Exploring the World of AI: Experiences from a MOOC on Artificial Intelligence for a Broad Audience

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***Abstract*—In this paper we report experiences from a Massive Open Online Course (MOOC) on AI literacy. The course aims to cater to a diverse audience including corporate learners, educators and the general public. It employs a pedagogical framework that emphasizes underlying ideas, playful and constructionist design, and interactivity and fosters engagement and community through discussion forums and hands-on activities. Despite common challenges in MOOCs such as high dropout rates and the need for more personalized learning experiences, the course achieves notable success in retention and learner satisfaction. Data from the course reveals low attrition rates and positive feedback, highlighting its effectiveness in bridging the gap between different learner groups and promoting comprehensive understanding of AI among a broad audience.**

I. Introduction

Technology is advancing rapidly, significantly impacting various aspects our daily lives. In particular, machine learning and artificial intelligence (AI) are having a profound impact on the digital systems we use, establishing these topics as critical areas of study in education and workforce training. Consequently, it is essential for everyone to acquire skills to critically assess and engage with AI. This demands the introduction of AI education, focusing on its core concepts and machine learning, from an early stage in schools [1]. However, this does not address those outside of school environments or those already in the workforce, highlighting the need for a broader and more inclusive approach bridging the gap between professionals and a broader audience.

Massive Open Online Courses (MOOCs) promise to address this need. MOOCs are a way to deliver distance education fostering self-regulated learning typically by providing a means for social interaction and freely accessible online learning resources such as videos on a given topic [2]. Their potential reach and scalability make them an ideal medium for addressing the needs in global AI education, as well as within university teaching [3].

However, MOOCs are not guaranteed to succeed in democratizing AI education [4]. Associated with MOOCs are issues such as high dropout rates [5], unequal access to the digital learning experience and a need for more personalized learning experiences are significant barriers to the effectiveness of such courses to reach a broad audience [6]. Addressing these issues will require creative solutions in how courses are designed, delivered, and supported to fully achieve their potential of promoting AI literacy for all.

In this paper, we report on experiences from a MOOC that serves as an introduction to the world of AI. To this end, we first provide background on MOOCs and describe common challenges within MOOCs in section II. Afterward, section III presents the context, structure and pedagogical design of our course. Section IV we share selected evaluation results. Based on these, we discuss lessons for the design of similar offerings for a broad audience and potential applications in higher education in section V.

II. Background and Related Work

MOOCs are a popular form of distance education that anyone can access. They are particularly popular in the field of artificial intelligence (AI), with a significant increase in the number of AI-related courses being offered on platforms like Coursera and Edx [7], [8].

MOOCs on artificial intelligence cater to a broad spectrum of learners, from beginners to advanced practitioners. While a number of these courses do target engineers and computer scientists, there are specialized courses for other professions, such as public administration professionals [9] and courses for a general audience. One notable MOOC for the latter domain is *Elements of AI*, which targets a large audience with the goal of increasing public understanding and demystifying AI [10]. The course exemplifies the trend towards comprehensive education on AI.

Completion rates for MOOC courses are generally not very high. Some courses such as Stanford's *Introduction to Artificial intelligence* or *Introduction to Machine Learning* have reported completion rates of 12,5%, others such as *Artificial Intelligence Planning* have completion rates of around 2% [11]. When bound with university credits, completion rates of the *Elements of AI* MOOC even reached 19% [12]. However, when not tied in with university credits completion

rate is estimated to be way lower. This is reflected in general completion rates of MOOC courses that is reported to be generally around 6.5% [11].

Accordingly, attrition rates are correspondingly high, often exceeding 60% [13], [14]. In the context of MOOCs, the attrition rate is often refereed to the percentage of users that showed engagement with the course beyond mere registration by having completed the first weeks content, but have not completed the course. All attrition rates in this and referenced work are calculated as $1 - \frac{\text{completion first quiz/test}}{\text{completion last quiz/test}}$.

