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RESEARCH

Educational ideals affect AI acceptance in learning environments

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Abstract
AI is increasingly used in learning environments to monitor, test, and educate students and allow them to take more individualized learning paths. The success of AI in education will, however, require the acceptance of this technology by university management, faculty, and students. This acceptance will depend on the added value that stakeholders ascribe to this technology. In two empirical studies, we investigate the hitherto neglected question of which impact educational ideals have on the acceptance of AI in learning environments. We find clear evidence for our study participants' conviction that humanistic educational ideals are considered less suitable for implementing AI in education than compentence-based ideals. This implies that research on the influence of teaching and learning philosophies could be an enlightening component of a comprehensive research program on human-AI interaction in educational contexts.

Keywords AI-based learning · Higher education · AI acceptance · Future of learning

1 Introduction

Artificial intelligence (AI) is ubiquitous and part of our everyday life. Unsurprisingly, it has also been implemented in the field of education, from systems that monitor students [1–4] to more elaborate ones that recommend exercises or chat with them [5–7]. The latter examples are usually seen as positive because they may provide personalized learning experiences and tailored feedback. This offers the possibility of fostering strong students while helping weaker students. Hence, it could make education fairer. Nevertheless, monitoring students can be considered critical, particularly when students are surveilled by collecting data via biosensors [8], drilled to finish exercises in a certain amount of time [1], or when the main goal is increasing concentration [9] without a reflection on the learning goals. However, the educational ideal behind these implementations is hardly reflected or investigated in terms of how it influences the perceived acceptance of such AI technology in the classroom.

The two main conceptions of education in a university setting are humanistic and competence-based. The latter has largely roots in England, Canada, Australia, and the USA, where the formulation of learning outcomes fits professional practice needs [10, p. 260]. The former was adopted under a Humboldtian ideal of education in the early nineteenth century in universities and has similarities to the liberal arts education in the anglophone world. Nevertheless, the so-called "Bologna Process" has been a step toward a more competence-based education in Europe. Even though the conceptions of education and their differences are usually discussed in handbooks about pedagogy [11–13], the actual focal point where their differences grow more acute is in the educational visions of universities. Some have adopted explicitly a competence-based approach to teaching and education [14–19], while others emphasize their humanistic roots [20, 21] or a liberal arts approach [22–25].

Humanistic education, on the one hand, is process-oriented, reflexive, and transformative [11, p. 73], [12, p. 74], [13, p. 16]. The learner should develop freely to gain an understanding of herself and the world [11, p. 68]. On the other hand, competence-based education emphasizes learning outcomes [11, p. 73] and is practice-oriented [26, p. 258]. It can be understood as a functional means to achieve an external end: to acquire competencies or learning goals

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and, ultimately, a certification that prepares for professional life. It might also seem that technological implementations in a competence-based education could be easily integrated because they can help reach a particular learning outcome. In contrast, humanistic education emphasizes human interaction and might dismiss technological implementations like chatbots or learning platforms.

The opposing educational ideals also raise ethical challenges and are highly debated, as different value commitments play a crucial role. Humanistic education emphasizes the development of autonomous selves as the ultimate goal of education, with critical thinking and judgment as key components. From a humanistic point of view, competence-based education is accused of reducing education to preparation for professional life. Conversely, advocates of competence-based education tend to focus more on competencies such as problem-solving, which can be acquired by integrating AI-based systems. This is done, for example, in so-called "smart learning environments," which are enriched with technologies to analyze and react to learners [27, p. 139/140]. It has also been proposed to use biosensors to collect data from the learners [8, p. 709]. Such smart learning environments, on the one hand, pose a threat to the learner's privacy by offering tools for surveillance. Advocates of humanistic education might consider the guidance that these systems provide to learners as threats to learners' autonomy undermining their self-determined human judgment. On the other hand, advocates of competence-based education might view the provision of personalized feedback as a way to increase learners' autonomy by guiding them, for instance, through different writing tasks [28, 29]. Some have proposed recommendation systems for literature searches, where a "teacher-centered education" could shift to a "peer-centered education" [30, p. 208].

