AI in Education, Research, and Innovation

DSI Strategy Lab 2023—Position Paper

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The DSI Strategy Lab

This position paper was developed as part of a workshop held from August 20 to 22, 2023 on the Weissenstein (near Solothurn) as part of the Strategy Lab of the Digital Society Initiative (DSI) of the University of Zurich (UZH). Beside the authors of the position paper also Christian Busch and Johannes Mure from the State Secretariat for Education, Research, and Innovation (SERI) took part in the workshop. Scenarios and recommendations for the use of AI in education, research, and innovation were developed at the workshop. This account of the workshop recommendations was drafted by the authors through a multi-stage process.

As part of the DSI Strategy Lab, a survey of UZH students was developed and conducted with the collaboration of doctoral students from the *DSI PhD Excellence Program* and other UZH departments. Some of the survey results form part of this position paper.

The recommendations in the position paper are divided into three categories that relate to three areas: “learners,” “teachers,” and “researchers.” For each category of recommendations, the respective addressees from education policy, administration, universities, and other potential stakeholders are named. The boxes in each category section contain further relevant information. The final editing of the position paper was undertaken by Abraham Bernstein, Markus Christen, and Judit Martinez Moreno.

Each year, the DSI Strategy Lab focuses on a specific area of digital transformation and develops conceptual analyses and strategic scenarios for future developments in digital change. Further information on this and other DSI Strategy Labs can be found using the following link: https://www.dsi.uzh.ch/en/research/projects/strategy-lab.html.

1 Recommendations on the Topic "Learners"

AI Scenarios for Learners
The use of widely accessible AI tools in studying has become a reality. In a survey of UZH students conducted in March 2024, 97% of the 926 respondents indicated having had experience with AI tools; for example, in the six months prior to the survey, 90% had used ChatGPT and 77% had used the translation tool DeepL. With regard to the longer-term impact of AI use by university students, the following scenarios were discussed during the DSI Strategy Lab workshop:

- *The use of AI tools can reinforce the "digital divide"*: While strong students benefit much more because they critically question the answers given by AI, weak students could be left behind.
- *The writing process can be disrupted:* Writers lose self-confidence when they feel in competition with AI. Their ability to develop and write text can also increasingly be lost (e.g., because of increased learning via graphics), which can further impact the learning process.
- *AI as a study partner:* The AI-Buddy scenario is separately described below.

Based on these scenarios, recommendations were developed that relate to the AI skills that students need in advance of using AI for their studies and the aim to restructure university learning spaces.

General note: The recommendations in the "Teachers" and "Learners" categories are partly complementary or mutually dependent.

1.1 AI skills for all students

The aim of this recommendation is to ensure that the importance and impact of AI tools for researching, analyzing, structuring, classifying, and generating knowledge content is addressed in all university subjects, that the potential of the resulting teaching and learning scenarios is didactically implemented in corresponding courses and students are enabled to use them.

The implementation of this recommendation should be accompanied by the following activities:

- Students acquire the understanding and necessary skills to use AI tools that are relevant to them as well as the outlined integrative tools (e.g., AI-Buddies). Universities offer interdisciplinary courses in which students learn how to use the relevant tools.
- Cooperation with future stakeholder groups (e.g., employers, etc.) to define the knowledge components of study programs will be strengthened while preserving the freedom of teaching and research.
- Universities support lecturers and those responsible for study programs in exploring the possibilities and limits (in terms of content, didactic ethics, and legal nature) of using AI tools for performance assessment (including in examinations).

The addressees of this recommendation are in particular the Vice Rectorates responsible for teaching and studying as well as the office of student affairs of the faculties of the respective universities.

The AI-Buddy

The term "AI-Buddy" refers to an AI system that is intended to accompany university students throughout their studies and offers various functions to support their academic success.

In a survey conducted among UZH students in March 2024, the AI-Buddy was described as a digital companion that should fulfill the following functions:

1. *Provide knowledge:* Help students access a variety of educational resources from the university's offerings, including courses, videos, literature, and more.
2. *Advice on the study plan:* Customized academic planning advice based on the student's individual academic goals and preferences.
3. *Networking:* Connecting with peers with similar academic interests for collaborative learning and study groups.

In the UZH survey, 64.5% of respondents (926 students) stated that they would probably use such an AI-Buddy if it were offered by UZH. The focus here is on functions in the areas of "providing knowledge" and "advising on study plans" (the usage rates for individual functions were between 58% and 78%), rather than the area of "networking." Students also indicated a high willingness to share academic data (e.g., study documents, timetables, learning preferences, grades, etc.) with an AI-Buddy. Students also desired that AI be used primarily as a personal tool, not as a tool for university administrative or grading purposes.