A literature review by Khalil and Ebner (2014) [15] highlights multiple factors influencing MOOC completion rates. They found that time constraints emerge as a major barrier, with students struggling to balance course requirements with their schedules. Also, fluctuating motivations can affect completion. Feelings of isolation, caused by limited interaction and feedback, significantly impact student satisfaction and focus. Insufficient background knowledge and skills challenge students' ability to engage with course content, while hidden costs, such as the need to purchase textbooks. Dalipi et al. (2018) [16] came to similiar results, reporting that two main factors predict learner dropout in MOOCs: learner-related factors (e.g., lack of motivation, lack of time, insufficient background knowledge and skills) and MOOC-related factors such as course design, feelings of isolation, the lack of interactivity, and hidden cost.

In summary, MOOCs hold significant potential in particular for a topic such as AI. However, they frequently struggle to keep participants engaged. Appropriate pedagogical approaches are therefore essential to address this issue.

III. Structure & Design

In this section we describe the setting that the course is developed in, then outline the design principles derived from computing education principles, before we describe the specific structure of the course and how the principles are embedded.

A. Setting

Businesses have long discovered the role that MOOCs can play in scalable learning opportunities for their employees and partners. One of these corporate MOOC learning platforms is openSAP where free online courses about new technologies or products are offered to interested audiences. Additionally, it hosts general educational resources on topics such as programming or artificial intelligence as well as resources for corporate volunteers under a creative commons license. To create courses, openSAP cooperates with company internal or external experts of the desired field. Experts provide the knowledge and educational resources. They are supported by an SAP internal knowledge consultant e. g. with the structuring of resources, recording of videos in a video studio, preparation of questions, copy editing and uploading of course materials. The creation of a course happens in close collaboration over several months. From a technical perspective, it is based on openHPI [17].

Courses on the openSAP platform [18] follow the traditional xMOOC setup that is determined by a fixed duration, structured learning content accompanied by exercises and tests [3]. Each course is divided in several chapters called "weeks". During a course's active phase, which includes moderation and certificate issuance, a new chapter is released weekly. Each week consists of a number of units, which entail lecture-like videos, a self-test for immediate feedback of the understanding of the last topic and optional exercises. Additionally, the platform offers a discussion forum for each course that lets participants exchange about the course topic or ask questions to the course experts. The forum can also be used for additional exercises. During the active phase, participants can take part in a weekly assignment and a final exam assessing the comprehension of the content of a chapter or the whole course. A feedback form is accessible at the end to all registered users. Participants who gain more than 50 percent of the maximally available points in all exams get a "Record of Achievement". Participants who accessed more than 50 percent of all resources in the course obtain a "Confirmation of Participation". Both are available as downloadable PDF files and digital badges.

After the active period of a course ends, the forum becomes read-only, and posting is no longer possible. However, all materials remain accessible in a "self-paced" format, allowing both past participants and new learners to review the content at their convenience. While new learners can access the resources in self-paced mode, they are not eligible to receive a Record of Achievement.

B. Designing a MOOC on AI based upon computing education principles

While learner-related factors predicting learner dropout are to some degree beyond the control of the course design, MOOC-related factors such as course design, feelings of isolation, the lack of interactivity, and hidden cost can be addressed. To address these, we relied on the following pedagogical approaches borrowed from computing education for designing the MOOC:

- **Underlying ideas:** To accommodate learners with a diverse and maybe insufficient background knowledge, our approach prioritizes underlying concepts rather than focusing solely on specific implementations. This approach is oriented towards the underlying ideas and fundamental concepts, which helps deepen participants' comprehension regardless of their prior experience [19].
- **Foster communication:** We deliberately incorporated tasks that necessitate communication, aiming to mitigate feelings of isolation and maintain motivation through social interaction. This element is crucial for building a community within the course and enhancing the learning experience.
- **Interactivity first:** We paid great attention to interactivity through the use of applets and active learning strategies, such as prompting learners to pause videos and engage in hands-on activities that were made available either

as a digital experience, or that learners could also print and build themselves in the style of computer science unplugged activities [20], [21]. This method fosters engagement and deepens understanding by encouraging learners to apply concepts in practice.

