

ELEMENTS OF AI - TEACHING THE BASICS OF AI TO EVERYONE IN SWEDEN

F. Heintz¹, T. Roos²

¹*Linköping University (SWEDEN)*

²*University of Helsinki (FINLAND)*

Abstract

The Elements of AI is a massive open online course on the basics of artificial intelligence (AI) aimed at the general public. It was first launched in Finland in 2018 and since 2019 the course has been offered in Sweden, in Swedish, with Linköping University as the academic partner. Over 32 000 people have signed up for the course in Sweden. One of the major challenges with the course is the scale. Large-scale open online courses are quite common, but university courses at this scale and with continuous admittance and examination are rare. This paper describes the course, how it was offered as an academic study unit with thousands of students running across semesters with continuous admittance and examinations, and the lessons learned.

Keywords: MOOCs, artificial intelligence, inclusion, higher education, lifelong learning, online education

1 INTRODUCTION

Massive open online courses (MOOCs) offer learning opportunities to students in educational institutions and lifelong learners alike [1, 2]. The COVID-19 pandemic has accelerated the growth of the demand for distance education. Between the years 2017 and 2020, the volume of massive open online courses (MOOCs) increased from about 9 400 courses with 81 million participants to about 16 300 courses with 180 million participants [13]. Contrary to the early hype brought on by the “Year of the MOOC” 2012, MOOCs have not wiped out traditional educational institutions or removed all barriers to quality education [4]. Nonetheless, the train has moved on and during the past decade, MOOCs have gradually become an essential part of the educational landscape.

The massive open online course (MOOC) Elements of AI developed by the University of Helsinki and the technology company Reaktor has been an international success story in educating first the Finnish and then the world population about the basics of AI. During the first three years (May 2018–May 2021), more than 680 000 people have started the course and more than 80 000 have finished it. The course has been translated to 25 languages. On Class Central¹, one of the most widely used MOOC rating platforms, Elements of AI is currently the highest rated computer science course (out of 3 911 courses) with an average rating of 4.8 on a 1–5 scale.

Sweden was the second country to adopt the course on a national scale in May 2019. Linköping University has been the academic partner and has offered university credits for the course. Since the launch more than 32 000 people have started the course, more than 6 000 have finished it and 3 000 have taken out university credits for the course.

2 ELEMENTS OF AI – THE OPEN ONLINE COURSE

Elements of AI gives a broad overview of AI to a general audience. Besides the very basic level technical underpinnings of AI technology, such as search-based problem solving, machine learning, and neural networks, the course also covers the main trends in the history of AI and some of the relevant philosophical notions.

The course goes one step beyond the buzzwords and snake-oil (see [8]) and provides concrete examples of AI techniques, their real-world applications, as well as their limitations and risks. One of the six chapters is dedicated to the societal impact and the ethics of AI.

The pedagogical approach is well captured by the EAST framework [12] – although the course was created already before this framework was proposed – that emphasizes the following factors:

¹ <https://www.classcentral.com/course/independent-elements-of-ai-12469>

Ease of getting started: All the material is openly accessible without registration, registration only requires a simple form that takes minimal effort to complete, and the course website is mobile friendly.

Attractiveness of the design: The style intentionally avoids the common AI tropes like brains imprinted on circuit boards, all-blue color palettes, and images of space (cf. [14])².

Social factors enabled by interaction such as peer reviews, a discussion forum, and shareable credentials.

Timeliness While the field of AI has existed since the 1950s, the course focuses especially on the more recent AI developments and applications like search engines and recommender systems whose impact on our everyday life is pervasive and tangible.

All decisions made during the course creation process were user-centered, see [5], based on interviews among interest groups, careful consideration of the end users, and pervasive use of methods of interaction design [11].

As opposed to most MOOCs where the primary means of presenting information is video (see [3]), the Elements of AI contains no video at all. We believe that while video may be a convenient and even entertaining medium, it has a number of drawbacks such as poor support for quick browsing and re-reading of the material at the learner's own pace. Another feature that is present throughout the course is humor, which can make the learning experience more personal and improve student retention and learning outcomes, as emphasized by Oakley and Sejnowski (2019) [9], the authors of massively popular *Learning How to Learn* MOOC.

Following the success in Finland, the course has been translated to all major language in the EU and is today available in more than 20 countries world-wide. Sweden was the first country after Finland to translate the course and make it available at a national scale.

3 ELEMENTS OF AI – THE UNIVERSITY COURSE

Linköping University has since fall 2019 provided a 2 ECTS credits course (also) called Elements of AI (*Grunderna i AI* in Swedish). The only course material in the course is the open online Elements of AI material. A person that has completed the online course can register for the course, upload their Elements of AI certificate, and do a validation test to get the university credits. It is also possible to first get admitted to the university course and then do the online course material. The course is given in both Swedish and English. The only difference is the language used for communication and validation. The language used in the university course and the language used in the online course material are independent, so any combination is possible.

