Special Issue from: Visions for Future Cities: Innovations & Environmental Technologies Conference, (VFC2022), Cairo, Egypt, 24-25 September, 2022

Setting an Agenda for Urban AI Adaptivity in Urban Planning and Architecture E-learning

Somaya Kayed[1], Lamiaa Ghoz[2], Farah Elbehairy[3] , Ahmed Ghonim[4], Mennatullah Hendawy[5]

[1]*Electronics and Communications Engineering, Head of department, Obour High Institute For Engineering (OHI) email:-dr.somayaismail@ohie.edu.eg*
[2] *Faculty of engineering and material science Architecture and urban design program, The German University in Cairo and Impact Circles Berlin – email:lamiaghoz@hotmail.com*
[3]*R&D Team, Umami E-learning solutions- email: farahelbehairy@gmail.com*
[4]*Umami E-learning solutions – Ahmed.ghoniem@umami-learning.co m*
[5]*Faculty of Engineering, Department of Urban Design and Planning, Ain Shams University, and Impact Circles Berlin – mennatullah.hendawy@eng.asu.edu.eg*

***Abstract*-The rapid spread of technology and learning systems have altered the viewpoint about the lack of E-learning to the human element. The intersection of AI and education is highlighted by many technologists and researchers showing the diverse possibilities and challenges of using AI in education. However, little research addresses the potential of using AI to create an adaptive e-learning experience that brings a fully personalized experience to e-learners in architecture and urban educational fields. Building on that, we postulate that adaptive AI learning could be useful for urban online teaching and urban development Massive Open Online Courses (MOOCs), specifically as urban planners need to explore different scenarios of future city making. Therefore, the aim is to explore how educators from the architecture and urban field E-Learning stakeholders perceive AI in the creation of urban Moocs as well as other online teaching activities, as well as address the ways in which adaptive learning can be created in urban e-learning MOOCs using AI. In an attempt to answer the question, what is the current perception of educators about AI adaptivity in e-learning?**

To achieve this, first, we review the literature available on the topic to provide a comprehensive and inclusive look at adaptive AI learning, its potential, and its challenges. This overview informed and guided the formulation of the survey questions. Then we conducted a survey on educators in Architecture and urban fields from universities in Egypt. The unfamiliarity of the participants with AI provides us with deeper insights into perceptions of educators' AI adaptivity in online learning and MOOCs. The study develops a framework for adaptive e-learning using AI in an attempt to create more interactive and personalized e-learning experiences that can be used in different fields and for different types of learners.

***Keywords:* AI Adaptively, On-Line Teaching, Architecture E-Learning, Urban E-Learning**

I. BACKGROUND

Large In 1999, in 1999, Elliott Maisie invented the word "e-Learning," which marks the first time the term was used professionally (Lawless, 2018). Simply put, it is learning that takes place outside of traditional classrooms by utilizing electronic technology to access educational curriculums. (Ruiz et al., 2006; Tamm, 2020; The Economic Times, 2022). E-learning systems give learners flexibility over the material, learning sequence, the pace of learning, time, and often media, allowing them to personalize their experiences to match their specific learning objectives (Ruiz et al., 2006). The Internet, the development of multimedia, accessible digital devices, and well-designed learning management systems have enabled eLearning to become the most prevalent method of providing training or education in the modern era (Lawless, 2018). A learning management system (LMS) is used to provide online training. An effective LMS will provide you with the tools and assistance you need to flawlessly implement your e-Learning plan (Lawless, 2018). The Sharable Content Object Reference Model (SCORM) is an additional sort of e-learning that provides your students with a more interactive and engaging experience and gives you more control over the time spent on your courses. It is a set of technical requirements that were created to provide a standardized method for the development and usage of eLearning content. Most SCORM courses are created with popular authoring tools and hence have a similar structure (Lawless, 2018). In recent years, Application Programming Interface, known as API or xAPI (Torrance, 2021), have become a popular new standard for delivering online training (Lawless, 2018). It is a standard way for software systems to interact and share data (Torrance, 2021). xAPI is sometimes referred to as the next evolution of SCORM because it redefined some of the key monitoring strategies for learning experiences. Through controlling data tracking and storage, xAPI delivers a full view of your learners' experiences (Lawless, 2018; Torrance, 2021). With such detailed data, we can personalize learning sessions (Torrance, 2021).

Later, in 2008, the term "massive open online course" (MOOC) was introduced by Dave Cormier in reference to a course named Connectivism and Connective Knowledge. Much like online learning today, the goal was to remove the constraints of classroom learning and let students from all over the world participate, establishing a model for distributing learning content online to anybody who wishes to take a course (Adedeji, 2022; Bowden, 2021). In brief, the purpose of a Massive Open Online Course (MOOC) is for it to reach a large number of people (Massive); it should be open to the public and free of charge (Open); provided online (Online); and it should allow students to study a new topic (Course) (Adedeji, 2022; Bowden, 2021). MOOCs have progressed significantly; there are now specialized platforms for them, such as Edx and Coursera. The COVID-19 pandemic represented the beginning of a new era in the digital revolution, with learning playing a crucial role in this huge transformation. For instance, enrollment at Coursera increased by 640% between mid-March and mid-April 2020 (Adedeji, 2022).

The COVID-19 pandemic crisis posed a challenge to the global education system, forcing educators to transition to an online method of instruction overnight. Many academic institutions that had previously been hesitant to abandon their

traditional pedagogical methods found themselves with little choice but to transition totally to online teaching-learning (Adedoyin & Soykan, 2020; Dhawan, 2020; Nambiar, 2020). Globally, in light of the COVID-19 pandemic, educational boards have mandated the delivery of online courses at the college and university levels, replacing physical classrooms with virtual ones (Nambiar, 2020).

Education technology was seeing rapid expansion and adoption even before COVID-19. Global edtech investments totaled $18.66 billion in 2019, while the online education market is projected to reach $350 billion by 2025. Since COVID-19, the use of language apps, virtual tutoring, video conferencing technologies, and online learning software has increased significantly (Nambiar, 2020). COVID-19 has become a catalyst for various industries to look for creative solutions in a short period of time. This shift to online learning has undoubtedly resulted in a new and more effective method of educating students. The majority of online education platforms are emphasizing skills such as critical thinking and adaptability, which are vital for future success. These critical characteristics are also vital to the success of online learning platforms. Innovative learning modalities, such as live broadcasts and virtual reality experiences, are expected to someday replace traditional in-person classroom training (Anjana, 2022).