- **Playful and constructionist design** Another aspect of our course design incorporates a playful and visual style including playable games to make learning more engaging and interactive [22]. Additionally, we apply a constructionist approach allowing learners to adapt their own projects, which has been shown to significantly boost motivation and learning effectiveness [23]

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C. Structure of the MOOC

”Exploring the world of AI” is a course offered in English and German, which is hosted on the openSAP platform. The course has been co-created in a collaborative effort by industry and academia. It is aimed at anyone interested in learning about the basic concepts of Artificial Intelligence (AI).

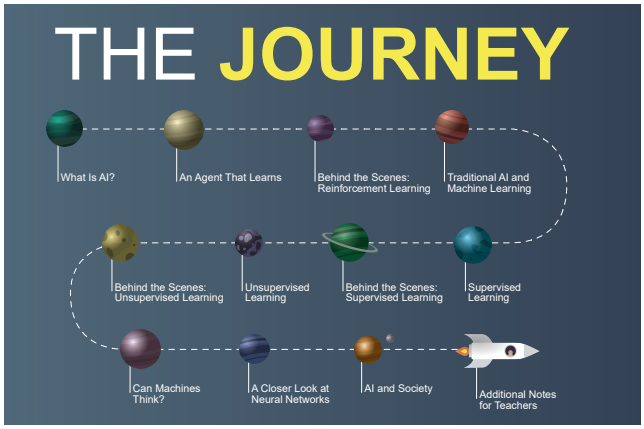

Fig. 1. MOOC structure, each planet represents a learning unit, each row represents a week.

The course is made out of 3 weeks each consisting of 4 units with an explanatory video (in total 3,2 hours in the German and 3 hours in the English version) a multiple choice self-test and an exercise. The course is outlined in figure 1. The first week starts with an introduction, distinguishes between machine learning (at the example of reinforcement learning) and knowledge-based approaches to AI. Week 2 addresses the other two machine learning approaches, namely supervised and unsupervised learning. In week 3, we engage in philosophical discussions, investigate neural networks in detail, and address social implications of AI.

We’ve designed our MOOC with the intention of creating a welcoming and inclusive learning environment that caters to a diverse audience. As openSAP is a platform where a lot of professionals seek to advance their skills in topics related to SAP products, our goal was also to bridge the gap between various groups, from curious beginners and teaching professionals to corporate learners. To this end, we have incorporated the pedagogical approaches outlined above as follows.

To highlight the **underlying ideas**, we intentionally selected easy-to-comprehend methods to explain the various ways computers learn and summarized these concepts in a clear info-graphic later. This approach allows us to concentrate on the bigger picture rather than getting distracted by details. By shifting the focus to such a more holistic perspective, learners are better able to grasp the overarching principles and their practical applications.

Fostering communication and exchange between the participants, some of the exercises ask them to specifically discuss their experiences in the course discussion forum. Week 1 unit 1 for example lets learners share their everyday life encounters with AI with the other participants. In order to make the discussion forum more welcoming, an introductory post was prepared and uploaded for each week motivating the learners and showing them where to post their questions.

In our course, **interactivity** is prioritized to enhance learning. For example learners are repeatedly encouraged to pause the instructional video and engage with an interactive applet or board game. This includes playing a mini-chess game designed to demonstrate principles of reinforcement learning, as illustrated in figure 2 as well as experiment with the weights of a neural network.

