



## Innovative Education Approach Toward Active Distance Education: a Case Study in the Introduction to AI course

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### Abstract

*In this paper, we first describe various methods for enhancing student engagement in big online courses. We showcase the implementation of these methods in the "Introduction to Artificial Intelligence (AI)" course at Luleå University of Technology, which has attracted around 500 students in each of its iterations (twice yearly, since 2019). We also show that these methods can be applied efficiently, in terms of the teaching hours required. With the increase in digitization and student mobility, the demand for improved and personalized content delivery for distance education has also increased. This applies not only in the context of traditional undergraduate education, but also in the context of adult education and lifelong learning. This higher level of demand, however, introduces a challenge, especially as it is typically combined with a shortage of staff and needs for efficient education. This challenge is further amplified by the current pandemic situation, which led to an even bigger risk of student dropout. To mitigate this risk, as well as to meet the increased demand, we applied various methods for creating engaging interaction in our pedagogy strategies. The main methods of this pedagogy are as follows: short, and interactive videos, active discussions in topic-based forums, regular live sessions with group discussions, and the introduction of optional content at many points in the course, to address different target groups. In this paper, we show how we originally designed and continuously improved the course, without requiring more than 500 teaching hours per iteration (one hour per enrolled student), while we also managed to increase the successful completion rate of the participants by 10%, and improved students' feedback for the course by 50%. We intend to share a set of best-practices applicable to many other e-learning courses in ICT.*

**Keywords:** *students' engagement, online learning, e learning, 6 Cs, continues development, course evaluation*

### 1. Introduction

Artificial Intelligence (AI) profoundly transforms the world in different aspects, like daily life, business, manufacturing, education, and many others. The main objective of this course is to increase and individualize AI education by proposing an innovative educational approach. This aim will give a chance to more people to learn about AI and its benefits to have a better understanding of the current world's advanced transformation process. The course syllabus is designed to attract many participants regardless of their backgrounds and knowledge about AI. It starts by furnishing the participants with a basic overview of Artificial Intelligence (AI) and its applications, explains how to analyze data and design AI applications for practical use, and discusses various aspects concerning AI ethics and governance that will value society. To reach to individualize AI education, many problems should be addressed during the design stage. One of these challenges is how to design an interactive university course that can be easily accessed by many students attending remotely from various parts of the world, especially during the era of pandemics. Teachers in this scenario should know how to design the course materials in a way to reduce the teacher's role in the learning experience and focus on the student(online) interaction. This design builds a kind of community discussion that might have a broader scope and fruitful information than the one provided by the teacher in a university's classical designed course. Another challenge is the ability of the course to cover the "diversity of learners"; i.e., the learners come from diverse cultures, backgrounds, different English proficiency levels, and many other differences. With the substantial number of students attending the course, troubles related to insufficient examples, presenting too many ideas, the poor link between the activity and the objective should be minimal, if not non-existent in an ideal scenario. This will request the teacher to consider all



these concerns while designing the course, and all the parts should be well connected and harmonized together. Teachers also should ensure that the designed assessments are structured to assist students in reaching the first two levels of Bloom's Taxonomy, which are remembering and comprehending, before moving on to questioning, analyzing, and investigating the concept underlying the topic.

This paper describes how we design and continuously improve a distance course with 500 students in each iteration and the various methods we utilized to enhance student engagement and increase the completion rate. The rest of the paper is organized as follows. First, we introduce the different techniques to enhance students' engagement in Section 2. Then in Section 3, we present the course implementation and the course pedagogical philosophy. Next, we introduce the course evaluation and statistics in Section 4. Finally, we discuss some learned lessons and suggestions for others then we present future work in Section 5.

## 2. Methods for enhancing students' engagement

This section discusses the various methods that apply in our course to increase student engagement. Engagement appears through different course activities, and motivation is essential to improve student engagement [1]. Moreover, motivation has also been linked to course completion [2]. So, as to emphasize the focal role of student motivation in our course, for each method applied, we will discuss how it contributes to establishing a motivational learning environment. We will do so by linking each method to one or more of the 6 Cs (Choice, Challenge, Control, Collaboration, Constructing meaning, and Consequences), presented in the six Cs model of Turner and Paris [3].

