Promoting Life-Long Learning Through Flexible Educational Format for Professionals Within AI, Design and Innovation Management

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Abstract. In recent years, the concept of lifelong learning has been emphasized in relation to higher education, with a bearing idea of the possibility for the individual for a continuous, self-motivated pursuit of gaining knowledge for both personal and professional reasons, provided by higher education institutions (HEI:s). But how can this actually be done in practice? In this paper we present an ongoing project called MAISTR, which is a collaboration between Swedish HEI:s and industry with the aim of providing a number of flexible courses within the subjects of Artificial intelligence (AI), Design, and Innovation management, for professionals. Our aim is to describe how the project is setup to create new learning opportunities, including the development process and co-creation with industry, the core structure and the pedagogical design. Furthermore, we would like to discuss both challenges and opportunities that come with this kind of project, as well as reflecting on early stage outcomes.

Keywords: Flexible education · Lifelong learning · Pedagogical design · Learning for professionals · AI education

1 Introduction

Contemporary higher education institutions (HEI:s) are undergoing change; some changes are incremental in nature, while others are a result of world events, most notably the covid-19 pandemic that swept over the world recently and forced universities globally to switch to digital and/or remote teaching almost overnight. In the public debate, much of the changes are due to the ongoing digitalization of society [e.g., 1–3]. Another change for HEI:s has to do with challenging the idea that students in higher education today are persons who come to higher education straight out of high school, complete an education program after a few years and then disappear into working life never to return. Rather, this change can be linked to the idea that HEI:s should offer continuous access to learning through all phases of life. One such phase is education aimed at people who have been professionally active for a longer period of time. In this paper, we present

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a substantial collaborative project between HEI:s and industry called MAISTR (Data Analytics and Service Innovation based on Artificial Intelligence) which aims to develop an educational concept consisting of a number of different courses with flexible format within limited fields of content aimed at professionals.

The involved HEI:s are Halmstad University, Skövde University, Blekinge Institute of Technology and RISE which are known for performing high quality AI research in collaboration with industry, as well as delivering campus-based education in the fields of AI, Design and Innovation management. These universities decided to develop content for lifelong learning directed towards professionals through the support from KK-foundations "Expertkompetens" program. The content that was proposed was a program consisting of 26 courses on advanced level in the fields of AI, Design and Innovation management with a flexible format that is suited for professionals. Developing the education in collaboration with industry is an expectation from the KK-foundation and the initiative is supported by about a dozen Swedish industrial partners from both the Swedish production industry as well as from the Swedish service industry.

In this paper we would like to address issues concerning the development of flexible formatted courses aimed at professionals and highlight the importance of these in relation to the concept of lifelong learning. Examples of issues we face in the project are about acquiring insight about competence needs from the companies, design of courses that achieve sufficient flexibility, and scalable examination. The MAISTR project provides a competence development framework for non-traditional students (i.e., working professionals) who would otherwise not be able to participate in higher education.

1.1 Learning Perspective

To be able to start talking about the framework of the courses included in the MAISTR project and the learning that is supposed to take place there, we need to start off by saying something about learning itself. Generally speaking, one pedagogical principle is that as a learning individual you have your own responsibility for your learning through your actions. This can be expressed in different ways; partly through the approach the individual has towards his or her own learning and whether there is an expectation of gaining knowledge or to generate knowledge, partly through the individual's participation in the learning situation and if this participation appears to be active or passive. A starting point that derives from this and is based on pedagogical research [e.g. 4], stems from the belief that learning is promoted by one's own activity rather than by passively listening to a lecturer. Researchers Lave and Wenger [5] discuss different kinds of participation; from peripheral to central participation, and that a person can be part of a context, that is to say participate, without he or she actually participating. It may be about being denied participation, but it can also be about choosing not to participate [5].