"Explainable AI" in educational applications is used to increase trust in AI-based systems, by providing "transparent" systems [31] or to make system's decisions understandable [32], This could also be seen as increasing learners' autonomy because transparency and understandability might enable learners to adjust their learning goals in accordance with the available options provided by the systems, for instance, choosing a specific learning path on a platform. However, it has been observed in other contexts that explainability and transparency do not always increase trust [33, 34]. This must also be investigated further in the context of education. Another aspect to account for learners' autonomy is the focus on human-centred design that gives stakeholders agency in shaping digital tools and thereby increasing the chances that these tools are organizationally acceptable and ethically sound [35]. Participative design may thus be another way to foster trust in AI-based systems. Although AI-based systems seem to offer a promising point of connection for competence-based education, their perceived usefulness within a humanistic ideal of education must be further scrutinized.

In this study, we therefore wanted to test rigorously whether the conception of education influences AI acceptance. We investigated whether participants consider either a humanistic conception of education or a competence-based conception more suitable for implementing an AI-based platform at a university.

The study centers on participants' conviction that a particular conception of education would be more accepting of AI. Measuring the impact of educational ideals on AI acceptance in learning environments could provide valuable insights into how people conceive of this technology in general and how it could be meaningfully used in educational contexts in particular. Usually, the acceptance of technology revolves around the "perceived usefulness" and the "perceived ease of use" as the "fundamental determinants of user acceptance." ("Technology Acceptance Model") [36]. That different philosophical ideals about how people should acquire knowledge might influence attitudes toward AI was previously neglected in the literature. In closing this research gap, we hope to help draw a more nuanced picture of the suitability of AI in learning environments.

Although the "Technology Acceptance Model" [36] has been extended to account for social influences [37, 38], it remains merely on a descriptive level. Technology ethics, on the other hand, is mainly concerned with the normative dimension of technology [39–41]. The widespread use and acceptance of generative AI among students in educational contexts imply that factors such as "perceived ease of use" are obsolete. However, normative factors determining the acceptability of applications are of utmost importance, since the learner's autonomy is ethically at stake; therefore, a more differentiated concept of autonomy is needed to yield ethically acceptable applications in the field of education [42]. Still, the educational ideals are also normative conceptions that must be taken into account.

This paper proceeds as follows. In the second section, we will present the method and results of our first and second empirical study, respectively. The third section will discuss some implications of our findings and conclude.

2 Study 1: The impact of AI usage on the educational conception

Our first study investigated whether participants would be more likely to ascribe a certain educational conception to a fictitious person, if this person would decide for implementing an AI-based learning platform or against it, respectively. Participants were recruited via Cloud Research's Prime

Panels [43]. We pre-registered Study 1 on aspredicted.org (https://aspredicted.org/smhm-tgnx.pdf).

2.1 Study 1: Method

After giving informed consent, all participants read a short description of a humanistic and competence-based conception of education. The text for the humanistic educational concept was inspired by educational visions posted on webpages of several universities and read as follows.

> "The main idea of the long tradition of humanism is that one has the liberty to set one's own goals. This autonomy asks for constant self-reflection. The task of the university is to realize this humanistic idea of education. It is shaped by liberty, trust, and the intellectual curiosity of the people, who solve problems through dialogues. Education is yielded by the forming power of the whole human. Beginning in the classroom with exposure to new ideas, new ways of understanding, and new ways of knowing, students embark on an educational journey of intellectual transformation. Education expands our horizons, develops our capacities, deepens our humanity, and creates thus conditions for social transformation."

The text for the competence-based education concept was again compiled of educational visions from several university webpages and read as follows.

> "At the university all teaching and learning is centered around the skill set students are expected to acquire by the time they graduate. Its objective is to provide a comprehensive training and improve the competitiveness of students in their professional field to enable them to become the leaders who will face the challenges and opportunities of the 21st century. By means of well-crafted instructional units with transparent learning outcomes the learning experience is optimized and personalized. The development of disciplinary competences implies a gradual construction that starts from the fundamental competences and ends with the final competences of the discipline. The nature of teaching required to achieve the learning outcomes defined in competency profiles must go beyond conveying the distinct content of individual modules."

In the next step, the participants read a short text about a university president who needs to decide in favor or against the implementation of an AI-based platform. This text is reprinted in the box below.