### 2.1 Modular content delivery with introductory overview presentation

Modules can be thought of as a container or self-contained chunks that can organize the course content by week, segment, subject, or other different structures. We used a week-length module in our course (roughly 8-10 hours a week, as the course, is on a 25% level). Generally, using modules in the course can create one direction linear flow of what the students need to do because navigating through course contents could be confusing, especially for large classes with different students' backgrounds. Considering this fact, we designed the Introduction to AI course to have 20 modules (M0-M19), and each module has several activities, as shown in Figure 1. Additionally, a course roadmap was provided in M0 to provide a better overview of the course and explain how the different modules connected, which is tied to the 5th C; Constructing meaning. Because when the students know the modules' structure and the connection between them, they can easily construct meaning.

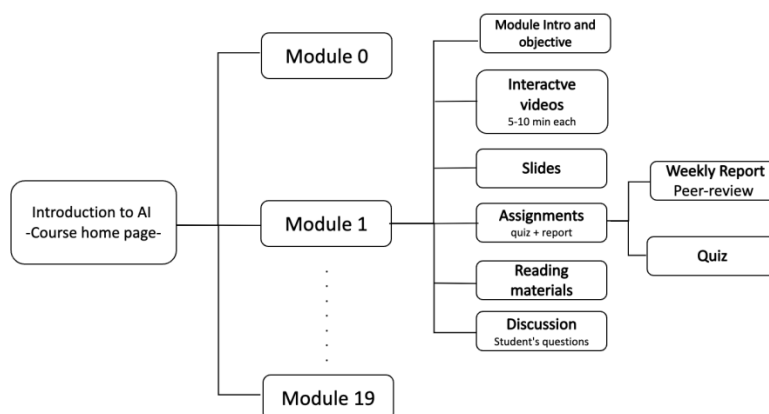


Fig.1. The modular structure of the course

### 2.2 Enriching the content in our flipped e-learning environment

The flipped classroom is not a new strategy in learning [4]. The general principle is that instead of attending lectures and working on tasks alone, it's flipped to ensure that the students are prepared before coming to the live session or class. This help in establishing a baseline understanding of the material, and then the students do other activities during class or live sessions. Therefore, instead of



only delivering information, the teachers facilitate the learning process and provide a richer learning experience that can enable our course pedagogical philosophy of making students be the centre of learning and serve our vision for a more flexible environment. We implement this by having an interactive video to increase the effectiveness of the lecture by including questions with feedback inside the video to increase the engagement and to be able to measure student interaction which provides a new way to improve learning outcomes by focusing on the lecture key takeaway. These videos were created then embedded in the learning management system.

In the flipped classroom students take control of their own learning, and they also have control over the material in the sense that they decide when to watch the videos, what pace to go in, and when to pause/continue with each video which links it to Control; the 3rd C.

### **2.3 Assignments motivating peer-interaction and optional elements**

In distance learning, assignments are essential in measuring student performance, reinforcing their learning and providing feedback that can improve learning outcomes and demonstrate that the students have achieved the learning goals. How can we assess learning outcomes with 500 students in the Introduction to AI course? We used different assessment tools such as quizzes to steer students' attention to the main topics of each module and to help them know their strengths and weaknesses [5]. We designed the quizzes to measure learning achievements on various levels of Blooms taxonomy, ranging from remembering to evaluating [6]. We also integrated discussion to highlight the key takeaways for each milestone of the course to promote students' interaction and enable collaborative communication [7]. Moreover, we asked the student to write weekly reports describing their learning process and learning outcomes then reports are distributed to two other students for peer review. We also provide a grading tool with consistent criteria to facilitate the review. Peer review has several merits, one of them being to develop cooperative learning, which allows them to embed new knowledge. Both peer review and discussions linked to the 4th C; Collaboration. Furthermore, peer review involved the students in the process of decision-making when they grade each other's assignments, which can be linked to the 3rd C; Control.

Finally, we provided an optional practical assignment to help the students to take a step further to apply their knowledge with real-life case studies. It is worth mentioning that with all the tasks, we considered Bloom's digital taxonomy, and we designed the assignment to have flexible deadlines to allow more students to complete the course. More importantly, making optional assignments with flexible deadlines gave the student the Choice, the 1st C.

## **3. Implementation in the intro to AI course**

### **3.1 Description to Intro to AI course**

The Introduction to Artificial intelligence is an international distance course given by LTU and anyone in the world can register for it. The course gives 7.5 credits, and it is free for anyone in the EU. The course attracts an average of 500 students each iteration, and we run it twice a year for a 5-month duration each iteration and the students have diverse backgrounds, some of them from academia and some from the industry.