A. Terminology and abbreviations

(API) Application Programming Interface: A standard way for software systems to interact and share data.
(AI) Artificial intelligence: Intelligence demonstrated by machines.
(LMS) Learning Management System: A system used to provide online training.
(MOOC) Massive Open Online Course: A model for distributing learning content online to anybody who wishes to take a course.
(SCORM) Sharable Content Object Reference Model: An additional sort of e-learning that provides your students with a more interactive and engaging experience.

II. THE DEBATE ON E-LEARNING

In the past, E-learning was not widely accepted because it was believed that this technology lacked the vital human element for learning. However, the rapid spread of technology and learning systems has altered this viewpoint (The Economic Times, 2022). While some believe that the unplanned and quick shift to online learning will result in a bad user experience that is unsuitable for long-term growth, others predict that a new hybrid model of education will emerge, with major benefits (Li & Lalani, 2020). The significance and efficacy of technology-based learning cannot be minimized or disregarded. Experts say that moving images and videos are easy for the human brain to recall, while visuals hold students' attention and are retained by the brain for longer (The Economic Times, 2022).

However, there are obstacles to overcome. Some students struggle to participate in digital learning because they lack dependable internet access or technology; this gap exists across nations and within income levels within countries (Li & Lalani, 2020). Moreover, there are difficulties with modern technology, for instance, downloading faults, installation issues, login issues, audio and visual glitches, and so on. Aside from technical issues, online teaching can be monotonous and uninteresting for students at times. Personal attention is another major concern with online learning, where students desire two-way contact (Dhawan, 2020). The learning process cannot be fully realized unless students apply what they have learned. Online content might be largely theoretical at times, making it difficult for students to practice and learn successfully. In summary, students believe that the main impediments to online learning are a lack of community, technological issues, and challenges in understanding instructional goals (Dhawan, 2020; Song et al., 2004).

Lack of focus and maintenance Engagement is a significant difficulty in a MOOC because it is dependent on each learner's ability to self-motivate (Adedeji, 2022; Elliott, 2015). MOOC completion rates are extremely low, despite featuring large enrollments. With as many as 160,000 enrolled students, dropout rates can be as high as 90% (Elliott, 2015). In 2013, MIT analyzed one of their MOOCs. They discovered that just 1,000 of the 17,000 students who registered actually completed the course (Elliott, 2015).

Despite these challenges, one of the most likely benefits of a MOOC is greater social learning through the creation of a knowledge-sharing culture. After all, everyone is striving for the same goal. As a result, people can share ideas and help one another enhance their expertise. It has been demonstrated that this increases productivity by 40%. (Adedeji, 2022; Elliott, 2015). A similar effect is produced by social learning elements on an LMS. Learners can share their thoughts on social media, in Clubs, or via Live Chat. This also aids in communication and connection improvement. (Adedeji, 2022). A MOOC usually takes far less time to complete than a regular certificate. A university course normally lasts at least three years, whereas a MOOC might last anywhere from one to sixteen weeks, which makes it faster and more efficient (Bowden, 2021; Elliott, 2015).

III. E-LEARNING CHALLENGES AND ADAPTIVE AI POTENTIAL

In the current digital world, several studies show that the emergence of artificial intelligence (AI) and the use of technology more broadly imply many transformations in the education sector, such as assisting teachers in tutoring, contextualizing the learning of students, creating assessments (Chaudhry & Kazim, 2021; Zhai et al., 2021). The recently launched International Conference on Artificial Intelligence in Education (AIED) in 2017 highlights the intersection of AI and education. Previous research shows the possibilities and challenges of using AI in education (Kengam, 2020). Additionally, many studies focus on the ethics of using AI in education (Chaudhry & Kazim, 2021). Within this context/trend, many technologists and researchers raise a lot of questions about the potential of using AI in education. Vorst, Jelicic (2019) ask, “Can AI bring the full potential of personalized learning to education?”

In spite of the global trend to integrate AI into education, little research addresses the potential of using AI to create an adaptive e-learning experience. How can AI bring the full potential of personalized learning to digital education? Recently, there has

been an increase in the number of advanced AI learning systems that are recognized due to mainly their capacity to offer learning content while also adapting to the unique requirements of students. Despite the fact that these modern learning systems are effective educational platforms that fulfill students' demands, there are still a limited number of implemented systems designed to solve the issues and challenges that many students encounter (Kabudi et al., 2021). To understand and extract exactly what to adapt in adaptive e-learning and how the adaptation is carried out, we need to understand what is meant by human-AI adaptivity and then explore by what means adaptive learning is applied in e-learning platforms.

IV. METHODOLOGY

This research involves a systematic review of the articles on adaptive AI in education and adaptive e-learning using the ''Connected Papers'' and ''ResearchGate'' research systems. Research in these systems has been performed using the following terms: Adaptive e-learning / Adaptive AI/ AI learning/ AI education/ Interactive AI learning/ Interactive AI education. Also, a review of online courses that use AI in education is needed to provide an inclusive look at adaptive e-learning experiences. Then, primary data will be collected through interviews/ surveys with educators who are using digital tools in their education. The aim is to develop a framework for adaptive e-learning using AI for more interactive and personalized e-learning experiences that can be used in different fields and for different types of learners.

Additionally, we developed a survey for educators in the architecture and urban field to assess their general perception and experience of adaptive AI learning and MOOCs. The survey sample was selected at random from general educators employed in the higher education system, specifically in the architecture and urban design fields. All educators participating in the survey are from Egypt and are employed at various educational institutions and educational systems. On August 25th, the questionnaire was distributed to sample participants using an online platform (Google Survey).

The survey questions are categorized into four types: demographics, educational and teaching experiences, online learning experiences, MOOCs, and adaptive AI experiences. The survey consisted of 3 demographic questions and 23 other questions regarding educators' experience and perceptions of online courses, MOOCs, and the applications they usually use to teach online. Some of the response choices consisted of predefined answers. Out of the 23 questions, 3 were open questions where the educators expressed, according to them, why they would consider using Artificial Intelligence (AI) more in their online teaching in the future, their opinions on the use of AI in online teaching, and the challenges that they expected to face if they were to use it.

The survey was administered via Google Forms. Educators from architecture and urban fields were selected for their unfamiliarity with AI adaptivity. The participants were contacted through email and asked to complete the survey. All 27 educators who participated in the study completed the entire questionnaire. There were no incentives for completing the survey. The respondents were provided with the survey's specifics. The completion of the questionnaire was considered as consent to participate.