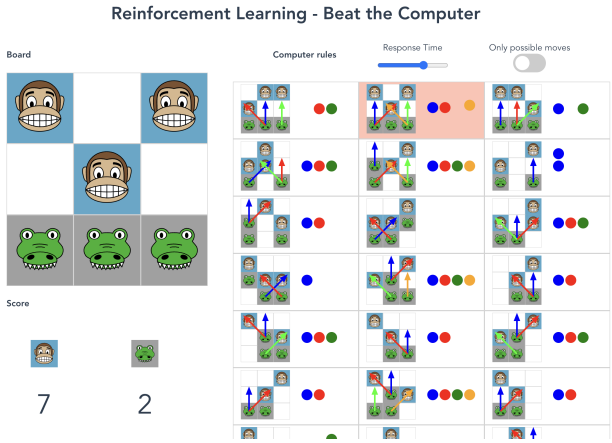

Fig. 2. Screenshot of the interactive mini chess applet for reinforcement learning

The course was chosen to follow a visually distinct style. For example, the idea of ”visiting planets” (see figure 1) was part of the playful design effort aiming to enhance the learning experience. To support a **constructionist approach**, exercises often contain hands-on activities like programming a reinforcement learning version of Pong in the block-based programming framework Snap*!* (week 1 unit 3, see figure 3). Afterwards, the learners are tasked to transfer these concepts to their own personally meaningful projects.

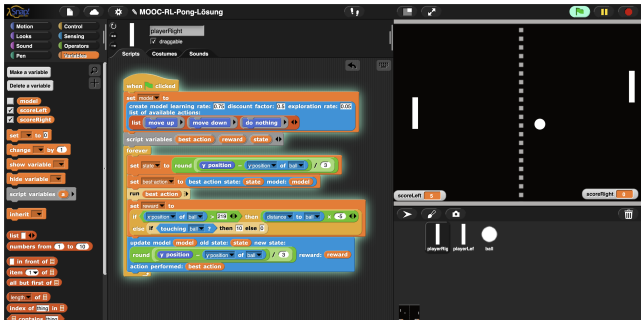

Fig. 3. Reinforcement learning programming exercises in the visual programming language Snap!

IV. Results

In the following, we present selected evaluation results for our MOOC. Our analysis is mainly based on the statistical and quantitative data by the openSAP system, as well as feedback from the participants. The feedback was gathered during the active phase of the course by using an "I like, I wish" framework along with rating various aspects of the course, such as overall satisfaction or applicability to their career using a four-point Likert scale at the conclusion of every week. In the self-paced mode, learners can not participate in the exams and the evaluation anymore, therefore, no information about the success of these participants is available.

Throughout the four-week run of the course, the German version saw an enrollment of 2,064 learners, while the English version attracted 8,902 participants. 25.9 % of the enrolled users in the German course did not have an openSAP account before starting the course and specifically registered to the openSAP platform to attend (9.4 % in the English version). Of those enrolled, 70% of learners in the German course actively engaged with the course materials, compared to 54% in the English version. This group of active participants is referred to as "attendees". The attendance rate of self-paced learners is 79.3 % in the German and 74.2 % in the English version of the course.

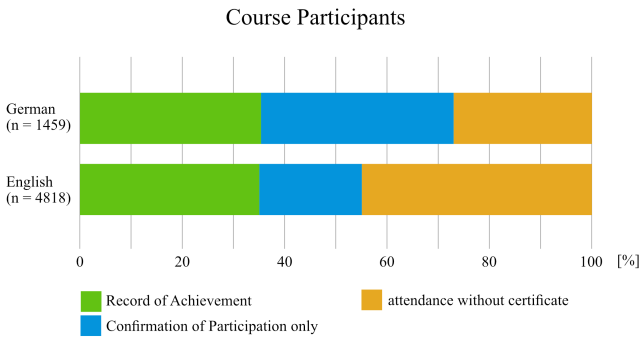

Fig. 4. Breakdown of learners by course achievement

Of the attendees, 35.4 % acquired a Record of Achievement in the German version, 35.0 % in English, respectively. A Confirmation of Participation without a Record of Achievement was accomplished by 37.6 % of the German attendees and by 20 % of the attendees in the English version (see figure 4).

The attrition rate – learners who participated in the weekly exam in the one week and dropped off in a later week – is 3.3 % over the whole course (18.8 % in the English version, see figure 5). The steepest drop off in both versions of the course is occurring from week 1 to week 2, 12 % in the German, 19 % in the English version respectively. In the two following weeks the dropout rate is lower than 2 % for both versions of the course. For the final exam, learners who seemed to have dropped out, returned, resulting in a negative attrition rate.