> "Christine Müller is the president of a university in Germany. A committee has proposed two options to improve teaching. Unfortunately, both options are very cost-intensive. Due to the limited resources of the university, only **one** of the options can be chosen
>
> The committee proposes the following options:
>
> **Option 1:** Learning platform based on artificial intelligence:
>
> A learning experience platform based on artificial intelligence will be developed as part of a research project. The aim is to support students digitally in self-study in addition to classic university teaching. On this platform, lecture recordings, instructional videos, or podcasts can then be converted into text, indexed, and made searchable. In addition, an AI tutor will interactively recommend teaching material to students and set exercises. This is intended to enable dynamic monitoring of learning objectives that adapts to the students' individual learning progress. This platform is intended to create a personalized learning environment
>
> **Option 2:** Increase in teaching and library staff
>
> More teaching staff are to be hired to teach students in smaller groups. This is intended to allow better mentoring for students, who will thus have more direct contact with the lecturers. Furthermore, the number of staff in counseling is also to increase. This should enable students to be better oriented in their studies. The opening hours are to be extended in the library, and courses in scientific work are to be offered."

What participants saw next depended on the experimental condition. In one condition, participants were shown the president's decision in favor of implementing the AI-based platform. In the other condition, the participants were shown the president's decision against implementing it. Participants were randomly assigned to one of two experimental conditions with equal probability. After showing the decision, the participants were asked which conception of education they thought the president would favor.

Specifically, our dependent variable was the strength of participants' conviction that a certain conception of education would be (more) suitable for implementing an AI-based platform. Conviction was measured via a slider ranging from the pole of "a more humanistic conception of education" (slider takes value of 0) to the pole of "a more competence-based conception of education" (slider takes value of 100).

We also included several control variables measuring participants' agreement with several statements on a Likert scale ranging from 1 ("I strongly disagree") to 5 ("I strongly agree"). Statements related to AI, in general (e.g., "AI might take control of people" or "I think AI is dangerous"), and to the use of AI in education, in particular (e.g., "AI can provide new opportunities to improve education" or "AI in education dehumanizes education").

2.2 Study 1: Results

Of the 321 participants, 215 (67.0%) were able to answer the control question of whether the university president decided in favor or against the AI-based learning platform correctly. The correct answer depended on the condition to which they

had been assigned. These participants were included in our analysis.

Participants signaled their conviction that the university president would favor a given education conception on a scale from 0 to 100. The minimum value of 0 represented a humanistic ideal, while the maximum value of 100 represented a competence-based ideal.

In the condition in which participants were told that the president had decided for implementing an AI-based learning platform, participants selected a mean value of 70.12 (sd = 27.80). In the other condition, in which they were told that the president had decided against the platform, participants selected a mean value of 43.62 (sd = 34.30). The difference between these values is statistically significant ($p < 0.001$, unpaired t-test). This implies that participants who had been told that the president had implemented an AI-based learning platform were clearly more likely to ascribe to her a competence-based educational ideal rather than a humanistic ideal than those who had been told that she had decided against implementing the platform. The latter tended to ascribe to her a humanistic ideal. The condition-dependent effect is visualized in Fig. 1.

This result is confirmed by the linear regression in which we regressed participants' conviction on the experimental condition as well as several control variables. Controls included participants' general attitudes toward AI and toward AI in education, the question of whether they had ever been inspired by at least one of their teachers and answers to some demographic variables. As can be seen in Table 1, the experimental condition turned out to have a significant influence, while none of the control variables did.

2.3 Study 2: The impact of the educational conception on AI usage

In Study 2, we tested the robustness of the findings obtained in Study 1. While Study 1 tested the impact of a given AI usage or non-usage on the president's presumed educational ideal, Study 2 tested the impact of a president's given educational ideal on her presumed decision for or against implementing AI. Participants were also recruited via Amazon Mechanical Turk. Subjects who had already participated in Study 1 were excluded from participating in Study 2. We pre-registered Study 2 on aspredicted.org (https://aspredicted.org/pdzj-rwp7.pdf).