V. WHAT IS ALREADY KNOWN ABOUT HUMAN-AI ADAPTIVITY IN EDUCATION?

With its remarkable ability to alter how people think, behave, and interact, AI-enhanced digital technology has played a crucial part in our daily lives. In the past few years, AI has been used in educational systems in different forms. In K–12 and university settings, instructors and students increasingly use tools and applications powered by AI technology, such as intelligent robots and adaptive learning systems (Chen et al., 2020). With the help of adaptive AI learning models, instructors have more opportunities to eliminate time-consuming, repetitive tasks and quickly respond to student inquiries, enhancing the adaptive and personalized teaching process. Retrieval of appropriate knowledge and content using AI is one of the main modules of an adaptive AI learning model (Minn, 2022).

Additionally, an adaptive learning AI model offers the instructors the opportunity to author and engineer content. The level of content authoring is limited by the fact that the AI-based model must not be constrained to resources or repositories because it is autonomous and intelligent enough to search, retrieve, and update its knowledge base regularly (Moedritscher et al., 2004).

Today, artificial intelligence techniques and resources are used to improve the teaching-learning process in higher education, particularly regarding technical topics. Student diversity is a constant difficulty that academics encounter daily. E-learning and learning management systems and or educational platforms acquire a considerable quantity of data about students, but in most situations, this data is retained without further consideration. This data might be analyzed by AI systems to discover student issues. Many of these issues might be avoided by guiding students to a specific subject (Ilkka, 2018; Núñez et al., 2020; Ouyang et al., 2020).

Data analysis might anticipate dropout risk and provide students with customized resources to facilitate learning and close the access gap. With AI, a more thorough examination can be performed, and quicker conclusions may be made. Coursera, for example, analyzes student replies and, if a significant failure is detected, the algorithm notifies the teacher and provides more comprehensive information to subsequent students. These methods give students rapid feedback that helps them grasp and retain an idea. AI may assist to improve numerous areas of teaching-learning processes, improving education by increasing personalization and learning outcomes, optimizing overall university operations, and progressing toward technological education equity (Ilkka, 2018; Núñez et al., 2020; Ouyang et al., 2020).

In real-world educational settings, the adaptivity aspect should be considered when designing an educational AI-human interface system (Holstein et al., 2020). Recent projects have given attention to human-human interactions during AI educational classes, exploring how AI-supported educational activities can strengthen teachers' abilities (Fancsali et al., 2018; Holstein et al., 2017; Holstein et al., 2018; Molenaar et al., 2019; VanLehn et al., 2019; Walker et al., 2014).

Other aspects of adaptive e-learning have been discussed in multiple frameworks providing partial views of adaptivity through whether focusing on what and when may be the responses of an adaptive e-learning system, ignoring the how question, or focusing only on the how and when questions, ignoring what to do in response (Holstein et al., 2020). Reflecting on the timing of the adaptation, the system may be designed to adapt per task or per step of a task (Rummel, 2018) or per design iteration in data-driven systems that are upgraded repeatedly (Aleven et al., 2016).

On the other hand, few frameworks detail the targets and goals of adaptability and what is aspired to be induced through it in students, whether it's enhancing the learning outcomes of students, or assisting them to become better self-learners (Holstein et al., 2020). Although designing an adaptive framework that promotes certain goals is important, these goals may not necessarily correlate with those of humans in real-world educational situations (Holstein et al., 2017; Ogan et al., 2015; Ritter et al., 2016). For example, an AI educational adaptive technology can enable each student to go through the curriculum at their own convenience, while at the same time, in practice, teachers may struggle to find a balance between their desire to create such customized classes and the external commitment to keep classes on time (Holstein et al., 2017; Ritter et al., 2016). Therefore, more work should be explored into the design of an AI educational system that supports and influences each other's goals (Holstein et al., 2020).

Another role AI can play in education is assisting human facilitators (teachers and educators) to effectively evaluate and reflect on their educational goals, because sometimes these goals are not aligned with known educational best practices (An et al., 2019; Gerritsen et al., 2018). Moreover, AI educational systems can be more productive if they are intended to take instructors' input concerning the goals they should be improving for. This means allowing instructors to help design the system's goals, and the system might help teachers manage trade-offs between conflicting goals more efficiently, for example, assisting teachers in choosing when to advance students in the curriculum while maintaining the least amount of harm to their learning (Holstein et al., 2019).

Reflecting on perceptual capabilities, educational AI systems may be built to extend what humans can perceive and notice in learning situations from both directions—learning and teaching (Holstein et al., 2020). Thus, tutors can better spot possibilities for successful intervention in the context of continuous peer tutoring (Walker et al. 2014). On the other hand, students can be assisted in monitoring their own aid-seeking behavior and identifying instances when they may be misusing the software's help features (Aleven et al., 2016). In that case, the potential use of AI to create an adaptive e-learning experience is not just limited to boosting human abilities but also to assisting humans in uncovering and staying aware of key characteristics in a learning situation when present guidance is not available (Aleven et al., 2016; Gerritsen et al., 2018; Sherin et al., 2011; Walker et al., 2014).

On the other hand, systems should also be designed in such a manner that people can assist them in perceiving on-ground information because people may have significant knowledge that the systems are unlikely to be aware of (Bull et al., 2016; Holstein et al., 2020). Aside from having people actively inputting knowledge, recent studies have started to investigate ways in which humans educate AI educational systems, by demonstrating, and recognizing pedagogically significant aspects that they should respond to subsequently (Lee et al., 2015).

In terms of decision policies, adaptive learning technologies can detect the behavior of students by mapping particular actions to perceived learning situations (Sutton et al., 2018). For instance, the system may react to detected dissatisfaction or stress by suggesting alternate tasks for the student to focus on or by requiring students to notify their teacher if they need assistance (Holstein et al., 2019). Despite recent research, there is still a gap in providing theoretical and conceptual guidance for diverse ways in which human-AI adaptivity (AI and human facilitators) can be shared in education.

In e-learning platforms, adaptive learning has been recognized as a crucial aspect as it's pivotal to successful and durable learning (Weber, 2012). Some students learn easily through visuals, while others choose texts and writings; some students learn best through theories, while others learn by trials and instances (Truong, 2016). Therefore, the heterogeneity of students and their preferences, represented in their various goals, abilities, and skills, provoked many researchers to find solutions that would assist teachers in developing educational materials and adapted learning objects that are customized for each learner through the integration of adaptive learning into e-learning platforms (Talaghzi et al., 2020).