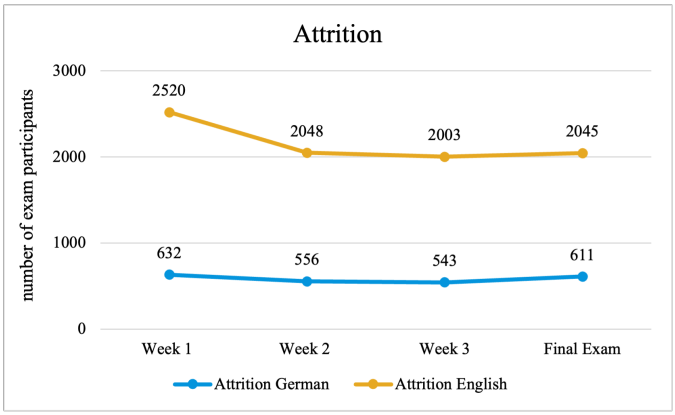

Fig. 5. Attrition rate over the four week duration of the course

On average, the learners who received a Record of Achievement spent 4.6 hours (4.1 hours in the English version) interacting with the learning resources, i.e. watching the videos, reading the additional material, participate in the assignments and tests, post and read in the forums.

40 % of learners read the discussion forum, 6 % even actively posted (35 % and 6 % in the English version). Although not mandatory for a successful course completion, the exercises that required learners to use the discussion forum to share their everyday experiences with AI received over 60 posts and replies (about 200 in the English version). Noticeably, learners returned to the forum and posted other applications of AI that they discovered later. Moreover, they discussed and interacted with each others answers. Learners also mentioned how the examples provided in the course helped them to understand and identify AI phenomena from their everyday life:

"[...] the examples were clear and easy to understand. Since it allows us to associate artificial intelligence with what we see on a daily basis."

The design principles of the course were perceived positively by the learners in the open " I like, I wish" feedback in the discussion forum. Multiple learners mentioned the short and precise videos and engaging examples as well as the interactivity:[1]

[1] Some quotes have been translated to English by the authors with minimal adjustments to improve comprehensibility.

"I liked that the course was pedagogically well thought through, well proportioned and with a rich variety of illustrative examples and exercises"
"[...] it explained all the concepts in a short time with very interactive examples"

The playful presentation of the course resources was valued by the learners: *"I work in a company that uses AI applications [...] Therefore, I had gotten in contact with different terminology, but was only able to understand them with your course. [...] Your playful but simultaneously precise and compact explanations let me understand the issue and I was able to share the exercises with friends :))"*

The responses also reveal that teachers within the audience were particularly fond of the plug-and-play resources provided, for instance:
"I'm looking forward to take up elements of this course in my lessons with my students"

Overall, the courses received a very positive feedback. Of the learners who filled out the course end evaluation, 99.43 % were very satisfied or satisfied with the course content and learning experience (97.72 % in the English version, see figure 6). Most participants found the course to be valuable for their future career (83.33 % in the German, 91.56 % in the English version). Both IT beginners and AI experts mentioned in the discussion forum that the resources were helpful to them, either to understand the topic better or to share their knowledge with others.

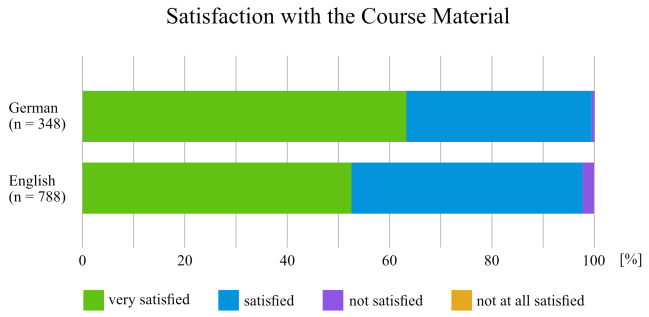

Fig. 6. Satisfaction with the course materials

V. Discussion

Data about the course was not collected with specific research in mind, however, the course statistics and feedback provide a valuable basis in order to get a feeling for understanding what aspects of the course were successful.