In addition, Lave and Wenger claim that learning is situated, i.e., takes place within the framework of a specific context and for a specific situation [5]. Based on this, most course elements in higher education should be about the students themselves 'deciding' or regulating their own learning based on their participation. Another angle of participatory learning is connected to an interactionist approach [e.g. 6] and has to do with learning taking place in interaction with others; it's in the interpersonal meeting in which development mainly takes place. From a sociocultural perspective on learning [e.g. 7, 8],

then you primarily focus on communication and language – which is absolutely the most important symbol within even symbolic interactionism [6] - and its social character [e.g. 8–10] as everyday action. This focus on dialogue and the importance of conversation in relation to learning - that we learn in interaction with others - can therefore not be emphasized enough [6]. The approach may seem obvious, but many institutionalized teaching contexts have traditionally focused rather on the individual's learning in relation to their own studies of literature (see for example [11]).

In the case of the current courses included in the project, they are primarily aimed at professionals in a few limited areas. This means that the students who are part of the project differ significantly from what could be called traditional students, in that they come from practical experience within professional practices. It is therefore of essence that they choose to actively participate in any educational endeavor, and in order to make it easier for them the format of courses offered in the MAISTR project are flexible. Coming from the experience of the working field, professionals develop so called "silent knowledge" within their practice [12]. This knowledge can be described vaguely as in "one's spine" and is usually brought to the fore in relation to professions such as nurses and craftsmanship, but professionals in all occupations more or less develop some sort of silent knowledge in their field. This knowledge, alongside the work experience, are crucial elements that professionals bring with them into an educational context. The idea, thus, is that the experience of the practice adds value for the student in the learning situation, which leads to a greater enhancement for the professional skills acquired.

2 Related Work

2.1 Flexible Education and Flexible Learning

Flexible education usually means that the education is available to students in for example adaptations in both time and space, but also in terms of the teaching mode or format. Closely connected to flexible education is the concept of flexible learning. Flexible learning is usually defined as concerning approaches to teaching and learning that are learner centered as well as the use of appropriate technologies in a networked environment [e.g., 13, 14]. Furthermore, flexible learning is more or less "free" regarding time, place and methods of learning and teaching. Flexible learning has been used within diverse areas such as learning environment [e.g., 15, 16], emergent frameworks for new learning opportunities [e.g., 17, 18], as well as teachers' adaptations to digital teaching [e.g., 19]. The term is commonly used as a means to describe changed classroom conditions [e.g., 20, 21] moving from physical to digital classroom with different options for students in terms of pace of studies. Basically, the term flexible learning describes a learning design perspective deeply rooted in the perceived needs of students, with the main objective being to provide them with the most flexibility about the learning content, schedules, access, and learning styles as possible. A flexible learning design customizes learning environments to meet the needs of learners, using both technological and non-technological tools and it includes an approach to learning in which the time, place, and pace of learning may be determined by learners [22]. The term most often includes varieties of learning such as blended learning, flipped learning, m-Learning (mobile), networked learning and digital learning [e.g., 23]. It is often incorrectly used

in an interchangeable manner with other terms such as open learning, distance learning, work-based learning, as well as e-learning, which are all instances or forms of flexible learning in that they provide flexibility to the student in terms of time/pace, place, access, content, and/or delivery mode [24]. The term is broadly used in descriptions of programs and courses delivery and design, in such a way as to cater for student demands for variety, access, recognition of diverse learning styles, and student control over the learning experience [24].

In addition, flexible learning is also a teaching strategy designed to empower students to learn in various ways. While working with and preparing for flexible learning and flexible education, there are many aspects to consider: content, time, space, learning styles, methods, requirements, organization and infrastructure. All these aspects are vital for the success of education [22]. The benefits for the students involved in flexible learning can be multiple: improved learning outcomes resulting from evidence-based and technology-enabled teaching methods [e.g., 25]; more choice in different kinds of learning (online, face-to-face, blended, MOOC:s, etc.); flexible learning delivers more scheduling options (e.g., day/night, on-/off-campus); enhanced personalization of degree programs; more just-in time learning options for career learners; improved learning experiences including more experiential and community-based learning options; more global learning options; more open content - learning materials are often free and not restricted to students registered in a degree program [26].