1.2 An AI-Buddy for every student

This recommendation aims to ensure that every student at a university[1] can have an AI-Buddy who not only serves to impart knowledge but also accompanies a student through their studies as a discussion and sparring partner.[2]

The AI-Buddy[3] particularly serves to impart knowledge to students from various university sources and reputable external sources (courses, texts, videos, etc.) to advise them in putting together an individual educational path (or curriculum), and to help them network with peers with similar, complementary (study) interests and skills (e.g., for learning groups). In addition, the AI-Buddy is intended to support students in evaluating and tailoring knowledge and skills to their individual needs and making recommendations for further knowledge content based on this.

The implementation of this recommendation should be accompanied by the following activities:

- An "as is" market analysis is conducted in universities to record and evaluate currently existing solutions regarding AI-Buddies and the functionality required by an AI-Buddy.
- Internal university initiatives that have content-related or technical links to a future AI-Buddy are bundled together (in the case of UZH, this could be E-Pass or the Social Student Network)

[1] The question of to what extent an AI-Buddy should be designed and implemented within universities (nationally, internationally) is still under debate. In view of the present recommendations, however, AI-Buddies should primarily be implemented within university (as a prototype), as coordination issues can lead to long delays.

[2] It is quite conceivable that AI-Buddies can already be used in schools and could one day accompany a person throughout their life (i.e., lifelong learning). However, such a scenario is beyond the focus of this position paper.

[3] While we only refer to a single AI-Buddy here, this could be several AIs working together. Whether these are presented to the students as one actor or several actors needs to be explored before implementation of the AI-Buddy program.

- The offer is developed step by step through participative in-house *development* (e.g., realization of the individual features one after the other, modular implementation with the involvement of teachers, students, and IT/administration).
- Legal issues (e.g., regarding the status of study recommendations by an AI-Buddy) are clarified in parallel with implementation.
- The implications of using an AI-Buddy both for the universities themselves and for the social environment are to be determined.

The addressees of this recommendation are (in the case of UZH) the Executive Board of the University and the committees involved in the UZH digital strategy. However, other higher education institutions such as swissuniversities are also addressed.

1.3 Restructuring of university learning spaces

To compensate for the increasing individualization and "virtualization" of university learning (e.g., through AI-Buddies), the university must be reimagined as a space for interaction in social learning relationships—between learners, lecturers, and the wider public. In particular, the mixing of synchronous exchange—whether in person or remotely—and asynchronous individual study and group work should also be taken into account.

This should be accompanied by a reassessment of the spatial organization of universities as a whole and the effects on disciplinary structures. Even if this reassessment is still pending, at least the following aspects are necessary and seem to already be emerging:

- Instead of lecture halls, more IT-smart rooms should be created for small group work and workshop settings in which hybrid working and the use of augmented reality are also possible.
- Where lecture halls are still being used, they should be created less for frontal instruction teaching and more for discussion-led teaching—as in the case study method, for example—and arenas where everyone can see one another.
- Architecturally, a university should be conceived as an "agora"—a marketplace for intellectual exchange between students and teachers—with corresponding public spaces for the social exchange of various stakeholder groups.
- In terms of content and structure, interdisciplinary and individualized work and research should be given a central place.

The addressees of this recommendation are university management in particular (in the case of UZH, the Vice-Rectorate for Teaching and Studies, and the Directorate for Real Estate and Operations), the relevant university office, and the office of student affairs of the respective faculties.

2 Recommendations on the Topic “Teachers”

AI Scenarios for Teachers

An often-heard cliché is that younger generations can adapt to digital technologies much more quickly than those who are supposed to train this generation in the use of such technologies. Even if the reality is more complex in this respect, the new AI tools would undoubtedly pose a major challenge for university lecturers. The aforementioned 2024 survey of UZH students, for example, showed that only 14% of students received knowledge and skills on AI tools from UZH lecturers; the more important sources were online learning resources (89%) or fellow students (48%). This indicates that lecturers are currently not viewed by students as the primary contact for acquiring skills in the use of AI tools.