2.4 Study 2: Method

Methodically, Study 2 reversed the independent variable and the explanatory variable of Study 1. The information that participants received in the beginning was identical. All participants read a short description of a humanistic and competence-based conception of education, just like in Study 1. Then, the participants read the same short text about a university president who needs to decide for or against the implementation of an AI-based platform used in Study 1. Participants were then again randomly assigned to one of two experimental conditions with equal probability.

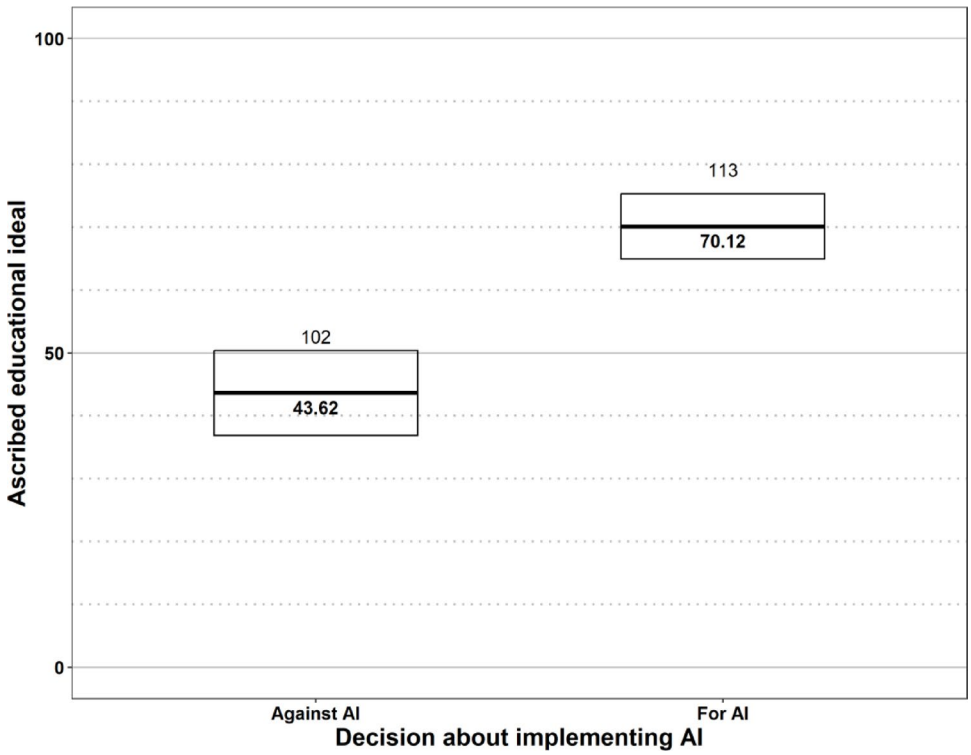

Fig. 1 Educational ideal ascribed to president depending on whether she decided for or against implementing AI. *Note*: Plotted are mean convictions that president adheres more to a humanistic educational ideal (0) or to a competence-based educational ideal (100), along with the 95% confidence intervals. The numbers of observations figure above the boxes

Table 1 Regression of conviction that the president is more likely to adhere to competence-based as opposed to humanistic ideal

	Estimate	Std.Error	t value	p
(intercept)	59.28	17.94	3.30	**0.001**
decision for AI	26.49	4.47	5.93	**<0.001**
AI has positive impact	− 6.67	3.61	− 1.85	0.066
AI is useful	4.07	3.33	1.22	0.222
AI is dangerous	2.06	2.94	0.70	0.485
AI spies on people	1.84	2.56	0.72	0.474
AI might rule humanity	− 1.76	2.44	− 0.72	0.472
educ AI is improvement	0.60	4.26	0.14	0.888
educ AI should grade	0.44	2.82	0.16	0.875
educ AI I would use it	− 2.33	3.30	− 0.71	0.480
educ AI should evaluate progress	2.40	2.98	0.81	0.421
educ AI should create exercises	− 1.32	2.98	− 0.44	0.659
teachers inspired me	− 3.19	2.03	− 1.57	0.117
age	− 0.90	1.43	− 0.63	0.533
gender	6.68	4.83	1.38	0.169
education	− 2.42	2.33	− 1.04	0.301

"decision for AI" is a dummy ("1" = yes, "0" = no); gender was treated as dummy, because only two genders were selected ("0" = female, "1" = male); bold p-values denote statistical significance at the 5% level ($p < .05$)

From this point on, Study 2 differed from Study 1. In one condition, participants were now informed that the president favors a humanistic conception of education. In the other condition, participants were informed that the president favors a competence-based conception of education.