The admittance is as far as possible continuous. There is no limit on the number of participants. Everyone who is eligible for university studies are accepted to the course. This basically means any high school degree or equivalent. Linköping University has three semesters: Fall, Spring and Summer. The normal application period usually ends about 4 months before the semester starts, then it is reopened for late admittance shortly before the semester starts. A course instance is open for late admittance until about a week before the end of the semester. This means that most of the year, there is an open course instance. All students are associated with the same page in the learning management system (which can be a bit confusing as the date does not necessarily match the course instance that the student is accepted to).

The examination, from the university perspective, is done in two steps. The first is to complete the online course material and the second is to upload the certificate and do a validation test on the university learning platform. The online course material consists of 25 questions covering all the course content. There are both multiple choice questions that are automatically corrected and free text questions that first goes through peer review (each question should be graded on a scale 1-5 by at least three students, and each student should grade at least three answers for each question) and then final decision (pass/fail) by a teacher. To get a certificate, a student needs to complete all questions with at least 50% correct answers. The validation test consists of six questions of the same character as in the online material, one for each of the six chapters. A new test is provided roughly every month. A student gets

² Stereotypical illustrations and stock photos can have damaging effects on the ability and willingness of the general public to understand the basics of AI and its relevance in their everyday life [7].

one attempt at each validation test and has to have at least 4 out of 6 points to pass course. Through the validation the university verifies the individual knowledge of the student as well as the identity of the student as the validation test is done after authentication.

Table 1: Overview of the number of students on the university course

Semester	# Registered	# Completed	% Completed
Fall 2019 (SWE)	2077	962	46
Fall 2019 (ENG)	60	15	25
Spring 2020 (SWE)	818	396	48
Spring 2020 (ENG)	308	165	54
Summer 2020 (SWE)	765	390	51
Summer 2020 (ENG)	306	162	53
Fall 2020 (SWE)	751	361	48
Fall 2020 (ENG)	242	123	51
TOTAL	5420	2606	48

Table 1 gives an overview of number of registered students for each instance of the course and how many passed it. As more than 300 students have finished the Spring 2021 course almost 3 000 students in total have received university credits for the course. There are many more students that signed up for the course but never registered for it. Unfortunately, that information is not kept by the university. Almost 50% of those registered on the course on the Linköping University system complete it, which is very good for a course like this.³

To manage a course with a few thousand students every semester most of the administration has been automated. Initially one faculty (the first author of this paper) worked about 10% with the course and one PhD student level course assistant worked about 60%. When the course was up and running, most of the day-to-day work was managed by three Master's level students working 20% each. Currently it is managed by one Master's level student working 20% with the course assistant supporting him (mainly by maintaining and improving the scripts that powers the reporting) and the faculty responsible for the examination and final reporting. An administrator has worked about 10% on the course to help with reporting grades and dealing with registration or reporting issues. The workload was much higher in the beginning before most of the administration was automated.

4 EVALUATION AND ANALYSIS

The potential benefits of MOOCs include student equity and social inclusion. The extent to which these goals are being reached varies greatly between different platforms and courses [6]. The Elements of AI has a very diverse set of students, as can be seen in Table 2 showing the demographics of the participants seeking university credits through Linköping University. The oldest is over 80 and the youngest has just finished high school (you need a high school degree to be admitted to the university course). We have had whole families taking the course and companies educating a significant part of their staff. More than 100 companies have for example pledged to take the course. This has been extra important during the pandemic when many people have had extra time for professional development.

Students complete the course completely on their own and in their own pace. It is therefore not possible to pass the course without active participation. The free text answers also require the students to formulate their own suggestions and answers on for example how they define AI. They will also need to read the answers provided by other students and reflect on whether these answers the question satisfactory. Finally, they will need to find other sources of information, such as a news article or similar, for one of the assignments and discuss its content. Taken together, it is clear that the course encourages active learning.

³ Not all users who sign up on the Swedish version of the course register to gain university credits. Among all users who registered on the Swedish version ($n = 33184$), the completion rate is 19.4%, while the global completion rate is 11.9%. These numbers are still relatively high compared to the average MOOC where the completion rates tend to be much lower; in a study covering all courses on the edX platform, Reich and Ruipérez-Valiente (2019) [10] report an average completion rate of 3.1% in 2017-2018.

Table 2: Overview of the % female and age statistics of the students on the university course

Semester	% Female	Min Age	Average Age	Max Age
Fall 2019 (SWE)	38%	18	35	83
Fall 2019 (ENG)	38%	20	33	53
Spring 2020 (SWE)	38%	19	34	68
Spring 2020 (ENG)	36%	20	34	65
Summer 2020 (SWE)	42%	19	29	76
Summer 2020 (ENG)	41%	19	29	59
Fall 2020 (SWE)	41%	18	33	79
Fall 2020 (ENG)	41%	18	33	68
TOTAL	39%	18	33	83

The course is 2 ECTS credits which corresponds to about 60 hours of work. Even without prior knowledge it should be possible to finish the course in this time. For many it most likely takes significantly less time. This is confirmed by the course evaluation where 74% agrees that the time corresponds to the amount of work needed, 18% thinks it takes less time, and only 2% that it takes more time.