### **3.2 Canvas**

As discussed in Section 2, maintaining a high level of interaction between the teaching team and the students is a key factor in course success. To facilitate this interaction, we use the Canvas learning management system (LMS), which supports online distance teaching. One of the tools Canvas provides us for this end is the course announcement, which allowed us to convey time-sensitive information to students. As for bidirectional communication, Canvas provides us the opportunity to open discussion forums that serve as open channel, contributing toward a supportive learning environment. These forums also provide a channel for teachers to provide knowledge-enhancing feedback, in addition to the ratings and comments they give on assignments [8].

It is also important, however, to use the time of teachers efficiently, and create a learning environment where students do not rely exclusively on teachers, but still get the benefit of individualized self-paced instructions. This approach, besides being more efficient, also has the added benefit of fostering



independence and self-awareness [8]. In achieving this, the most important Canvas property was the capability to import content from previous course iterations, which allowed us to create new course instances with minimal modifications. This also allowed us to create a comprehensive landing page where students by default start after logging in, and where they can see an overview of the whole course, including the schedule for lectures, as well as all assignments (with their due dates), and links for each live stream. Another way we ensured the efficient use of teacher hours was by encouraging student interaction by establishing student groups and requiring them to give peer-review on the assignments of each other. These options also require support from the LMS, which Canvas was, fortunately, able to provide with the right tools. Naturally, these tools can only be helpful if students are able to use them. Because of this, we created a dedicated module (Module 0) which provides guidelines on how to navigate through Canvas and use its options efficiently.

As a result of the efforts outlined above towards efficiency, we ensure that the teaching hours required for each iteration of the course did not exceed 500 hours.

#### 4. Course evaluation and statistics

Feedback is essential at any stage of the learning process, and course evaluation is a valuable method of feedback that contributes to course development. The course evaluation was in the form of self-report measures, where the students were asked to numerically rate their agreement regarding teaching and the quality of the course.

##### 4.1 Evaluation results

The evaluation has six sections as shown in Figure 2. The evaluation in the form of self-report measures and students are asked to give a rating based on Likert type items on a scale of 1-6; 1 (strongly disagree) to 6 (strongly agree).

No	section	Question	Average score
1	Self-assessment	I am satisfied with my efforts during the course.	4.3
2.1	Course aims and content	The intended learning outcomes of the course have been clear.	5.1
2.2		The contents of the course have helped me to achieve the intended learning outcomes of the course.	5.2
3.1	Quality of teaching	The teacher's input has supported my learning	5
3.2		The teaching and learning activities of theoretical nature have been rewarding.	4.9
3.3		The practical/creative teaching and learning activities of the course e.g., labs, field trips, teaching practice, placements/internships, project work, artwork, music, theater productions have been rewarding.	4.7
3.4		The technical support for communication, e.g., Learning platform, e-learning resources, has been satisfactory.	5
4	course materials	The materials assigned for the course, e.g., books, lab instructions, presentation frameworks, has supported my learning.	5.2
5	Examination	The examination was in accordance with the intended learning outcomes of the course	4.9
6.1	Overall assessment	The workload of the course is appropriate for the number of credits given.	5.2
6.2		My overall impression is that this has been a good course.	5.3

Fig.2. Students' self-assessment for H21 iteration of the course

##### 4.3 Course statistics

A key element in a distance learning course is the completion rate. We were able to increase the course completion rate, as shown in Figure 3.

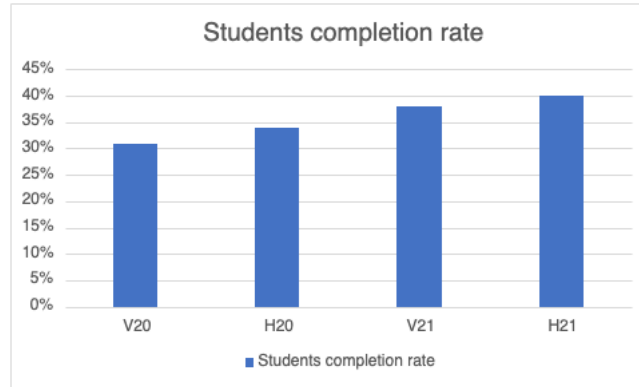


Fig.3. Students' completion rate

## 5. Conclusion

This paper summarizes methods for increasing the engagement level of students in distance learning, while keeping the amount of time needed for the educational staff on a low level. The key ingredients for increasing engagement were (i) modular content delivery with good overview presentations at the beginning (of the course and each module), (ii) enriching the content in our flipped e-learning environment, (iii) better prepared and more interactive live sessions, and (iv) assignments which motivate peer-interaction and optional paths for students with different interests. We were able to increase the successful completion rate of the participants by 10%, and improved students' feedback for the course by 50%.

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