After showing the president's favored educational ideal, participants' were asked which action they thought the president would likely take: implementing an AI-based learning platform or increasing staff and faculty. Hence, the dependent variable of Study 2 was the strength of participants' conviction that a certain action was taken to improve teaching at a university. This conviction was measured via a slider ranging from the pole of "investing in teachers, tutorials, and longer opening hours of the library" (slider takes the value of 0) to the pole of "implementing an AI-based learning platform" (slider takes the value of 100).

2.5 Study 2: Results

Of the 315 participants, 235 (74.6%) were able to answer the control question of whether the university president favored a humanistic or competence-based educational concept. The correct answer depended again on the condition participants had been assigned to. These participants were included in the following analysis.

Participants signaled their conviction that the university president would likely introduce one or the other measure to improve teaching on a scale from 0 to 100. The minimum value of 0 represented investing in staff and faculty, while the maximum value of 100 represented implementing an AI-based learning platform.

In the condition where participants were told that the president favored a humanistic educational ideal, participants' selected a mean value of 34.93 (sd = 34.49). In the other condition, in which they were told that the president favored a competence-based educational ideal, participants selected a mean value of 52.97 (sd = 34.10). The difference between these values is again statistically significant ($p < 0.001$, unpaired t-test). This implies that participants who had been told that the president favored a competence-based ideal were more convinced that she would decide to invest in AI rather than staff and faculty than those who were told that she favored a humanistic ideal. This condition-dependent effect is visualized in Fig. 2.

This result is also confirmed by the linear regression in which we regressed participants' conviction on the experimental condition as well as the control variables that we already used in Study 1. As can be seen in Table 2, the experimental condition turned out to once more have a significant influence on participants' conviction, while only one of the control variables did. This was participants' agreement with the statement that AI should be used to evaluate students' progress. The more participants agreed with this statement, the more they tended to be convinced that the president would favor the AI platform over investing in staff and faculty.

3 Discussion

We find in two empirical studies with different study participants that there exists a clear correlation between the conception of education and the acceptance of AI-based technologies. In particular, universities that are coined by a humanistic ideal of education seem less appropriate for implementing AI-based learning platforms than universities coined by a competence-based ideal of education. Our findings indicate that the acceptance of AI in education might depend not only on technical factors like predictive performance or design features like the specifications of the student-AI interface but also on social factors beyond mere technological development and deployment or user-experience research.

Our results have several practical implications. They suggest that implementing AI-based systems in learning environments might depend strongly on the vision of universities about teaching and education. This relationship has hitherto mainly been neglected in the research on AI in learning environments. Our results have several implications for different stakeholders. First, university leaders are well-advised to explicitly acknowledge the different educational