The university course gets very good evaluations. For 2020, the average score was 4.4 (out of 5), which is very high. The course got 4.65 on the question whether the content provided what is needed to reach the course goals, 4.55 on the question of whether the examination was relevant for the course, and 4.54 on the question whether the content, organization and examination is in line with the course plan. It is clear that the course is highly appreciated and that the course design is aligned with the course goals (constructive alignment).

The most common feedback from the students is about the administrative parts of the course. It can be confusing to both have an online course and a university course, and that you need to actively validate your results to get the university credits (some believe that you will get them automatically if you complete the online course and are admitted to the university course). There is an ongoing dialogue with the developers of the online course to support authenticating using the Linköping University authentication server. If this was possible, then the extra validation could be avoided. To minimize the confusing the university course uses the term "course material" to refer to the online course.

Another common feedback is that the validation takes more time than completing the course material. A student needs to create at least three different accounts, one in the national university acceptance system, the Elements of AI platform and finally on the Linköping University system. They will have to use at least four different platforms: Elements of AI, antagning.se (national university acceptance system), Linköping University student portal, and Linköping University learning management system (LISAM). All in all, very many steps are required, even though each is small. There are also delays associated with many of the steps. The single biggest improvement would be to remove as many steps as possible from this process, however, except from using the Linköping University login for the online course, it is hard to see how this could be achieved.

5 CONCLUSIONS

The overall experience of setting up and running a really large-scale course has been very interesting and rewarding. The impact has been very high, with many companies asking their employees to take the course. We expect to see similar educational collaborations to proliferate in the future. According to Bates (2015) [1], "[p]erhaps the greatest value of MOOCs in the future will be for providing a means for tackling large global problems through community action." Our experiences with the Elements of AI provide ample support for this statement.

ACKNOWLEDGEMENTS

The Elements of AI initiative has been supported by the Finnish Ministry of Economic Affairs and Employment, the Finnish Ministry of Education and Culture (Projects DEFA and FMSEI), the Technology Industries of Finland Centennial Foundation, Svenska Kulturfonden, and the European Commission. Elements of AI in Sweden has been partially funded by a grant from the Swedish Innovation Agency VINNOVA and has been supported by Linköping University, AI Competence of Sweden, and AI Sweden.

REFERENCES

- [1] A. W. Bates. *Teaching in a Digital Age*. Tony Bates Associates Ltd, 2015.
- [2] M. Buhl and L. B. Andreassen. “Learning potentials and educational challenges of massive open online courses (MOOCs) in lifelong learning”. *International Review of Education*, 64:151–160, 2018.
- [3] B. B. de Koning, V. Hoogerheide, and J.-M. Boucheix. “Developments and trends in learning with instructional video”. *Computers in Human Behavior*, 89:395–398, 2018.
- [4] J. Haber. *MOOCs*. MIT Press, 2014.
- [5] Z. E. H. Kahraman. “Using user-centered design approach in course design”. *Procedia - Social and Behavioral Sciences*, 2(2):2071–2076, 2010.
- [6] S. R. Lambert. “Do MOOCs contribute to student equity and social inclusion? A systematic review 2014–18”. *Computers & Education*, 145:103693, 2020.
- [7] D. Leufer. “Why we need to bust some myths about AI”. *Patterns*, 1(7), 2020.
- [8] A. Narayanan. How to recognize AI snake oil, 2019. <https://www.cs.princeton.edu/~arvindn/talks/MIT-STS-AI-snakeoil.pdf>.
- [9] B. A. Oakley and T. J. Sejnowski. “What we learned from creating one of the world’s most popular MOOCs”. *Science of Learning*, 4, 2019.
- [10] J. Reich and J. A. Ruipérez-Valiente. “The MOOC pivot”. *Science*, 363(6423):130–131, 2019.
- [11] Y. Rogers, H. Sharp, and J. Preece. *Interaction Design: Beyond Human-Computer Interaction*. John Wiley & Sons, 2011.
- [12] O. Service, M. Hallsworth, D. Halpern, F. Algate, R. Gallagher, S. Nguyen, S. Ruda, M. Sanders, M. Pelenur, A. Gyani, H. Harper, J. Reinhard, and E. Kirkman. “EAST: Four simple ways to apply behavioural insights”. Behavioural Insights Team, 2019. URL https://www.behaviouralinsights.co.uk/wp-content/uploads/2015/07/BIT-Publication-EAST_FA_WEB.pdf.
- [13] D. Shah. By the numbers: MOOCs in 2020. Class Central, 2020. <https://www.classcentral.com/report/mooc-stats-2020/>.
- [14] B. Singler. “The AI creation meme: A case study of the new visibility of religion in artificial intelligence discourse”. *Religions*, 11(5):253, 2020.