfaction and accomplishment by the members of the teaching staff, and the active participation of all students made guidance and teaching more enjoyable and less stressful. Significantly more time was spent on coaching and guiding the students, including the feedback sessions. This was compensated to a certain extent by the time that did *not* have to be put in correcting exams and assignments outside of office hours, or the organisation of a re-examination sessions.

acknowledgments The authors would like to thank all students that replied to the questionnaire and for their commitment getting most out of the course. We are also grateful to Raf Menten for his support teaching this course and Davy Vanacken for providing valuable feedback on this document. This work was funded by the Flemish Government under the "Onderzoeksprogramma Artificiële Intelligentie (AI) Vlaanderen" programme and by the VLAIO-TETRA XAI project.

References

[1] Rita Shuk Yin BERRY. "The assessment as learning (AaL) framework for teaching and learning: The AaL wheel". In: *Assessment and Learning* 2 (2013), pp. 51–70.

[2] Ruth Dann. "Assessment as learning: blurring the boundaries of assessment and learning for theory, policy and practice". In: *Assessment in Education: Principles, Policy & Practice* 21.2 (2014), pp. 149–166.

[3] Edward L Deci and Richard M Ryan. "Self-determination theory: A macrotheory of human motivation, development, and health." In: *Canadian psychology/Psychologie Canadienne* 49.3 (2008), pp. 182–185.

[4] Edward L Deci and Richard M Ryan. "Self-determination theory: When mind mediates behavior". In: *The Journal of mind and Behavior* (1980), pp. 33–43.

[5] Filip Dochy and Mien Segers. *Creating impact through future learning: The high impact learning that lasts (HILL) model*. Routledge, 2018.

[6] Michail Giannakos et al. "Understanding student retention in computer science education: The role of environment, gains, barriers and usefulness". In: *Education and Information Technologies* 22 (Sept. 2017). DOI: 10.1007/s10639-016-9538-1.

[7] John W McManus and Philip J Costello. "Project based learning in computer science: a student and research advisor's perspective". In: *Journal of Computing Sciences in Colleges* 34.3 (2019), pp. 38–46.

[8] Robert Pucher and Martin Lehner. "Project Based Learning in Computer Science: A Review of More than 500 Projects". In: *Procedia - Social and Behavioral Sciences* 29 (2011). The 2nd International Conference on Education and Educational Psychology 2011, pp. 1561–1566. ISSN: 1877-0428. DOI: doi.org/10.1016/j.sbspro.2011.11.398.

[9] Richard M Ryan and Edward L Deci. “Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions”. In: *Contemporary Educational Psychology* 61 (2020), p. 101860.