In the case of the MAISTR program flexibility looks as follows. At a program level, while there are recommendations for the order courses are taken (Fig. 1), the students may freely choose which courses to take and in the order they prefer. This freedom of choice is in line with the view that learning is situated and that the experience, motivation and wants of the students should inform learning objectives and activities. By allowing professionals to actively choose the courses in any order and from any track they deem relevant, MAISTR's flexibility provides a low-risk opportunity for them to expand their knowledge and comfort zones. To nudge such cross-coupling, mixing between courses in different tracks is not only feasible but encouraged.

2.2 Life-Long Learning

A concept that works well together with a flexible approach to education is life-long learning. There is no formal or final definition of the term life-long learning rather many co-existing definitions [e.g., 27], but generally the meaning concerns learning that is taking place outside a formal institution (such as a school). UNESCO has a broader definition of the term and describes life-long learning as follows: "All learning activities undertaken throughout life, with the aim of improving knowledge, skills and/or qualifications for personal, social and/or professional reasons" [28]. This definition implies that life-long learning also includes the opportunity to learn throughout the different stages in life, in both formal and informal contexts. Moreover, it implies that life-long learning is self-initiated in such a way that it is the individual's own choice and personal drive for personal development that is the basis for learning. In 2015, UNESCO released the book *The Role of Higher Education in Promoting Lifelong Learning*, in which the authors are advocating for the practical implementation of lifelong learning in higher education, both within their own regional context and globally, and they are pointing

out that life-long learning has been emphasized in relation to higher education more frequently in recent years [29]. Lessons learned from a Swedish national perspective on life-long learning in AI-education have been summarized in [30], which includes the importance of adapted learning formats and the specific challenges associated with adult learning in the AI field (e.g., the need to be able to do simple programming). The MAISTR programme is part of the Swedish national initiatives in life-long learning and aims to evaluate how different approaches to teaching in this context can be done in an efficient way, for both the professionals and for the university. Evaluation will be carried out by using different methods, such as standardized questionnaires for course evaluation as well as follow-up interviews with participants, industry partners and instructors.

3 The MAISTR Program Setup

3.1 Background

The program has three tracks: Machine learning (ML), Human-centered design (HCD) and Innovation management (IM). The courses are defined as free-standing so students do not apply to a program. Instead, there is a specific website (link) developed in the project where the courses are presented along with a link for each course to the national admission system. This allows the students to pick any combination and order of courses they like, as long as they fulfill the prerequisites of a specific course. The three tracks are balanced in terms of number of courses, ten in the ML track, nine in the HCD track, and seven in the IM track, see Fig. 1.

The course offerings in the MAISTR program vary in terms of instruction modality, length of study, instruction frequency, and examination styles. All of the courses are given online at a pace of approximately 20% full-time studies, with real-time instruction ranging from weekly to monthly. Some courses are completely self-paced with a reading guide that students can follow at their leisure during the course term, while others offer students the possibility to meet in person and participate in physical-digital hybrid discussions. Technical courses can run over a longer period than others to give students the opportunity to complete practical coding exercises and project work. Examination types vary from rating assignment completion to final projects and oral examinations. This variability of course characteristics ensures that the instruction method is accommodating to the subject area as well as the prospective student groups.

3.2 Courses and Tracks

Machine Learning Track: Machine Learning (ML) is a subfield of artificial intelligence that gives machines the ability to learn and improve automatically through experience and by the use of data. It has become a significant competitive differentiator for many companies, and we all probably use it several times throughout our day without knowing it. The machine learning track consists of courses related to topics such as learning algorithms, data mining and statistics with applications to domains like healthcare and predictive maintenance of vehicles. The courses assume some prerequisite knowledge of python programming and equip the student with both theoretical knowledge and practical skills to apply the latest state-of-art techniques in machine learning.