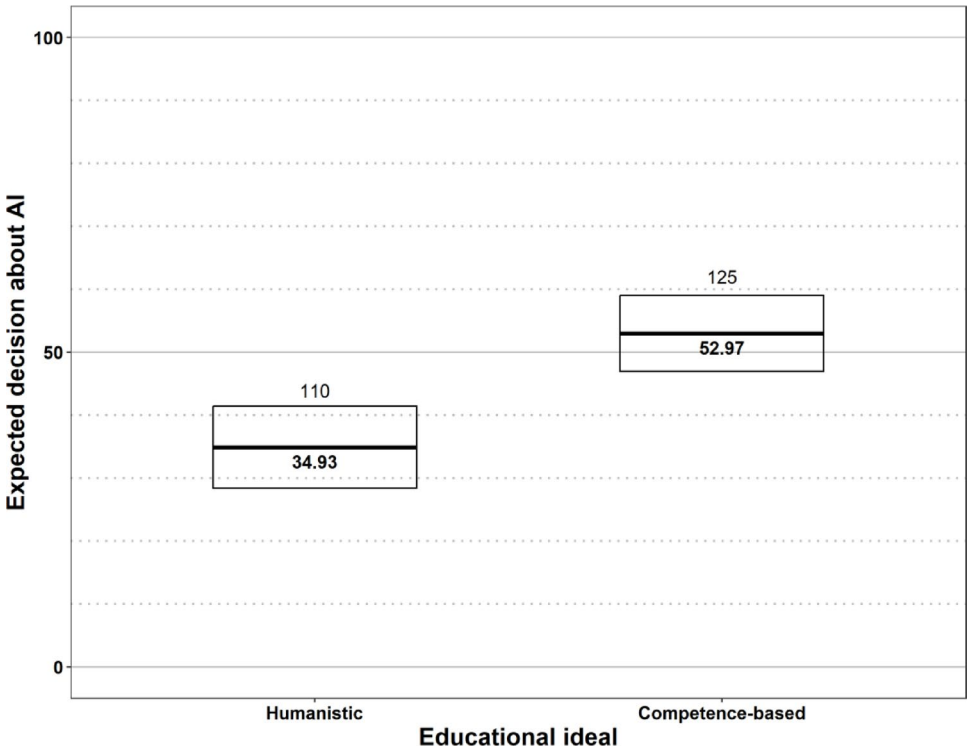

Fig. 2 Decision about AI expected from president depending on whether she adheres to a humanistic or competence-based educational ideal. *Note*: Plotted are mean convictions that president will decide for investing in staff and faculty (0) or for implementing an AI-based learning platform (100), along with the 95% confidence intervals. The numbers of observations figure above the boxes

Table 2 Regression of conviction that president is more likely to implement AI-based learning platform as opposed to invest in staff and faculty

	Estimate	Std.Error	t value	p
(intercept)	27.49	17.45	1.58	0.117
humanistic ideal	− 19.42	4.44	− 4.37	**< 0.001**
AI has good impact	4.21	3.86	1.09	0.277
AI is useful	− 2.55	3.72	− 0.69	0.494
AI is dangerous	0.85	2.95	0.29	0.775
AI spy on people	0.45	2.80	0.16	0.872
AI rule humanity	− 1.04	2.46	− 0.42	0.672
educ AI is improvement	1.46	3.81	0.38	0.702
educ AI should grade	− 3.40	2.84	− 1.20	0.233
educ AI I would use it	− 0.55	3.53	− 0.16	0.876
educ AI should evaluate progress	8.36	2.95	2.83	**0.005**
educ AI should create exercises	3.43	2.88	1.19	0.235
teachers inspired me	1.74	2.00	0.87	0.386
age	− 1.45	1.44	− 1.01	0.316
gender	− 2.64	4.55	− 0.58	0.563
education	0.17	2.90	0.06	0.953

"humanistic ideal" is a dummy ("1" = yes, "0" = no); gender was treated as dummy, because only two genders were selected ("0" = female, "1" = male); bold p-values denote statistical significance at the 5% level ($p < .05$)

ideals by explaining in their mission statements and strategy papers how they see the contribution of AI in fostering their respective goals. This will also include the drawing of clear boundaries. Including stakeholders with diverse viewpoints concerning educational ideals in the generation of such AI guidelines will help to foster a human-centred design. Such a participative strategy will also be likely to mitigate resistance against the developed concept of AI integration. Second, designers seem well-advised to develop customizable tools that can be tailored to educational preferences. In this sense, advocates of a humanistic ideal might prefer a reflexive mode that asks questions and offers advice on advanced readings, while advocates of a competence-based ideal might prefer structured exercises with direct feedback. Making systems customizable allows educators to tailor the tool to their educational preferences. Third, policymakers are well-advised to avoid considering AI in education as a mere tool to promote efficiency. Political funding calls should thus explicitly address aspects of both educational ideals and also require applicants to explicate how their projects will help to strengthen critical thinking and the facility of judgment through AI use. Furthermore, funding should not only be steered into the tools themselves but also into programs that train educators in the critical use of AI in teaching.

