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AI FOR LEADERSHIP: IMPLEMENTATION AND EVALUATION OF AN AI EDUCATIONAL PROGRAM

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ABSTRACT

AI education is rapidly becoming the next frontier when it comes to solving the world's grand challenges; however, ways to introduce AI to large complex organisations are still vastly understudied. To address this gap in 2021, Massachusetts Institute of Technology (MIT) entered into a collaboration with the US Air Force (USAF). The goal of this relationship is to develop, study, and evaluate different learning modalities and online/in-person experiences to introduce AI to the diverse USAF workforce. The USAF is a very complex organisation and its employees vary in terms of educational and cultural backgrounds, as well as in their work-related needs, demands and restrictions.

The initial program started in 2021 and a pilot study took place. The pilot evaluated the content, pedagogy, and educational technology used in 3 different learning journeys designed for 6 different learner profiles. Findings from 2021 guided improvements for future iterations. The updated iteration of the learning journey was introduced to the second cohort of the program in 2022. Cohort 2 included 200 USAF leaders, managers and decision makers, and the learning journey consisted of a combination of synchronous and asynchronous online experiences, as well as an in-person active learning component offered on campus to a subgroup of the learners. This research paper will introduce the updated iteration of the program, the evaluation of the learning journey, as well as the overall learner experience.

1 INTRODUCTION

As educational institutions are working towards understanding how to best educate the next generations of engineers and scientists in order to achieve the Sustainable Development Goals (SDGs), Artificial Intelligence (AI) is considered by many a tool that will considerably contribute to this goal [1,2]. Although AI will inevitably shape most professional sectors along with the ways most organisations will operate, potential impacts so far indicate both positive and negative expected impacts on sustainable development [3,4], making proper education for and about AI critical and relative to all academic fields.

Despite the rapid development at the AI forefront, education for and about AI, along with expected impact and ethical considerations, is still at a nascent stage and largely understudied. With the goal to better understand optimal ways regarding AI education, in 2021 the United States Air Force (USAF) and the Department of Defense (DoD) entered into a collaboration with multiple units within the Massachusetts Institute of Technology (MIT) to develop, pilot, and study a new academic program focusing on AI training. "Given the size and the diversity within the body of USAF employees, the goal of this collaboration is to design and implement an innovative program that will achieve maximum learning outcomes at scale for learners with diverse roles and educational backgrounds" [5] ranging from Air Force and Department of Defense (DoD) personnel to the general public.

2 AI EDUCATION PROGRAM DEVELOPMENT

2.1 Background

To start this new research program, the Joint Artificial Intelligence Center (JAIC) conducted a primary analysis of the US Air Force (USAF) personnel and created 6 learner profiles (also mentioned as “archetypes”), along with a list of desired AI related needs, skills and competencies for each one of them, and they are presented in great detail in the [6] JAIC report. In 2021, based on this information, a team that consisted of USAF representatives and MIT experts in AI and STEM Curriculum Development, developed 3 different 9 month-long learning journeys that were offered to the first learner cohort. This cohort included 3 different groups of learners: a) the Lead AI and Drive AI archetypes (L/D) - traditionally focusing more on management and leadership of the organisation, b) the Create AI and Embed AI (C/E) - being mostly technology developers and facilitators, and c) learners from Facilitate AI and Employ AI (F/E) - who are mainly AI technology end users [5]. The different learning journeys included a variety of courses and educational resources, offered through different learning modalities, representing content at different levels of difficulty. The various learning modalities included online asynchronous self-paced content, online asynchronous instructor-paced content, experimental online and in-person courses, along with participation in live online events with AI experts. A research team conducted a first pilot evaluation aiming to understand the learner perspective in regards to content, pedagogy, and technology used in the program, as well as the overall learner experience. To support the AI Education research program, a portal was also developed to support each learning journey and provide access to some of the content, but users often had to register to multiple platforms since courses were offered by different MIT teams. Details about program development, desired learning outcomes, implementation details, along with research findings from the first pilot evaluation are described in great detail in [5,7]

Feedback from the pilot study had highlighted some challenges regarding the long duration of the program, accessibility issues with the technology, occasional difficulty with the content, limited direct relevance of the content with the DoD daily operations and to real life application, and in some cases, learners mentioned that they wanted more real-life connections to experts/peers. Furthermore, additional feedback was provided by MIT experts, who were asked to review the curricula and perform a gap analysis, and by learning experts who offered pedagogical recommendations.

