How Should We Design for Online Learning?

Katerina Mangaroska
University of South-Eastern Norway, Norway   *katerina.mangaroska@usn.no*

Mariusz Grabowski
Krakow University of Economics, Krakow, Poland   *grabowsm@uek.krakow.pl*

Paweł Konkol
Krakow University of Economics, Krakow, Poland   *konkolp@uek.krakow.pl*

Dariusz Put
Krakow University of Economics, Krakow, Poland   *putd@uek.krakow.pl*

Abstract

Online courses serve as a disruptive force in education, challenging traditional educational paradigms. While classroom teaching remains prevalent, advancements in digitization, technology, and artificial intelligence (AI) are catalysts prompting a reevaluation of educational models and the necessity for new global frameworks. In this paper, we share initial insights from an online survey on the roles of humans in online course design. Recognizing the complex nature of education, we envision AI's future in education through collaborative relationships between humans and AI. Thus, we provide a conceptual model for designing online environments, utilizing human-centered design principles and human-centered AI frameworks aimed at prioritizing human interests rather than replacing human roles.

Keywords: human-centered design, online courses, online education.

1. Introduction

Designing for online learning requires a shift towards human-centered design approaches that prioritize human needs, values, and human agency. Human-centered design is a process that entails understanding the context, identifying end-user desires and requirements, and active involvement of stakeholders in different stages of design, testing, evaluation, and refinement. As such, human-centered design is an essential process for creating online learning systems that support human agency, i.e., users' perceived control over their actions to make decisions and influence outcomes [8].

While advancements in generative AI techniques and tools offer new opportunities for discovering valuable insights during online learning, they also raise questions about the appropriate extent and manner of AI integration in the design and implementation of online courses. Thus, it is crucial to explore the desires and needs of end-users within the context of online courses by actively involving them in designing, testing, and evaluating processes. With this goal in mind, we designed three university-level online courses, following human-centered design principles and ethical guidelines. Our aim was to deepen our comprehension of students' needs and preferences for online learning environments in the era of AI, focusing on higher education students for whom the courses were intended.

2. Research Background

The new challenges in designing for online learning refer to the growing interest in massive online education and to the new digital solutions that offer promising methods to build and design online courses. This refers to AI-based tools which support the requirements to build individual learning experiences and adaptive learning solutions that adjust to student's individual needs [1]. The flexibility in designing online courses and the lack of coordination at an institutional level, result in design of online courses primarily driven by interests of individual instructors, causing problems for maintaining common standards [5]. The following key aspects may be recognized as main challenges currently present in the field of online

learning closely tied to the design of online courses: 1) mismatch between content difficulty and students' skills; 2) ineffective assessment methods and limited feedback; 3) lack of interactivity within the course; and 4) absence of peer tutorial assistance. Other design challenges include navigation, an interface that is difficult to understand, a poor quality of online course design, adapting and selecting appropriate activities and content, managing time constraints, addressing technical hurdles, selecting suitable assessments, automating grading, and creating instructional materials for a large student body [3]. Presently, online learning paths tend to be more standardized, offering fewer options for content personalization. The development of personalized educational trajectories could be facilitated by AI techniques such as those proposed by Yu et al. [12]. More individual approach to learners through improved design of courses is necessary to generate more engagement, considering that online learning and massive open courses suffer from low completion rates [4]. However, using new digital technologies in the course design should take into consideration the fact, that new generations of learners, who possess technical knowledge appropriate to interact with social media or entertainment services, may find it difficult to be successful in online course [3].

3. Methodology

This paper focuses on a survey conducted to evaluate the developed university-level online courses, as part of a larger project. Initially, three online courses on AI were developed[1]. These courses, (1) AI: Introduction and Practical Examples, (2) Machine Learning in Practice and (3) Introducing Exploratory Data Analysis and Supervised Machine Learning with R, were presented as dynamic presentations with various educational resources (text, images, videos, assignments, quizzes). The first course catered to beginners in AI, while the second and third targeted individuals with experience in AI and programming.

Participants. The survey was administered to third year bachelor students from the departments of computer science, information systems, and social sciences, enrolled at two universities, one in Poland and one in Norway. The total number of invitations were sent to 250 students of which 119 replied, achieving a 48% response rate.

Human-centered design. We followed the ADDIE[2] paradigm for the design of learning resources used in the online courses. To determine the instructional goals, the required resources, and to confirm the intended audience, as part of the analysis stage, the professors worked in three teams, each evaluating and validating the work of the others. At this stage only experts in the field of AI as stakeholders were included, that through workshops evaluated the proposed outcomes. During the design stage, the teams invited PhD students and post-docs to brainstorm ideas and get feedback for the proposed strategies, pedagogies, and the general structure of the courses. The development stage, i.e., content generation, media usage, and assessments, was done in each of the teams without any involvement from stakeholders. At last, students were invited during the evaluation stage, by participating in one of the courses and filling in a questionnaire with their evaluation.