Currently, most e-learning systems contain technologies that adjust educational content and provide learners with personalized learning materials. Recent research working with adaptive e-learning discussed the elements involved in online adaptive learning. Talaghzi, Bennane, and Himmi (2020) argued, in their article, Online adaptive learning: A review of literature, the content and the educational objects that may be adapted (assessment, learning strategy, learning path, etc.), as well as the adaptation criteria (learning style, knowledge level, interests, and context), were based on certain adaptation parameters (learner behavior, test results, context data, etc.) for the learning personalization. They also identified the methods and algorithms used in the online adaptive learning domain.

VI. WHAT IS ALREADY KNOWN ABOUT HUMAN-AI ADAPTIVITY IN ARCHITECTURE AND URBAN EDUCATION

This study's aim was to collect evaluative input from educators on their experiences with online education and adaptive AI learning. As a result, a descriptive approach to data analysis is considered. Responses to open-ended questions were transcribed and classified within each question to determine similar responses by which the repeated nature of reactions is discovered. The detailed survey findings are described in the section below.

Among the 27 survey participants, 81.5% were female and 18.5% were male. As for the age group, the majority of the participants, 44.4%, were in the age group 26-30 years. While the rest of the participant sample were 18.5% for (31-35years), 18.5% for (36-40), 11.1 %(46-50) and 3.7% for (41-45), (51-55) each. As shown in Figure 1, the sample comprised 14.8% of professors and 29.6% of lecturers, while the rest varied between

assistant lecturers and teaching assistants, with percentages of 37% and 14.8%, respectively.

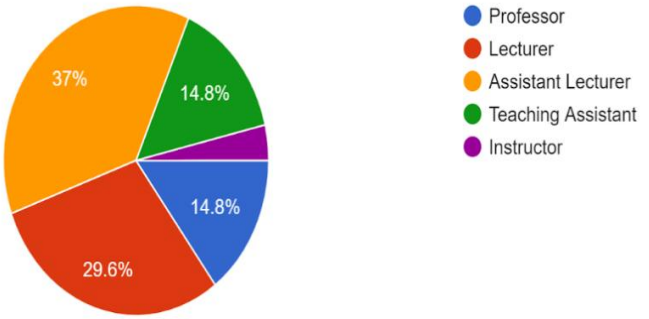

Figure 1: Professional background of survey respondents

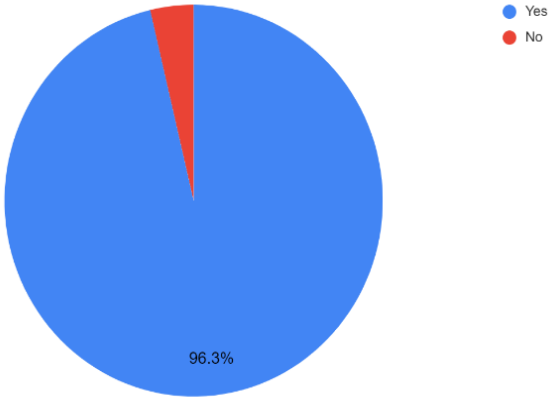

Figure 2: Participants who taught online before

51.9%of the participants acquired a master's degree, while 37% had a doctoral degree, and the rest had a bachelor's degree. As for the location, all of the participants worked at universities located in Egypt. In asking if they had taught online before, 96.3% replied with "yes" and only 3.7% replied with "no" see figure 2. As for the number of courses taught online, the answers varied, with the majority teaching around 3 or 4 courses online. Zoom and Teams were the most used platforms by the participants, with percentages of 88.9% and 44.7%, while 18.5% used an online teaching platform created by the institute they work at and 14.8% used Google (see figure 3). 88.9% hadn't instructed a MOOC before, while only 11.1% confirmed with a yes (see figure 4).

The majority of respondents were not familiar with the use of AI in online courses, with only 14.8% responding that they were informed about the topic. When asked to what extent they use AI in their online teaching, 18.5% replied to a moderate extent, while 59.3% replied that they do not at all use AI in their online teaching. As for if they plan to use it more in the future, the majority (48.1%) replied to a moderate extent, and very few percentages were loaded on the other factors, with values that varied between 11.1%, 22.2%, and 18.5%. Participants were asked to elaborate on their previous answers, and the responses included:

- I will start with moderate extent till I get used to it, then I can go to great extent if I find I would be capable to make it (Female, Lecturer, 36-40)

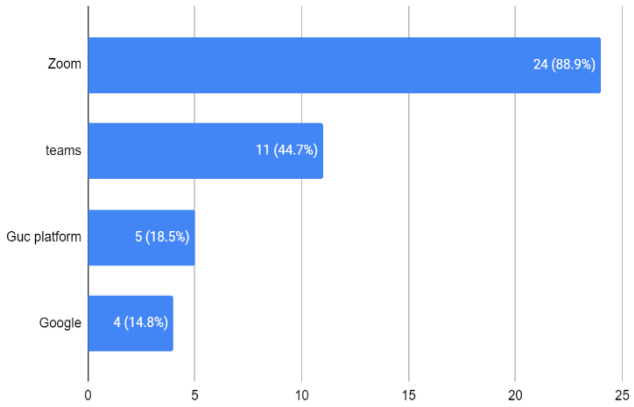

Figure 3: Commonly used online platforms for e-learning based on the survey respondents

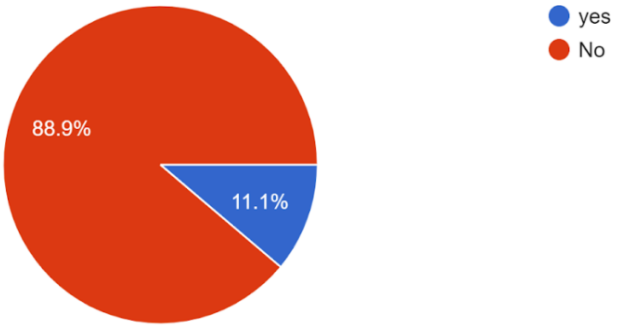

Figure 4 : percentages of respondents who instructed a MOOC before

- Teaching online has been great to keep students "connected," but especially for architecture and design, I am not sure it is very important. For sure, the possibility to share and integrate activities and experiences online is important. (Female, Professor, 46-50)
- I would like to learn more about the AI teaching tools that I could inject into the sessions and consequently use them on a regular basis if they showed success (Female, Assistant Lecturer, 26-30)

I do not currently teach online, but it seems that using AI saves time for the educator in terms of task automation,

- Grading, etc. Seems helpful (Female, Assistant Lecturer, 26-30)
- It is important to pave the way to implement AI technology in an interesting way to help the students understand the content. The integration of AI should be done moderately so that it doesn't distract the students from receiving the needed information (Female, Assistant Lecturer, 26-30).
- Would be interested in exploring new teaching techniques (Female, Lecturer, 26-30).