2.2 Second Iteration - Fall 2022

Based on feedback from the first pilot, the development team implemented several improvements on content, pedagogy, and technology and offered a new learning journey to a second cohort of 200 L/D learners in the Fall of 2022. This was a shorter, 3-months long, program. Figure 1 presents the second L/D learning journey.

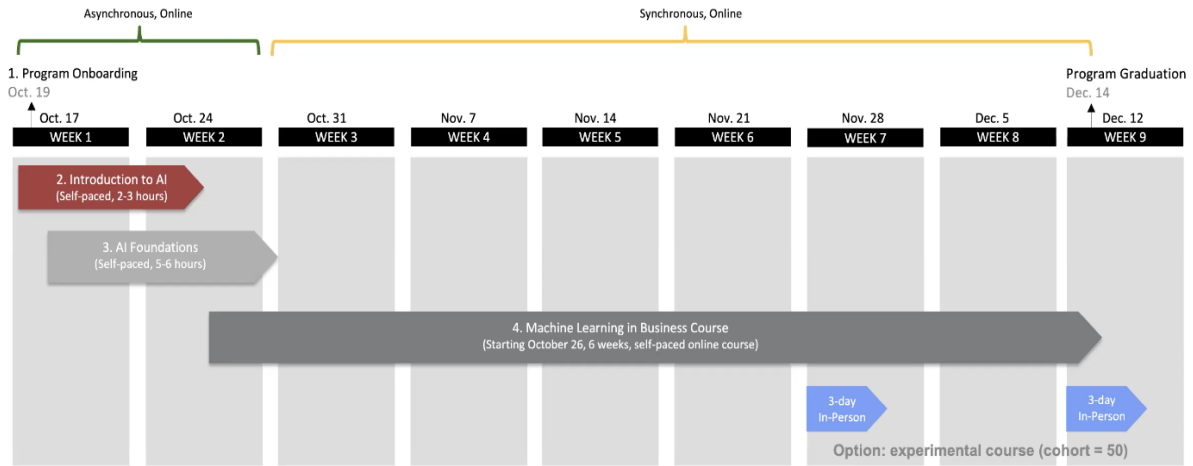


Fig. 1. Revised Lead/Drive Learning Journey - Fall 2022.

In the beginning of the program, all learners had access to two separate asynchronous self-paced courses, which involved reading content and watching videos: a) *Introduction to AI* (with content requiring 5-10 min per topic, and expected to be completely covered in 2-3 hours) and b) *AI Foundations* (with content requiring 10 minutes per topic, and expected to be fully covered in 5-6 hours). The cohort then had to follow the 8-weeks long, instructor paced, online *Machine Learning in Business* course. A small number of the learners were also selected (~40) by the USAF to visit the MIT campus and participated in the in-person hands-on intense 3-day long *Learning Machines: Computation, Ethics, and Policy workshop*, along with learners from other DoD offices (two workshops for ~20 learners each). Since this workshop included a new mixed group of learners, the research team decided to treat it as a separate class and performed a separate evaluation study.

Based on feedback from the pilot study, the following improvements, as presented in Table 1, were made to the *Introduction to AI* course and to the learning portal.