Survey protocol. We employed a pre-validated survey instrument, which had been previously verified and recommended by Lu et al. [6]. The survey was divided into two sections: the first focused on the general online course usage, while the second was specifically tailored to evaluate the courses created under the project. Each construct in the survey was assessed using a five-point Likert scale. The initial portion of the survey explored participants' overall perceptions and experiences regarding online courses. This section encompassed constructs such as perceived usefulness, interest, employability, prior experience, satisfaction levels, intention to recommend, and continued intention to utilize online courses.

The subsequent section of the survey prompted participants to evaluate if and how their interests and needs were met. Participants were asked to provide feedback on various design aspects, categorized in three groups, i.e., course quality, technical implementation, and overall perception. The questions aimed to evaluate the course quality revolved around subjective assessment of the difficulty level of the content, the assimilation of the learning material, and the course's impact on participants' knowledge expansion and its relevance to their professional

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[1] https://icam.uek.krakow.pl/video-courses
[2] ADDIE (Analyze, Design, Develop, Implement, and Evaluate) is an informal product development model adapted to the instructional design process, especially for distance learning [9].

career aspirations. The questions aimed to evaluate the technical aspects of the courses revolved around expected functionalities, navigation elements, and adaptation to the learner's needs and progress. Finally, participants were asked to respond to open-ended questions regarding their overall perception on all facets of the course design.

Conceptual model. The data collected from the open-ended questions were subjected to content analysis to quantify and analyze the presence, meanings, and relationships of concepts and themes. Aligning with the findings from the literature review we did as part of the project, we aim to propose a conceptual model, developed as a diagram, to arrange our findings into a coherent structure which will be useful to other researchers and guide further research in the field.

4. Preliminary Results

In total, 119 respondents filled in the survey, of which 24.4% declared themselves as IT students and 73.1% as non-IT students. Among these respondents, 88.2% (105 participants) indicated that they had never utilized any online course. Among the identified reasons, the most prevalent were: 1) *inability to identify a specific cause for the lack of online course usage* (36.2%); 2) *feeling unfamiliar with online learning environments* (23.8%); 3) *a preference for traditional classroom settings* (17.7%); and 4) *seeking face-to-face interaction* (13.8%). Of the 14 respondents who had engaged with online courses previously, six reported enrolling due to instructor recommendation, while the remainder cited a desire to enhance their professional skills. One notable discovery was that 64.3% of participants who utilized online courses (including participants that attended one of the courses developed under the project) found their experience to surpass their expectations, leading to improved learning effectiveness. Additionally, 92.8% of the respondents indicated having a positive overall experience, while 78.6% expressed intentions to utilize online courses in the future.

The outcomes of the content analysis were categorized into three groups: positive feedback, negative feedback, and suggestions for further enhancements. *Students expressed satisfaction* with the quality of the content presented, highlighting its clarity and accessibility, particularly beneficial for non-IT students to grasp current AI trends easily. They appreciated the ease of access, navigation, and flexibility. Additionally, students praised the well-written materials, structured information, and comprehensive content, considering it as a solid foundation that can equip them for further learning. *Regarding the drawbacks*, students primarily expressed their dissatisfaction with the voice narration. They found the humanized AI voice narration to be difficult to engage with, negatively affecting their concentration. Furthermore, they noted a lack of visualizations compared to text, creating difficulties to easily grasp the content at hand. Many students criticized the courses' visual appeal. Finally, through their *suggestions*, students emphasized the importance of practical examples in the future development of online courses, advocating for a shift towards hands-on skills practice. Additionally, they desire visually appealing and interactive content to enhance engagement, exploring a human voice over a humanized AI voice narration, and providing additional resources and guidance for post-course practice and further learning steps.

5. Discussion and Future Research

Our research findings indicate that most of the participants provided positive feedback across the three main aspects: course quality, technical implementation, and overall perception. In addition, over 70% of respondents stated that the courses were beneficial for their professional growth. These encouraging results emphasize the need to surpass "the borrowed familiarity of a real-world university" [11] and design specifically for online learning. This trend is evident in students' inclination and demand for interactive materials and supplementary post-course resources. This observation resonates with the necessity for digital-compatible tools and content, addressing the shift away from replicating in-person experiences typical of traditional educational models in online environments.

Our research findings reaffirm the widely held belief that online courses play a pivotal role in fostering lifelong learning. To reach this goal, online courses need to re-shift the focus from standardization to personalization and avoid duplicating the passive instructionism [11], which are some of the reasons why online education has been criticized for unengaging instruction, lack of interaction, and low retention of students. This is where the advancements in AI become

relevant, if used to serve human interests rather than to achieve technological goals.