AI can have useful applications in online teaching methods, giving feedback to teachers and instructors, measuring how useful the course is to students, and from their interests, AI can

cluster and track the potential interests of some students. All of these attempts can improve the teaching and learning content, process, and experience (male, instructor, 31-35)

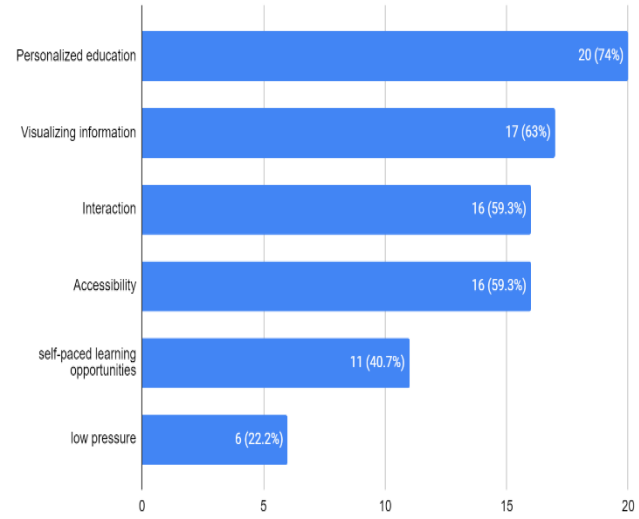

Figure 5: Reasons participants find AI making online learning experience better for students

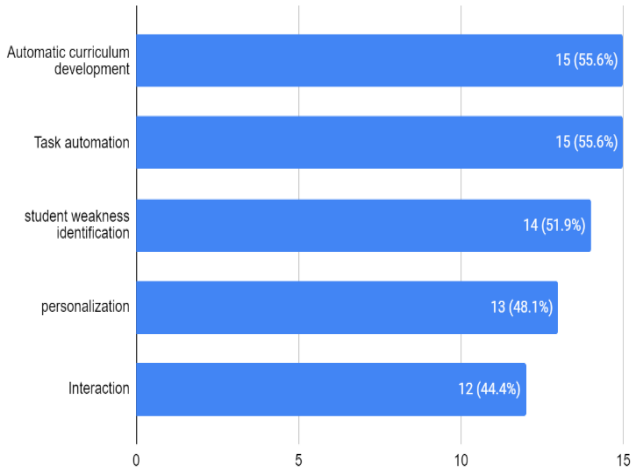

Figure 6: Reasons participants find AI making g online learning experience better for instructors

When participants were asked where AI makes the online learning experience better for students visualizing information (63%), accessibility (59.3%), and interaction (59.3%) were the most agreed-upon factors. While automatic curriculum development (55.6%), students weakness identification (51.9%), and personalization (48.1%) were the most agreed upon factors where AI makes the online learning experience better for instructors see figure 5&6.

Lastly, in the responses to the challenges that educators expect to face if they were to use AI in online courses, there was agreement on the lack of knowledge and familiarity with the tool, technical issues, data privacy, and AI bias. Moreover, participants were asked to share their opinions or remarks on the use of AI in online teaching. One response (Female, Lecturer, 36-40)suggested including more human-device interaction methodology, while the other response (male, Instructor, 31-35) found the experience of using AI very promising in any pedagogical environment in the future, yet the process has to be safe, controlled, and the AI has to be well pre-experimented and trained.

VII. DISCUSSION AND CONCLUSION: AN AGENDA FOR URBAN AI ADAPTIVITY IN ARCHITECTURE AND URBAN EDUCATION

The literature review and data analysis from the survey both yielded crucial insights into educators' perspectives on the applicability of AI and MOOCs. These data points formed the basis for the creation of an agenda for urban artificial intelligence adaptivity in architecture and urban education.

The majority of participants in the survey were not familiar with the potential and capabilities AI adaptivity can add and enrich their e-learning teaching experiences, which showed the necessity for such tools to be introduced and familiarized among architecture and urban educators, which formulated the first step in the agenda.

Secondly, there is a hesitation when it comes to using AI as a tool, imposed by skepticism towards the implementation of AI in online learning environments. Moreover, the lack of familiarity with using such tools poses a difficulty for some educators adding to their hesitation to whether or not to use the tool at all.

The concept of teaching architecture and urban planning online is still debatable and incomprehensible for some educators. The need for face-to-face interaction, brainstorming, sharing, and discussing ideas creates a barrier between e-learning and teaching architecture, not just AI Adaptivity. This defines the third step in the agenda.

In general, the topic of data privacy poses a concern whenever addressing any technological advancement. Similarly, when introducing AI adaptivity to educators, a lot of concern was shown towards data privacy, as well as the functioning behavior of the tool presented in algorithms and how this might create a bias towards students. This crucial point formulated the fourth step in the agenda.

Finally, as with any newly presented tool, research and future studies go hand in hand, especially when it comes to user behavior and impressions. A technological tool cannot be efficient unless it addresses the needs and concerns of its users. As a result, the fifth step of the proposed agenda involves influencing the perception of architecture and urban educators.

Agenda 1: Familiarise and understand the terminology of the MOOC and AI adaptivity

- It was notable that the majority were not familiar with the term, even though they were familiar with the concept and platforms that provide this kind of e-learning.
- Similarly, AI adaptivity in online learning. The majority were not sure how it could be implemented and in what ways it could assist both the learner and the educator.

Agenda 2: get familiar with the tool, technicalities, and its challenges

- After analyzing the data, it is clear that the majority of educators are still hesitant about the use of AI in online courses.
- Other educators were worried that not being familiar with the tool would present a difficulty to them. It's kind of a black box.

Agenda 3: Breaking the barriers between architecture and urban education and online education

- Some urban and architectural educators prefer personal interaction and discussing projects and ideas face to face rather than online distance learning, which shows the need to break the barrier between architecture and urban education and online learning.
- Despite being forced during the pandemic to use online learning as a tool in architectural and urban education, some educators believe the challenge lies in teaching architecture online, not just using AI.

