

“ai4health” - Development and Conception of a Learning Programme in Higher and Continuing Education on the Fundamentals, Applications and Perspectives of AI in Healthcare

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Abstract. AI applications play an increasingly important role in all areas of healthcare. Therefore, a basic understanding of AI technology for health professionals seems necessary. However, to date there is no learning programme in Germany that includes technological basics, applications, and perspectives of AI in healthcare for interdisciplinary health professions. The *ai4health* project investigates which basic knowledge and competences health professionals need to acquire for an informed handling of AI applications in healthcare, and what the appropriate didactic approach is. Through the qualitative research by interviews and a workshop, six relevant areas of competences were identified. The two most important areas are ELSA and relevant AI applications. Explainability was also highlighted as an important point. The implementation of the topics in a blended learning course for interdisciplinary health professionals and educators in the healthcare sector is now planned.

Keywords. Artificial Intelligence, continuing education, higher education, course development, education and training, future skills, health professionals

1. Introduction

The use of artificial intelligence (AI) entails far-reaching changes in future healthcare. The acquisition of basic AI skills for health professionals therefore seems necessary for the informed handling of AI applications [1,2]. In Germany there exist some AI courses for physician training [3], but to date there are no courses aimed at other health professionals such as nurses, therapists, or administrative staff. A nationally accessible learning programme encompassing the technological basics, applications, and perspectives of AI in healthcare is therefore still missing in Germany.

The project *ai4health* develops a learning programme of this kind. This course is aimed at three target groups: executives in the healthcare sector, health professionals in patient care and administration, as well as teaching staff in the respective fields. The course can be used in line with continuing education for health professionals as well as

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courses in the corresponding study programmes. The blended learning format includes a MOOC (Massive Open Online Course), SPOC (Small Private Online Course), and attendance phases. The MOOC is hosted on the e-learning platform *AI Campus* (www.ki-campus.org), which offers various learning opportunities for topics around AI. At the same time, teaching materials licensed as OER (open educational resources) are selected or newly created and made available for teaching staff to be used in the SPOC and attendance phase.

To meet the requirements of the interdisciplinary target groups of the course, relevant areas of competence had to be identified. For this purpose, the following research question was investigated: What are the relevant topics and areas of competence health professionals need to acquire to be able to understand the basics, applications and perspectives of AI in healthcare, and how should the knowledge be conveyed?

2. Methods

To investigate the research question, qualitative expert interviews and a workshop with university educators were conducted. Before the interviews and workshop, the *ai4health*-team used literature (e.g. [1,4,5]) as well as media content such as public panel discussions on AI and healthcare (e.g. [6]) to select preliminary topics and subtopics for the course. The selected main topics are: Fundamentals of AI; the role of data; AI applications in healthcare; perspectives of different professional groups; ELSA (ethical, legal, and social aspects); prospects of AI in healthcare. The team created a digital conceptual map containing all topics and subtopics.

Individual interviews were conducted with three students from the following areas: management in healthcare, teaching at vocational schools (health sciences), and nursing management. Subsequently, seven individual interviews and three focus group interviews were conducted with experts from the fields of computer science, health informatics, medicine, law, cognitive science, and speech therapy. In addition, a workshop (n= 10) was held with experts from the fields of nursing and midwifery science. All participants were active in a scientific context or students at one of the two Osnabrück universities.

For the interviews, the experts had received an introduction of the course concept and the digital conceptual map ahead of time, so they were able to get familiar with it and start collecting thoughts on a digital board. The interviews were started off with a reiteration of the concept and preliminary course contents. Then, the experts were asked to discuss the key questions from the point of view of their expertise. During the interview, successive extensions and modifications were made to the conceptual map. The interviews followed a semi-standardized guide that included questions about the thematic content of the programme as well as the didactic implementation. The key questions were further specified depending on the expertise of the interview participants. The following key questions are examples from the guide:

- *Which AI competences do you consider crucial for health professionals?*
- *Do you know of AI applications in your field that are particularly interesting?*
- *How do you rate the relevance of the suggested topics? Do you think there are redundancies or missing topics?*
- *What could be a suitable didactic concept for the implementation of the course and individual course contents?*

In the workshop, the *ai4health*-team introduced the course concept and main topics to the participants. The attendees were split into three groups in which they discussed the following questions amongst each other with guidance from the *ai4health*-team:

- *What chances and risks do you see regarding the use of AI in healthcare?*
- *What are specific topics, questions, or applications that should be included in the course?*
- *What should be the weighting of the topics overall – i.e., should the focus lie on technological basics, data, applications, or ELSA?*

The interviews and workshop took place between mid-July and mid-September 2021. While the interviews were conducted online, the workshop took place on site. All interviews and workshop lasted an average of one hour. Essential verbal content was simultaneously transcribed or documented by transcript.

The evaluation of the interviews is based on a qualitative content analysis [7] using a deductive category system that originates from literature on healthcare and AI. The categorization was carried out by two scientists who made an assignment independently of each other, also to ensure intersubjective traceability. Inconsistencies in categorization were resolved by consensus.