There are several limitations of our study. One limitation relates to the fact that the obtained results might be contingent on the German sample used in this study. It is crucial to investigate whether our results carry over to other cultures. Moreover, our study focused on higher education by solely considering a university context. It would be interesting to include lower levels of education in which different intuitions might prevail. Testing the robustness of our findings in diverse cultures and at different levels of education seems

important given that (over-)trust [44] and mistrust or aversion [45] toward AI-based systems seem highly dependent on the context, as inconsistent conclusions regarding trust in AI demonstrate. Finally, it should also be noted that our experimental findings are based on one specific context in which a tradeoff between the implementation of an AI system and the hiring of personnel was described. Further studies will have to test whether the observed relationship between educational ideals and AI acceptance expressed by the addressing of this tradeoff robustly carries over to other educational contexts, i.e., the generalizability of our findings has yet to be challenged.

Appendix: On-Screen Instructions (translated from German)

Screen 1:

"The main idea of the long tradition of humanism is that one has the liberty to set one's own goals. This autonomy asks for constant self-reflection. The task of the university is to realize this humanistic idea of education. It is shaped by liberty, trust, and the intellectual curiosity of the people, who solve problems through dialogues. Education is yielded by the forming power of the whole human. Beginning in the classroom with exposure to new ideas, new ways of understanding, and new ways of knowing, students embark on an educational journey of intellectual transformation. Education expands our horizons, develops our capacities, deepens our humanity, and creates thus conditions for social transformation."

Screen 2:

"At the university all teaching and learning is centered around the skill set students are expected to acquire by the time they graduate. Its objective is to provide a comprehensive training and improve the competitiveness of students in their professional field to enable them to become the leaders who will face the challenges and opportunities of the twenty-first century. By means of well-crafted instructional units with transparent learning outcomes the learning experience is optimized and personalized. The development of disciplinary competences implies a gradual construction that starts from the fundamental competences and ends with the final competences of the discipline. The nature of teaching required to achieve the learning outcomes defined in competency profiles must go beyond conveying the distinct content of individual modules."

Screen 3:

Christine Müller is the president of a university in Germany. A committee has proposed two options to improve teaching. Unfortunately, both options are very cost-intensive. Due to the limited resources of the university, only **one** of the options can be chosen

The committee proposes the following options:

Option 1: Learning platform based on artificial intelligence:

A learning experience platform based on artificial intelligence will be developed as part of a research project. The aim is to support students digitally in self-study in addition to classic university teaching. On this platform, lecture recordings, instructional videos, or podcasts can then be converted into text, indexed, and made searchable. In addition, an AI tutor will interactively recommend teaching material to students and set exercises. This is intended to enable dynamic monitoring of learning objectives that adapts to the students' individual learning progress. This platform is intended to create a personalized learning environment

Option 2: Increase in teaching and library staff

More teaching staff are to be hired to teach students in smaller groups. This is intended to allow better mentoring for students, who will thus have more direct contact with the lecturers. Furthermore, the number of staff in counseling is also to increase. This should enable students to be better oriented in their studies. The opening hours are to be extended in the library, and courses in scientific work are to be offered

Screen 4:

Condition 1:

President Christine Müller has decided in favor of the AI-supported learning platform and against increasing the number of teaching staff

Condition 2:

President Christine Müller has decided to increase the number of teaching staff and against the AI-supported learning platform

Screen 5:

Recall the mission statements of the two universities. What mission statement do you think the president adheres to?

Move the slider to the right or left to see which model the president is more likely to represent

0	100
Humanistic conception	Competence-based conception

Study 2:

Screens 1 to 3 are the same as in the first study.

Screen 4:

Condition 1:

President Christine Müller adheres to a competence-based idea of education

Condition 2:

President Christine Müller adheres to a humanistic idea of education

Screen 5: Slider task

Recall the options for improving teaching. In your opinion, which measurement does the president decide on because of her educational idea?

Move the slider to the right or left to see which action the president chooses

0	100
Increasing staff	Learning platform based on AI

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Data availability Data will be made available upon reasonable request.

Declarations

Competing Interests The authors declare no competing interests.

Ethical approval Ethical approval for the studies was obtained from the German Association for Experimental Economic Research e.V. (Institutional Review Board Certificate No. D8BPNocs). Furthermore, all participants provided informed consent before participating in the studies.

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