Table 1. Introduction to AI Course and AI Education Portal Improvements

| | |
|------------|--|
| Content | <ul style="list-style-type: none"> AI topic content updated. Added “Impact Spotlights” between different modules (mini case studies about how AI is being applied to solve real world challenges). Added “Technology Spotlights” between different modules (new content element within articles that calls out specific details about a technology and how it works). |
| Pedagogy | <ul style="list-style-type: none"> Added knowledge checks embedded throughout articles to support retrieval effect. Added “Impact spotlights” (mini case examples) to support learning reinforcement. |
| Technology | <ul style="list-style-type: none"> Improved portal homepage experience was added. Knowledge checks were embedded at the end of articles. New UI for impact spotlights was created. |

Similar to the first pilot program for the L/D archetypes, desired learning outcomes remain the same, namely learning about: foundational concepts, AI application, data management, responsible AI, AI delivery, and AI Enablement. In greater detail the second program iteration covered AI basics, how AI works, benefits and limitations, common misconceptions, recent developments, uses of AI in industry, case studies relevant to the USAF and DoD, the future of AI, and a primer in AI ethics.

3 METHODOLOGY

3.1 Data Collection and Analysis

All research material, instruments and procedures were approved by the MIT (COUHES) and Air Force (HRPO) IRB offices. All personnel received commander approval prior to their participation in the program’s research component.

The research team designed and delivered a pre-questionnaire (baseline assessment) and a final exit post-questionnaire offered to the 200 learners. The pre-questionnaire sought to understand learner demographics and educational level, as well as prior familiarity with AI related content, pedagogies that will be implemented during the program, and educational technology the learners will be asked to use. Furthermore, they had to answer questions about their own personal interest in AI. After completion of the program, the post-questionnaire asked learners to self-report their perception about the AI content, the pedagogies and technologies employed, and engagement and success regarding learning goals. For situations where participants were unable to complete a course, they were asked the reasons for dropping out. Additional questions about the program interest, relevance to work, and the overall learner experience were included as well. A total of 178 (89%) of the learners completed the pre-questionnaire, and 51 of them (25.5%) completed the post-questionnaire. Descriptive statistics were used to analyse the data.

4 RESULTS

4.1 Completion Rates

Table 2 presents the completion rates of the 3 courses offered to cohort 2. In this cohort 149 learners (83%) identified as male, 26 (14%) female, 1 (1%) transgender, and 3 (2%), prefer not to respond to this question. It should be noted that the pre-questionnaire showed that 142 learners (79%) had a Masters or PhD degree, with a great number coming from STEM schools.

Table 2. Completion rates

| | |
|---|---|
| <i>Introduction to AI & AI Fundamentals</i> | 183 (~92%) participants logged on to the platform at least once. 173 (~87%) active participants (read one or more articles). 121 (~61%) active participants completed all content (including videos). |
|---|---|

| | |
|--------------------------------------|---|
| <i>Machine Learning for Business</i> | 173 (~87%) active participants. 160 (80%) completion rate (read one or more of the articles). 160 (80%) got certificates. |
| Complete Learning Journey | 70% of active participants completed the entire journey (452,734 total learning minutes). Certificates: to those who completed 90%+ of the learning journey. |

4.2 Research Findings

Basic AI knowledge and familiarity with its uses and applications are core program learning outcomes, suggesting the competencies gained by learners. Upon completion of the program, as presented in Figure 2, 75% of the respondents (39 learners) expressed that they now feel above average familiarity with AI concepts.