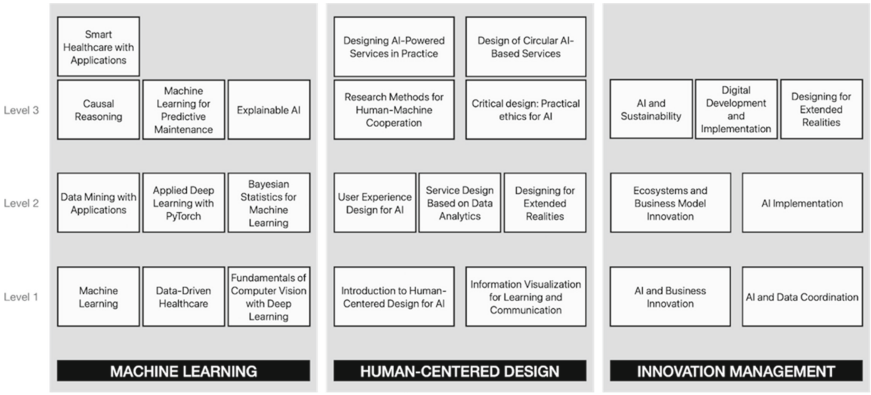

Fig. 1. Track and course disposition in the MAISTR program.

Human-Centered Design Track: As AI-powered functionality in digital services increases in availability, the need for thoughtful interaction and service design increases as well. However, in order to create valuable and usable AI-powered services, designers have to make sure that they understand who the service is for, how it creates value, and how it affects existing workflows and business offerings. Translating AI technology into real-world socio-technical systems is the domain of human-centered design [31]. The Human-Centered Design track consists of courses related to design thinking, service innovation, UX design, research methods and information visualization. All courses are built from an AI-first perspective, which means that various kinds of AI are seen as a new "design material" for designers, and that methods and approaches are taking AI-specific features into consideration.

IM Track: Data is intermittently seen by practitioners, business and other organizations as 'the new oil', with AI–and particularly ML–acting as "refineries" that produce rapid and cheap prediction machines; the capacity to destroy and create new jobs, business opportunities and professions; but also as being terribly overhyped. The IM track addresses all of these aspects by focusing on the management of AI-oriented innovation processes, structures, and resources by explaining and reflecting upon what is new with AI. Participants have heterogeneous backgrounds, ranging from data science, nursing, engineering, and business studies, and covering any type of industry or public sector. All courses are based on blended learning, with a combination of pre-recorded lectures, online group discussions, and situated learning-oriented assignments.

3.3 Example Pedagogical Design and Learning Approaches

As previously stated, MAISTR consists of over two dozen courses given at the master's level. For the purposes of this paper, we use the case of human-centered design as an example of how MAISTR courses combine flexibility and life-long learning into the program.

The HCD track (Fig. 1, center column) starts with a self-paced introductory course called Introduction to human-centered AI. The resources consist of academic journal and conference papers, podcast episodes [cf. 32] as well as some industry reports related to AI and human-centered service design. The course consists of three parts: The first part consists of an overview of the field of human-centered design. The purpose of this part is to provide a common vocabulary and understanding of central concepts that students will be exposed to during the rest of the introduction course and upcoming courses in the track. The second part introduces artificial intelligence on a level that is suitable for professional designers. In the third and final part of the course, students try to synthesize human-centered design with artificial intelligence. This three-stage introduction equips them to take on the upcoming courses in the HCD track. The course's three parts are examined by three written assignments. There is also one peer critique module as part of the second assignment. The critique module provides an opportunity for social interaction and consists of reading another student's submitted assignment and writing a rebuttal.