Agenda 4: AI adaptivity and data privacy

- Notably, few educators showed concerns regarding the AI adaptivity and data privacy of users, as well as how the algorithms would work without presenting bias towards students.
- The topic of data privacy has been a debate in any technological advancement, so it would be a very sensitive case when it comes to education and teaching. Therefore, data policies need to address this issue from the early steps.

Agenda 5: Further research is still needed to improve educators' perception of the AI's potential and challenges.

- Approaching educators in the architecture and urban planning fields who are not familiar with the AI adaptivity concept showed the need for further research on how to familiarise educators in this field with AI and online tools.
- Therefore, AI adaptivity has a long way to go. Moreover, further research is needed on the relationship between AI adaptivity and educators' perceptions.

VIII. RECOMMENDATIONS AND FUTURE WORK

We demonstrated the potential and challenges of implementing adaptive AI, as well as conducted a survey to provide further insights toward adaptive AI in the Egyptian context of architecture and urban E-learning. The survey results have shown the current perception of educators from the architecture and urban fields towards existing e-learning tools, particularly AI adaptivity and MOOCs.

Despite the unfamiliarity with the tools, there is a willingness to learn more about the tools and utilize them among the survey participants if the challenges and concerns were addressed. Therefore, we recommend following the proposed five-step agenda for implementing adaptive AI in the current online teaching.

Moreover, the topic of data privacy should be among the first challenges tackled when implementing AI adaptivity and other e-learning tools in online education since in the survey participants expressed data privacy concerns as a hindrance to using the AI adaptivity tool.

Finally, any newly presented topic, calls for further research and future studies. Therefore, in the AI adaptivity implementation for architecture and urban e-learning, research needs to be conducted on how to utilize AI adaptivity in architecture and urban e-learning. Moreover, research needs to address user perception and needs, particularly in fields like architecture and urbanism, whereby the teaching process requires specific requirements and face-to-face interactions. This is especially important in fields like architecture and urbanism, where teaching demands specific requirements and face-to-face interactions.

REFERENCES

1. Aleven, V., Roll, I.,McLaren, B.M., Koedinger, K.R. (2016). Help helps, but only so much: research on help seeking with intelligent tutoring systems. Int. J. Artif. Intell. Educ. 26(1), 205–223
2. Aleven, V., McLaughlin, E.A., Glenn, R.A., Koedinger, K.R. (2016). Instruction based on adaptive learning technologies. In: Mayer, R.E., Alexander, P. (eds.) Handbook of Research on Learning and Instruction, pp. 522–560. Routledge, New York
3. An, P., Bakker, S., Ordanovski, S., Taconis, R., Paffen, C.L., Eggen, B. (2019) Unobtrusively enhancing reflection-in-action of teachers through spatially distributed ambient information. In: Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems, pp. 1–14
4. Adedeji, M. (2022, March 9). What is a MOOC? Massive Open Online Courses Explained. Growth Engineering. Retrieved August 25, 2022, from https://www.growthengineering.co.uk/what-is-a-mooc/
5. Adedoyin, O. B., & Soykan, E. (2020). Covid-19 pandemic and online learning: the challenges and opportunities, Interactive Learning Environments. Interactive learning environments. 10.1080/10494820.2020.1813180
6. Anjana. (2022, August 12). Top 6 Online Learning Platforms in the World for 2022. ColorWhistle. Retrieved August 24, 2022, from https://colorwhistle.com/top-online-learning-platforms/
7. Baker, R. (2019, October 22). Webinar: Exploring Subjectivity: An Introduction to Q Methodology. YouTube. Retrieved August 11, 2022, from https://www.youtube.com/watch?v=WfiwaUMdRjs
8. Bowden, P. (2021, June 3). Beginners Guide to Massive Open Online Courses (MOOCs). Class Central. Retrieved August 26, 2022, from https://www.classcentral.com/help/moocs
9. Bull, S., Kay, J.: SMILI (2016) A framework for interfaces to learning data in open learner models, learning analytics and related fields. Int. J. Artif. Intell. Educ. 26(1), 293–331
10. Chaudhry, M.A., Kazim, E. Artificial Intelligence in Education (AIEd): a high-level academic and industry note 2021. AI Ethics (2021). https://doi.org/10.1007/s43681-021-00074-z
11. Chen, X., Xie, H., Zou, D., & Hwang, G. J. (2020). Application and theory gaps during the rise of Artificial Intelligence in Education. Computers and Education: Artificial Intelligence, 1. https://doi.org/10.1016/j.caeai.2020.100002
12. Cho, J. Y., & Cho, M. H. (2014). Student perceptions and performance in online and offline collaboration in an interior design studio. International Journal of Technology and Design Education, 24(4), 173-491. https://doi.org/10.1007/s10798-014-9265-0
13. Cordingley, L., Baumann, A., & Akhtar-Danesh, N. (2008, October 1). Q-methodology in nursing research: a promising method for the study of subjectivity. Western Journal of Nursing Research, 30(6), 759-773. 10.1177/0193945907312979
14. Dhawan, S. (2020, September 1). Online Learning: A Panacea in the Time of COVID-19 Crisis. Journal of Educational technology systems, 49(1), 5-22. https://doi.org/10.1177/0047239520934018
15. Elliott, S. (2015, May 12). How many MOOC students finish their courses? People | HowStuffWorks. Retrieved August 25, 2022, from https://people.howstuffworks.com/how-many-mooc-students-finish-courses.htm
16. Elrawy, S., & Abouelmagd, D. (2021). View of Architectural and Urban Education in Egypt in the Post Covid-19 Pandemic. European Journal of Sustainable Development, 10(2), 91-112. 10.14207/ejsd.2021.v10n2p91
17. Erittali, M., Hssina, B., & Boussakssou, M. (2020). Towards an Adaptive E-learning System Based on Q-Learning Algorithm. Procedia Computer Science, 170, 1198-1203. Retrieved August 10, 2022,https://www.sciencedirect.com/science/article/pii/S1877050920304579