The advancements in AI prompt inquiry into the extent and manner by which AI ought to be incorporated in the design of online education models, while avoiding being invasive, disruptive, and compromising learners' autonomy. Relying solely on AI to autonomously adapt learning may have negative consequences, particularly for learners [10]. This triggers two challenges, 1) understanding how well education can be accurately depicted and modelled; and 2) what aspects of teaching and learning can be captured reliably with data [10]. Since education is inherently complex, fostering synergy between humans and machines through the development of human-centered AI systems leverages the strength of both [10]. Human-centered AI is an emerging discipline aimed at prioritizing human interests rather than replacing human roles [11]. Going back to our findings, more than 90% of the participants found the humanized AI voice narration to be difficult to engage with. This opens at least two directions: 1) to continue the research on how to add intonation to AI narration, and 2) keep the human as the main actor in designing for online education. If we look at the benefits students reported from the online courses, we can notice that when it comes to instructional design methods, human intelligence applied to such tasks brings positive results. This does not exclude the possibility to automate the process of instructional design in the future, but before even thinking to do that, we need to understand what aspects of teaching can be captured reliably in data form. Nonetheless, full automation is unlikely to be valuable [11]. It might bring dehumanization of learning and diminishes the richness of a learning experience. Learning is not about absorbing information, it is about developing various metacognitive abilities, social competences, emotional intelligence, etc. through the knowledge that comes from experience, critical engagement, and practical acquisition of skills.

In that regard, a hybrid teacher-AI system can explore ways in which AI could be beneficial as part of a response to educational challenges. Moreover, a collaborative relationship between humans and AI will avoid the issues of representation and reduction, to structure educational environments in formats that AI can interpret and utilize effectively. Moreover, instructors and learners will not have to adapt their dynamics to AI, by modifying their actions to align with machine-readable formats, developing 'parseable pedagogies,' or by losing the 'gut-feeling' decisions that result from cumulative experiences [10].
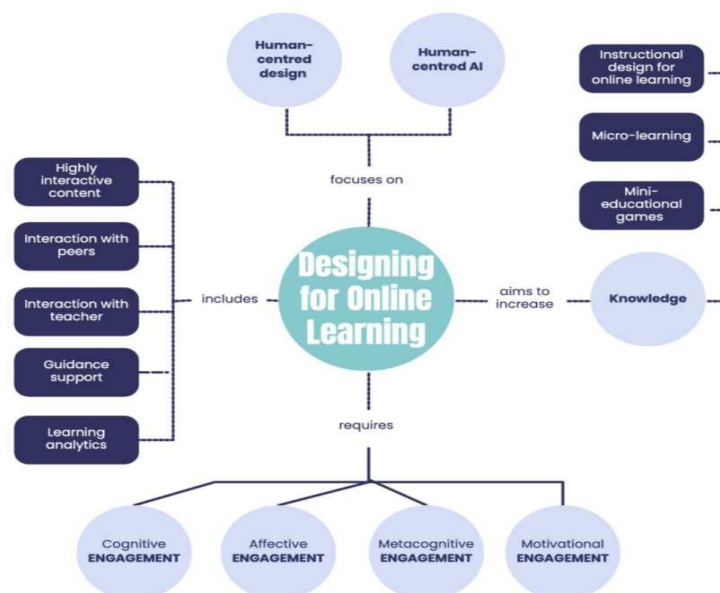

Fig. 1. Conceptual model to guide design for online learning.

Design implications for research and practice. Findings like ours offer insights into shaping design protocols for online learning, especially in the domain of online courses. Thus, we propose a conceptual model that draws on our findings to guide further research in designing for online learning and be useful to other researchers in the field (summarized in Figure 1). We highlight the importance of adopting *human-centered design principles* and integrating *human-centered AI tools* that will prioritize human interests and needs [11]. Embracing these approaches

will facilitate the creation of online learning conditions that meet the contemporary requirements, such as digitization, interactivity, scalability, leveraging emergent technologies, and offering location and time flexibility. This shift moves away from merely replicating in-person experiences and "photocopying" teaching methods inherent in traditional educational models. Moreover, *instructional design methods* for online learning should explore *micro-learning* and *mini-educational games*, which share a common ground in their emphasis on brevity and focused learning experiences, particularly important for learners with short attention spans. This strategy perfectly aligns with the European Union's recommendation on *micro-credential programs*, which promote a culture of lifelong learning.

Furthermore, because *engagement* is the holy grail of learning [2], linked with positive outcomes, academic achievements, and increased motivation, effective design for online learning requires incorporation of *highly interactive content* to sustain student engagement. This entails integration of interactive learning materials, dynamic and formative assessment methods, and engaging activities, all of which foster *continuous interaction* not only between students and course content, but also among students, their peers, and instructors. In addition, we must design how we will offer *guidance support* to students throughout the learning process in online learning where there is no face-to-face interaction and communication, to aid the translation of learned concepts into practical skills.

Finally, we argue that engagement should be recast as a spectrum of *cognitive, affective, motivational* and *metacognitive* processes [2], [7], because learning is a complex, multimodal process, and the *learning analytics* produced for each dimension will provide a more nuanced understanding of engagement, enriching comprehension of the intricate interplay among the "student–learning–context" dynamics [7], particularly important in online environments. Therefore, the role of the design and the quality of the analytics hold an important role in *designing for learning*, and as such hold the potential to guide the development of AI educational systems that support human agency.

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