Later in the HCD track, students can take the Service Design based on Data Analytics course. It is a three-credit course where the focus lies on using data analytics and machine learning for service design. The course allows the students to expand from user experience and interaction design to strategic and holistic service experiences. The course consists of a series of invited lectures from industry. All video lectures are recorded so that students can consume the content at different times. Since the course has been given several times, there are several video recorded case studies that can be reused in future courses. There are also traditional video lectures that are given live digitally and recorded for students that do not have the possibility to attend the live sessions. Apart from traditional readings, the course makes use of selected episodes from a podcast-based course called Human-Centered Machine Learning [32]. Podcast episodes are also examples of readily available resources that can be reused and accessed "life-long" and in a flexible manner.

4 Current and Expected Outcomes

The MAISTR project has defined a number of different kinds of impact that should be achieved by the program for both students, companies and universities. This is related to aspects such as increased ability and skills in AI, increased opportunities for flexible learning, strengthened relations between companies and universities, increased employer branding, etc. We are considering several ways to measure the level of impact, including the formulation of additional questions in the final course evaluation, as well as having interviews with company staff and managers to get testimonials.

4.1 The Student Perspective

As of September 2022, eight courses have been given in the program (three in ML, three in HCD and two in IM) and course evaluations indicate a general success and high appreciation of both content and format. Standard course evaluations from the

students have been carried out at the end of each course. In particular, self-paced reading-based courses–such as those described in Sect. 3.3–have been favored by the course participants.

Participants in the course evaluations voice the importance of flexibility, and the advantage of being able to access resources in flexible formats, such as reading PDF files on any kind of device, listen to podcasts via existing platforms, or being able to run the written content through a text-to-speech service to consume the content via audio. Through course evaluation responses and dialogues with instructors, some MAISTR students have indicated that they would not have otherwise been able to participate in such continued education programs.

4.2 The Industry Partner Perspective

The MAISTR leadership group meets regularly with industry partners to present the status of the program, course evaluations, and strategic plans. Industry partners provide feedback on how the content of the courses are aligned with general competence development needs that exist in the labor market. Similar to students themselves, project leaders and supervisors may also notice improvements in performance indicators that after a colleague took a MAISTR course. Long-term follow-ups with industry partners are necessary to evaluate any effects on workplace impact.

Time is a big challenge for professionals taking courses while working. Professionals may not be able to take time off from work to pursue higher education, and employers do not want to lose productive hours on their skilled staff. Self-paced content and long course duration are two qualities that are appreciated by the students and employers alike, based on the initial course evaluations.

4.3 The HEI Perspective

Course evaluations have identified a risk for lack of interaction (both student-student and student-teacher) due to the high degree of self-paced content. As a whole, the program is a mix of approaches, where flexibility differs between courses. This makes the program different from completely self-paced online courses where there is no teacher interaction at all and teaching is limited to pre-recorded videos.

HEIs need not develop full education programs and compete with other institutions. The MAISTR project gives partnering HEIs the ability to develop stand-alone courses in line with their respective profiled areas, potentially easing in staffing and other resource management concerns. Students benefit from being able to take a cohesive set of stand-alone courses across multiple HEIs in ML, HCD and IM, without needing to compromise for a generalized program given by one university.

4.4 Future Plans

At present, the MAISTR project has not yet run its full 26-course curriculum. As more information is gathered from course evaluations, follow-up interviews and workshops with industry partners, we will be able to formally evaluate whether the design (and

subsequent adjustments) of the MAISTR project and its courses are meeting the expected outcomes from each stakeholder's perspective.

Participants have expressed some worry that they are "alone" in their new competency development after having completed a course. A significant challenge consists of actually changing work practice in the home organization after finishing the course. A critical mass of team members needs the new knowledge, as one person cannot change work practices on his or her own. This implies that we should encourage several team members from the same division or organization to participate. One way to approach this is to modify some courses to be (a) domain-specific, and/or (b) be designed for team participation. To this end, we are planning to deliver at least one course in conjunction with a real industrial project (more specifically, the course "Designing AI-powered services in practice") where we aim to test a project course concept where practical training and mentorship from the teachers are combined with work at a company to support the professionals' learning and future dissemination in the home organization.

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