18. Fancsali, S.E., Yudelson, M.V., Berman, S.R., Ritter, S. (2018). Intelligent instructional hand offs. In: International Educational Data Mining Society
19. Gerhard Weber. (2012). Adaptive Learning Systems. In Encyclopedia of the Sciences of Learning, Norbert M. Seel (ed.). Springer US, Boston, MA, 113–115.
20. Gerritsen, D., Zimmerman, J., Ogan, A. (2018) Towards a framework for smart classrooms that teach instructors to teach. In Kay, J., Luckin, R. (eds.) Rethinking Learning in the Digital Age: Making the Learning Sciences Count, 13th International Conference of the Learning Sciences (ICLS) 2018, vol. 3. International Society of the Learning Sciences, London
21. Holstein, K., Aleven, V., & Rummel, N. (2020). A Conceptual Framework for Human–AI Hybrid Adaptivity in Education. Artificial Intelligence in Education, 12163, 240 - 254.
22. Holstein,K., McLaren, B.M.,Aleven,V. (2019). Designing for complementarity: teacher and student needs for orchestration support in AI-enhanced classrooms. In: Isotani, S., Millán, E., Ogan, A., Hastings, P., McLaren, B., Luckin, R. (eds.) AIED 2019. LNCS (LNAI), vol. 11625, pp. 157–171. Springer, Cham https://doi.org/10.1007/978-3-030-23204-7_14
23. Holstein, K., McLaren, B.M., Aleven, V. (2018). Student learning benefits of a mixed-reality teacher awareness tool in AI-enhanced classrooms. In: Penstein Rosé, C., et al. (eds.) AIED 2018. LNCS (LNAI), vol. 10947, pp. 154–168. Springer, Cham https://doi.org/10.1007/978-3-319-93843-1_12
24. Harman, H. H. (1960). Modern factor analysis (Second ed.). The University of Chicago press. https://archive.org/details/ModernFactorAnalysis/mode/2up
25. Harris, K., Henderson, S., & Wink, B. (2019, October 1). Mobilising Q methodology within a realist evaluation: Lessons from an empirical study. sage,25(4),430-448. https://journals.sagepub.com/doi/full/10.1177/1356389019841645
26. Holstein, K., McLaren, B.M., Aleven, V. (2017). Intelligent tutors as teachers' aides: exploring teacher needs for real-time analytics in blended classrooms. In: Proceedings of the Seventh International Learning Analytics & Knowledge Conference, pp. 257–266
27. Huong May Truong. (2016). Integrating learning styles and adaptive e-learning system: Current developments, problems and opportunities. Computers in Human Behavior 55, (February 2016), 1185–1193.
28. Ilkka, T. (2018). The Impact of Artificial Intelligence on Learning, Teaching, and Education [Policies for the future, Eds. Cabrera, M., Vuorikari, R & Punie, Y.]. Publications Office of the European Union.
29. Jagadeesh Kengam (2020), Artificial intelligence in education, 21 st International Conference on Artificial Intelligence in Education.
30. Langeveld, J., Cuppen, E., & Nieuwenhuis, E. (2022, July). The role of integration for future urban water systems: Identifying Dutch urban water practitioners' perspectives using Q methodology. Cities, 126. https://www.sciencedirect.com/science/article/pii/S0264275122000981
31. Lawless, C. (2018, October 25). What is eLearning? A Complete Guide for your Business. LearnUpon. Retrieved August 25, 2022, from https://www.learnupon.com/blog/what-is-elearning/
32. Lee, M.H., Runde, J., Jibril,W.,Wang, Z., Brunskill, E.(2015). Learning the features used to decide how to teach. In: Proceedings of the Second. ACM Conference on Learning@ Scale, pp. 421–424
33. Li, C., & Lalani, F. (2020, April 29). The rise of online learning during the. The World Economic Forum. Retrieved August 25, 2022, from https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning/
34. Maftuhah Damio, S. (2018, June 30). The Analytic Process of Q Methodology. Asian Journal of University Education, 14(1), 59-75. Retrieved August 11, 2022, from https://files.eric.ed.gov/fulltext/EJ1207802.pdf
35. Minn, S. (2022). AI-assisted knowledge assessment techniques for adaptive learning environments. Computers and Education: Artificial Intelligence, 3. https://doi.org/10.1016/j.caeai.2022.100050
36. Moedritscher, F., Barrios, V. M. G., & Guetl, C. (2004, January). The Past, the Present and the Future of adaptive E-Learning: An Approach within the Scope of the Research Project AdeLE. https://www.researchgate.net/publication/242378532_C_The_Past_the_Present_and_the_Future_of_adaptive_E-Learning_An_Approach_within_the_Scope_of_the_Research_Project_AdeLE
37. Molenaar, I., Horvers, A., Baker, R.S. (2019). Towards hybrid human-system regulation: understanding childrens' SRL support needs in blended classrooms. In: Proceedings of the 9th International Conference on Learning Analytics and Knowledge, pp. 471–480
38. Nambiar, D. (2020, June). The impact of online learning during COVID-19: students' and teachers' perspective. The International Journal of Indian Psychology, 8(2). 10.25215/0802.094
39. Newman, G., George, B., Li, D., Tao, Z., Yu, S., & Lee, R. J. (2018). Online Learning in Landscape Architecture: Assessing Issues, Preferences, and Student Needs in Design-Related Online Education. Landscape Journal, 37(2), 41-63. https://doi.org/10.3368/lj.37.2.41
40. Núñez, J. L. M., & Lantada, A. D. (2020). Artificial Intelligence Aided Engineering Education: State of the Art, Potentials and Challenges. International Journal of Engineering Education, 36(6), 1740-1751.
41. Ogan,A.,Yarzebinski, E., Fernández, P., Casas, I. (2015). Cognitive tutor use in Chile: understanding classroom and lab culture. In: Conati, C., Heffernan, N., Mitrovic, A., Verdejo, M.F. (eds.) AIED 2015. LNCS (LNAI), vol. 9112, pp. 318–327. Springer, Cham https://doi.org/10.1007/978-3-319-19773-9_32
42. Oktay, H. E., Danaci, H. M., Unvan, M., Kavas, K. R., & Bakir, İ. (2021, January 17). Virtual Education Trials and Evaluation Process in Architecture. Journal of Qualitative Research in Education, 25, 302-315. 10.14689/enad.25.13
43. Ouyang, F., Jiao, P., & Alavi, A. (2020, April). Artificial intelligence-based smart engineering education. 10.1117/12.2557464
44. Kabudi, T., Pappas, I., Olsen, D. (2021) AI-enabled adaptive learning systems: A systematic mapping of the literature, Computers and Education: Artificial Intelligence, Volume 2, 100017, ISSN 2666-920X, https://doi.org/10.1016/j.caeai.2021.100017
45. Ritter, S., Yudelson, M., Fancsali, S.E., Berman, S.R. (2016). How mastery learning works at scale. In: Proceedings of the Third. ACMConference on Learning@Scale, pp. 71–79
46. Ruiz, J. G. M., Mintzer, M. J., & Leipzig, R. M. M. (2006, March). The Impact of E-Learning in Medical Education. Academic Medicine, 81(3), 207-212.
47. Rummel, R. J. (1967, December 1). Understanding factor analysis. Journal of Conflict Resolution, 11(4), 444-480. https://doi.org/10.1177/002200276701100405
48. Rummel, N. (2018) One framework to rule them all? Carrying forward the conversation started by Wise and Schwarz. Int. J. Comput. Support. Collab. Learn. 13(1), 123–129
49. Sherin, M., Jacobs, V., Philipp, R. (eds.). (2011) Mathematics Teacher Noticing: Seeing Through Teachers' Eyes. Routledge, New York
50. Sutton, R.S., Barto, A.G. (2018). Reinforcement Learning: An Introduction. MIT Press, Cambridge
51. Sik Kim, J. (2017, January 11). Home. YouTube. Retrieved August 10, 2022, from https://archive.corp.at/cdrom2016/papers2016/CORP2016_13.pdf
52. Song, L., S. Singleton, E., R. Hill, J., & Hwa Koh, M. (2004). Improving online learning: Student perceptions of useful and challenging characteristics. Internet and Higher Education, 7(1), 59-70. https://www.learntechlib.org/p/102596/
53. Talaghzi, J., Bennane, A., Himmi, M., Bellafkih, M., & Benomar, A. (2020). Online Adaptive Learning: A Review of Literature. Proceedings of the 13th International Conference on Intelligent Systems: Theories and Applications.
54. Tamm, S. (2020, December 21). What is the Definition of E-Learning? E-Student. Retrieved August 25, 2022, from https://e-student.org/what-is-e-learning/#what-is-the-definition-of-e-learning
55. Torrance, M. (2021, May 21). What Is xAPI? ATD. Retrieved August 28, 2022, from https://www.td.org/magazines/what-is-xapi
56. The Economic Times. (2022, August 24). What is E-learning? Definition of E-learning, E-learning Meaning. The Economic Times. Retrieved August 25, 2022, from https://economictimes.indiatimes.com/definition/e-learning
57. VanLehn, K., et al. (2019). Can an orchestration system increase collaborative, productive struggle in teaching-by-eliciting classrooms? In: Interactive Learning Environments, pp. 1–19
58. Vorst, Jelicic (2019) Artificial Intelligence in Education Can AI bring the full potential of personalized learning to education? 30th European Conference of the International Telecommunications Society (ITS)
59. Walker, E., Rummel, N., Koedinger, K.R.(2014). Adaptive intelligent support to improve peer tutoring in algebra. Int. J. Artif. Intell. Educ. 24(1), 33–61
60. Watts, S., & Stenner, P. (2005). Doing Q methodology: theory, method and interpretation. Qualitative Research in Psychology, 2(1), 67–91. https://doi.org/10.1191/1478088705qp022oa