3. Results

The deductive category system in the form of competence areas and topics was validated and partly supplemented inductively. Different competence requirements and topics were highlighted from the experts. The identified areas and subcategories are presented below (see Table 1):

Table 1. Areas of competence and topics for the learning programme "ai4health".

1.	Basics of AI	1.1.	Demarcation and definition of central concepts
		1.2.	Symbolic and subsymbolic methods of AI
		1.3.	Explainable AI
		1.4.	Use cases and underlying AI concepts
	Expected learning outcomes: The participants are able to name basic terms, AI-based procedures and concepts.		
2.	Data management	2.1	Quality of data for big data, AI research and applications
		2.2	Basic concepts of data protection and data security
	Expected learning outcomes: The participants are able to recognize the relevance of data quality for AI processes and know the basic characteristics of data protection and data security in AI applications.		
3.	Applications of AI	3.1.	Health promotion and prevention
		3.2.	Diagnostics and treatment
		3.3.	Research
		3.4.	Care/Nursing
		3.5.	Administration and management of healthcare facilities
		3.6.	Education and training of health professionals
	Expected learning outcomes: The participants are familiar with exemplary AI applications in different areas relevant to health care.		
4.	Profession-specific perspectives	4.1.	Case studies for different professional groups
		4.2.	Role of people / changes in the professional field
	Expected learning outcomes: The participants can explain the potential importance of AI applications for different professions and their possible implications for occupational fields.		
5.	Ethical, legal and social aspects	5.1.	Ethical and social implications
		5.2.	Legal aspects
		5.3.	AI in public discourse

Expected learning outcomes: The participants are able to deal with possible ethical, legal and social aspects of AI usage in healthcare.			
6.	Future Prospects	6.1.	Current research and technological developments
		6.2.	Incentives, impact and adoption in the healthcare system
		6.3.	Future competence requirements for health professionals
Expected learning outcomes: The participants can estimate future developments in AI research, technology, and competence requirements. Furthermore, they know basic requirements for the implementation of AI applications in the health sector.			

The experts pointed out that there is no necessity for in-depth knowledge of AI technology or programming, but a necessity for intrapersonal and interpersonal competences. One important intrapersonal competence is the professionals’ ability to explain technological knowledge "formula-free" to patients if treatment involves AI applications. Regarding interpersonal competences, the need for interdisciplinary cooperation and a "common language" was highlighted. Didactically, the course should focus on conveying a basic understanding of AI methods by means of exemplary AI applications from the participants’ occupational area. Not only does this strengthen the participants’ interest in the topic, but it also enables them to assess and evaluate AI applications in their professional life. Furthermore, it dissolves the so-called “black box” of AI especially in medical decision support, and therefore contributes to explainable AI.

In the workshop, “AI applications in healthcare” was deemed the most important topic, followed by ELSA and the AI fundamentals. In concordance with the interviews, attendees of the workshop emphasized that fundamentals (e.g., knowing what makes an algorithm “intelligent”), as well as being able to evaluate AI applications and discussing ethical, legal, and social aspect is more important than knowing technological details. Nevertheless, a basic technological knowledge of AI methods is considered necessary. The workshop participants also highlighted the need for skills to explain AI applications to patients as well as the importance of knowing legal aspects (e.g., who owns the data). In addition to a variety of risks (e.g., data misuse), the participants also saw the benefits of AI applications such as work support or help with personnel deployment planning. Overall, all workshop participants agreed that AI competences are necessary

The results of the qualitative research are now used to develop and test the course and its teaching materials.

4. Discussion

The qualitative research has shown that intrapersonal and interpersonal AI competences should be conveyed in a manner that is user-oriented and closely related to the participants’ professional life. This can be achieved by explaining AI methods using exemplary applications from the participants’ occupational area. Another focus must be put on ethical, legal, and social aspects.

Accordingly, the weighting of the topics in the course was made in favor of more application references and for ELSA. As for the fundamentals, technological content was reduced while the very basics such as definitions of common terms was increased.

In addition, there is a need for AI competence development tailored to health professionals from the various disciplines. This has already been highlighted in other studies [1]. It has been shown that to promote trust in AI applications, it is necessary to deepen the AI education in both patients [8] and users [9].

However, the difficulty in the conception and development of such a learning programme consists mainly in the heterogeneous target group and limited mathematical and technological skills, especially a lack in programming skills, of the participants.

A limitation of the findings is that other healthcare groups, such as additional therapeutic professionals or managers of health facilities, have not yet been included. Furthermore, only experts from an academic context were interviewed. A progressive validation with employees in healthcare might have produced further results. However, since a conscious use of AI has hardly arrived in everyday working life in the German healthcare organizations, this has so far not been conducted.

From the results of the qualitative part of the study, a learning programme is now being developed that is aimed at interdisciplinary professional groups from the healthcare sector.

5. Conclusions

The development of AI competences should be integrated into the future training and continuing education of health professionals. It is necessary to find the right ratio of technological knowledge and ethical, legal, and social aspects. Furthermore, intrapersonal and interpersonal competences, such as interdisciplinary communication, should be part of the training and continuing education of health professionals.

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