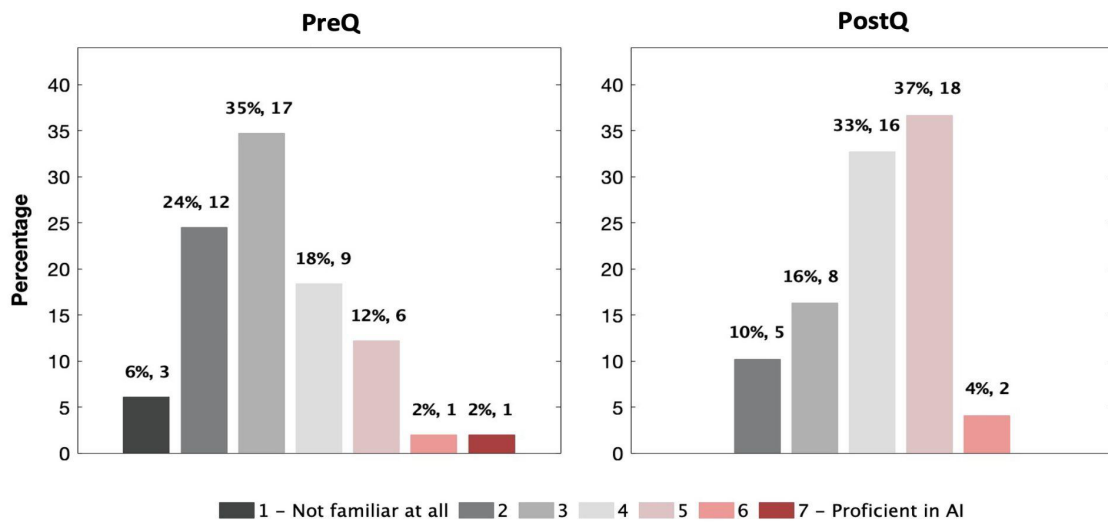


Fig. 2. Familiarity with AI: Comparative plots representing pre- and post-questionnaire responses (percentage, response count), respectively

Learners were also asked to discuss their overall experience with the program. As presented in Figure 3, 93% of respondents (47 learners) would recommend the program to a colleague. More specifically, they were asked to comment on whether they found the program interesting and relevant to their work. When discussing interest, as presented in Figure 4, 100% of the learners that responded to the post-questionnaire (51) found the program to be above average levels of interest with 81% (42) rating the program very high. When discussing the relevance of the program to the work of DoD (Figure 5), 87% (45) could see relevance, while 31% (16) found the program to be very relevant to their current work. From a pedagogical perspective, when asked to discuss the portal, 61% (31 learners) of the post-questionnaire respondents mentioned revisiting prior content on the portal throughout the duration of the program to refresh their memory. These first indicators suggest the program aligns with the learner training needs and the program goals.