61. Xu, M., & Yang, X. (2021). The Use of Q Methodology to Evaluate Instruction in Higher Education. EdTech Books. Retrieved August 10, 2022, from https://edtechbooks.org/id_highered/the_use_of_q_methodoe

62. Zhai, X. et al. (2021) A Review of Artificial Intelligence (AI) in Education from 2010 to 2020, Complexity, 2021, pp. 1-18. doi: 10.1155/2021/8812542

Adaptive AI learning Survey

Name*
==========
Email*
==========
Gender*
Male
Female
Prefer not to say
==========
Age*
20-25 Years
26-30 Years
31-35 Years
36-40 Years
41-45 Years
46-50 Years
51-55 Years
56-60 Years
More than 60 Year
==========
How many years of teaching experience do you have?
==========
What is your profession?*
Professor
Lecturer
Assistant Lecturer
Teaching Assistant
other:
==========
What is your highest education degree?*
Bachelors
Masters
Phd
Habilitation
Other:
==========
Institution*
==========
location*
==========
Did you teach online before?*
Yes
No
other:
==========
How many courses did you teach online before?*
==========
Which platforms did you use before for online teaching?*
Not Applicable
Zoom
Google
Teams
other:
==========
Did you instruct an online MOOC course before?
Yes
No
==========
How many MOOC courses have you instructed online before?
Short answer
==========
Incase you instructed a MOOC before, What are the titles and links of the MOOCs that you instructed before?
==========
Which platforms did you use to host your MOOC?
Coursera
Udemy
edX
Linkedin learning
skillshare
Udacity
Other: ……
==========
Approx. number of students who completed your MOOC *
Not applicable
Up to 5.000
Up to 10.000
Up to 20.000
Up to 30.000
More than 30.000
==========
Who were the target students of your previous MOOCs (Multiple Choice possible)*

Undergraduate
Postgraduates
Doctoral
Not applicable
==========
I I am well informed about the use of Artificial Intellegence (AI) in online courses (1 = not agree at all; 5 = agree to a great extent)*

1						2

==========
Please indicate to which extent you use Artificial Intellegence (AI) in youronline teaching*
Not at all.
To a little extent
To a moderate extent
To a great extent
To a very great extent
==========
Please indicate to which extent you PLAN to use Artificial Intellegence (AI) more in your online teaching*
Not at all
To a little extent
To a moderate extent
To a great extent
To a very great extent
==========
Please explain your previous answer
==========
How do you rate the importance of AI to online courses *
Very important
Important
I am not sure
Not very vital
Not needed at all
==========
Where do you see AI making the online learning experience better for students (multiple answers possible)?
Interaction
Personalized Education
Visualizing information
Accessibility
Low Pressure
Self-paced learning opportunities
Personalized learning opportunities
other:
==========
Where do you see AI making the online learning experience better for instructors (multiple answers possible)?*
Interaction
Automatic curriculum development
Personalization
student weaknesses Identification
Task automation
other:
==========
To which extent, do you see it Hard to integrate AI in your online teaching? *
Not at all
To a little extent
To a moderate extent
To a great extent
To a very great extent
==========
What are the challenges that you expect to face if you were to use AI in your online courses
==========
Do you have any opinions or remarks on the use of AI in online teaching that you would like to share