Both the English and German version of the course have a very low dropout rate compared to similar courses with a general educational aspiration. Especially in the German course, the combined attrition rate (3.3%) over all three weeks is very small. Retention in MOOCs is a significant concern with attrition rates from the first to the last quiz often being substantially higher (e.g. 48% [24], 61 % [13]), 82% [14], or 86% [25]). These statistics suggest that both versions of the course have been exceptionally effective in maintaining learner engagement and completion, outperforming typical MOOC retention figures and supporting the criteria proposed for the design of the course.

The videos in the German course are in total 3.2 hours long (3 hours in the English version). This means that on average each participant who earned a Record of Achievement spent an additional 84 minutes (65 minutes in the English course) working on self tests, assignments and forum discussions. This is however only the time spent on the openSAP platform. openSAP does not track the time while the app is running in the background or the tab is not actively selected. Since exercises in Snap! and with the interactive applets were conducted in other platforms, the actual time participants engaged with the course material might have been significantly longer.

The assumption that users spent a significant amount of the additional time in the discussion forum is also supported by the large ratio of learners who read and actively shared ideas or asked questions there. The results indicate that the weekly welcoming posts by the course instructors as well as the exercises encouraging forum posts contributed to the high forum engagement.

In general, both the German and English versions of the course received very positive feedback by the learners – especially for the engaging examples, playful design and interactive exercises. Although anyone registered for the course could provide feedback, it is assumed that the responses are biased towards those who remained engaged until the end."

The high rate of new registrations to the openSAP platform for the course indicates that non-traditional audiences outside of corporate learning were reached. This is also supported by the above-mentioned qualitative feedback of teachers from the discussion forums.

Moreover, in the course feedback survey as well as the qualitative forum feedback, users emphasized the usefulness of the learned concepts for their daily work independent of their previous knowledge of IT and computer science. Given that a lack of prior knowledge is a key barrier to MOOC completion as identified by [15], this in combination with the low dropout rates further affirm the course design's emphasis on foundational concepts that cater to a wide range of proficiency levels, offering beginners a framework for understanding new ideas and allowing experts to deepen their existing understanding through a broader conceptual lens. It also highlights how MOOCs can contribute to educate learners with different levels of expertise on cutting edge technologies on a large scale. Taking into account the high ratio of new users this also illustrates how MOOCs can and bring together and foster exchange between beginners and experts.

Due to the positive feedback, we have since adopted the course for training both pre-service and in-service teachers[2], who will teach AI as part of compulsory computing education. To do this, we have adopted a blended learning approach, using

[2]The results of these participants have not been included in the evaluation in section IV.

the course to teach the technical concepts and using the time in the classroom to derive teaching approaches and to facilitate discussion on the topics being covered [26].

VI. Conclusion

In this article, we presented experiences with a Massive Open Online Course on Artificial Intelligence, aiming to extract valuable insights for the design of similar digital literacy courses intended for wide audiences. Our findings show that both the English and German versions of the course achieved remarkably high completion rates in comparison to other courses with general educational goals. Notably, the attrition rate and the analysis of the time invested by participants who obtained a Record of Achievement indicates substantial engagement beyond the video content, particularly in self-tests, assignments, and forum discussions.

Feedback from learners was overwhelmingly positive, with particular appreciation for the courses' engaging examples focussing on underlying ideas and high interactivity that made the courses stand out from other MOOCs. This positive reception, alongside active participation in the forum and a significant number of new registrations on the openSAP platform, suggests that the course succeeded in reaching beyond traditional corporate learning audiences to include a diverse group of learners, including educators.

In conclusion, our investigation into this AI-themed MOOC demonstrates its success in engaging a broad audience, achieving high completion rates. The experiences from this MOOC can help guide the design of similar courses that bridge the gap between corporate learning and broader individual educational needs, emphasizing the importance of interactive content, active forum participation, and the inclusion of diverse learner groups.

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