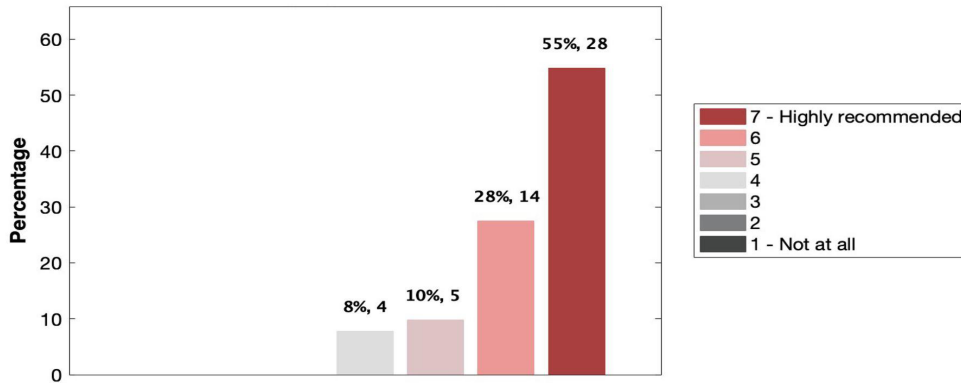


Fig. 3. Recommend program to a colleague

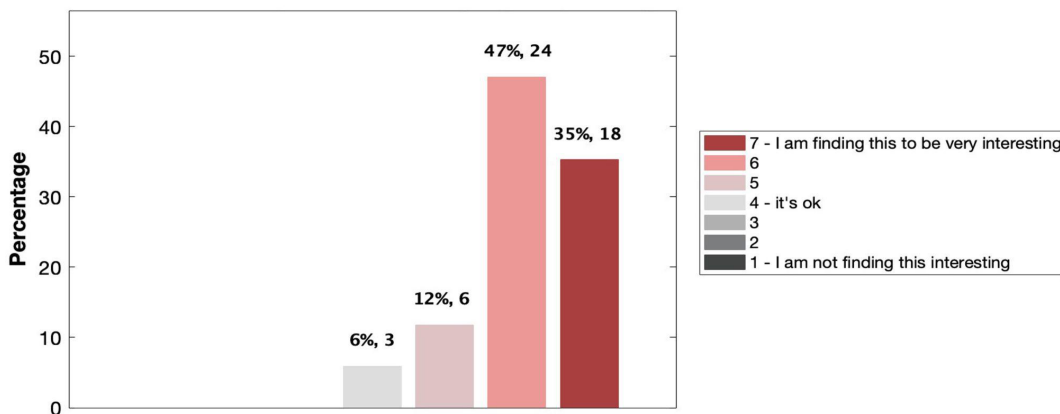


Fig. 4. Interest to the AI program

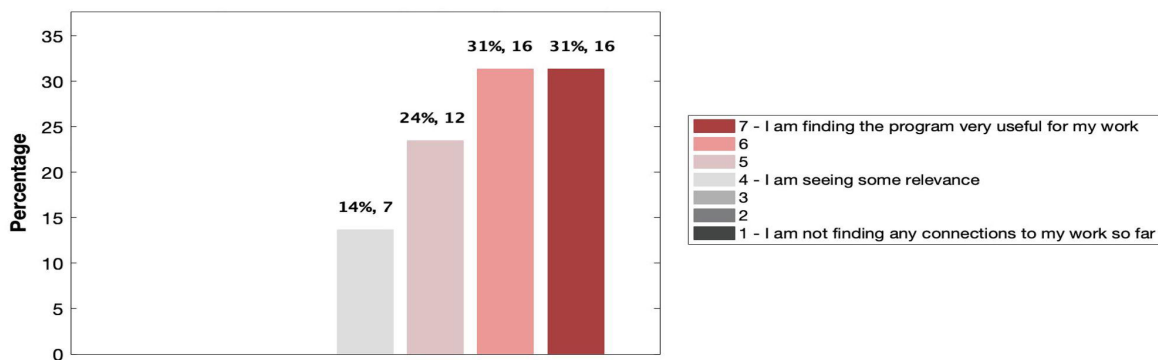


Fig. 5. Relevance to DoD work

5 FUTURE WORK

The development team is now experimenting with 2 different courses (one digital and one in-person) offered again to small groups of L/D participants. They are also preparing to experiment with an online, asynchronous, offering to a much larger cohort in the future to better study scaling to large numbers. In the meantime, the team is using feedback received from the first two cohorts to implement further improvements in regards to content, pedagogy and technology while the research team also plans to assess key AI-related ethical considerations, including safety, privacy, explainability, fairness, and externalities. Table 2 presents improvements

that are currently under development.

Table 2. Introduction to AI Course and AI Education Portal Future Improvements

| | |
|------------|--|
| Content | <ul style="list-style-type: none"> ● AI topic content updated to include Generative AI and other recent AI developments. Currently also exploring the intersection of digital tech (AI, big data, cloud etc) and sustainability. ● More Impact Spotlights - mini case studies about how AI is being applied to solve real world challenges. ● Reflection questions added to community forum sections. |
| Pedagogy | <ul style="list-style-type: none"> ● A knowledge check at the end of the journey rather than embedded to improve technical experience. ● Added “Impact spotlights” library (mini case examples) to support learning reinforcement. ● Addition of community forum sections per topic to promote peer-to-peer learning. |
| Technology | <ul style="list-style-type: none"> ● Improved portal homepage experience was added with a user profile. ● New, clearer, user interface for knowledge checks was created. ● New filterable tool for impact spotlights was created. ● Developed a forum functionality to support reflection questions and community engagement. |

Furthermore, based on learners’ feedback, improvement is now considered in four broader areas: accessibility, scalability, support, and implementation. Regarding accessibility, all content needs to become accessible through the whole military network (some resources are still getting blocked so learners have to access on personal devices at home). About scalability, more scalable active learning and hands-on activities are necessary. For better support online learning communities and additional staffing is considered. Last but not least, it is considered a good time for USAF leadership to start shifting from learning about AI to start investing in the adoption and implementation of ML/AI technologies at work. All the above topics will help us further measure and understand future impact.

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