As part of the workshop, scenarios were developed for teaching staff that, as with the “Learners” topic, were not geared towards immediate challenges (e.g., avoiding examination fraud), but concerned aspects that are relevant in the longer term. The following scenarios were discussed:

- The teaching of AI tools is likely to require *new types of courses*. Instead of large lectures, taught content may migrate to the online area, and small events with project-based learning will gain importance.
- AI is becoming increasingly important in *self-study* (see the AI-Buddy discussion in Section 1.2), so the teaching of learning content will increasingly take place through the interplay of classroom teaching and AI-controlled learning at home. Due to the increasing importance of self-study, students will also work in groups on specific issues and assess each other.
- *Interdisciplinary learning* will generally gain in importance, which may lead to teachers working together more on an interdisciplinary basis.
- AI will enable *project- and experiment-oriented teaching* in subjects where this was previously not possible due to a lack of experimental environments.
- In the future, an *AI tutor* (as a sub-function of an AI-Buddy) may not only organize courses but also impart learning content. This could lead to a breakdown of course and possibly faculty boundaries, and in extreme cases, to the dissolution of traditional courses. Instead, a degree course would be completed when a sufficient skills repertoire has been achieved.

Based on these scenarios, recommendations were developed regarding the relevant skills to be taught in the future, the use of data for the individualization of teaching, and fundamental aspects of the university‘s image and the motivation of teachers.

General note: The recommendations in the “Teachers” and “Learners” sections are partly complementary or mutually dependent.

2.1 Systematically check which skills are "AI-hard" (i.e., should endure in the face of continued AI use)

University disciplines and degree programs must systematically and continuously examine which of the competencies and skills taught might be taken over by AI systems in the foreseeable future and which might not (i.e., which skills are "AI-hard"), and what this means for future teaching content.

It should be noted that the ability of AI to take over certain functions and skills does not automatically mean that they will be removed from the curriculum. For example, it may well make sense for cognitive development and the acquisition of skills learning to also address skills covered by AI (just as mental arithmetic is still taught at school).

Which Human Abilities Should be Retained?

A fundamental insight is that every technical aid increases human-tool-combination capabilities, but potentially reduces those of humans alone (therefore, *every augmentation is an amputation*, according to Marshall McLuhan[4]). For example, navigation apps make it possible for humans to find their way around unknown places, but to some extent, they lose their "natural" sense of direction. As AI can take over important functions in what are considered to be "primal human" abilities—such as learning, hypothesizing in research, or creative idea generation—this raises questions of whether humans could increasingly lose these abilities, or which abilities humans should be retained so that, for example, the work of AI systems can still be accurately assessed.

During the workshop, the following skills were, among others, described as "AI-hard," i.e., skills that should undeniably be retained in (university) education (this list is not considered to be complete):

- *Basic technical skills:* In addition to a basic understanding of how AI technology itself works, basic technical skills include the ability to use technology for inspiration, motivation building, and solution space exploration; being able to handle the output of AI tools (data, text, etc.); being able to use AI technology for collective and asynchronous work; and being able to assess the limitations of the technology.
- *Socialization skills:* To counteract the tendency for AI technology use to lead to student isolation, skills such as social learning, empathy, resilience, and effective teamwork need to be fostered. This also requires an understanding of and reflection on ethical values and scientific ethos.
- *Critical thinking:* To ensure that AI tools are not used unquestioningly (e.g., to prevent automation bias), critical discourse and critical thinking in models and abstractions, and the ability for multi-perspective cognition and analysis, must be promoted among students. This also includes the ability to "meta-reflect" (i.e., to reflect on the methodology of reflection itself).
- *Acting under uncertainty*: To address the speed of technological progress (and also known global challenges such as climate change), skills must be promoted that make it easier to act under uncertainty. These include training in intuition and abstract problem-solving.

Needless to say, many of the skills mentioned here need to be further formulated and specified and are discussed in the following recommendations.

[4] https://quotecatalog.com/quote/marshall-mcluhan-every-extension-X7qE4A7/

The implementation of this recommendation should be accompanied by the following activities:

- Degree programs evaluate their catalogs of taught methodological skills (e.g., writing texts, data analysis, programming, information procurement, evaluation, classification, etc.) with regard to the probability that AI systems could implement these functions in the future.
- This analysis must take into account which of these skills must be taught for didactic reasons, for example, or so that students can interact appropriately with future AI tools. This includes both the dialogical cooperation skills that will probably be in demand in the future, as well as the more direct skills of operating AI and being able to adequately assess, classify, and reuse its results.
- Based on the results of the analysis, the corresponding curricula, teaching formats, and learning objectives should be successively and continuously adapted and lecturers should be trained and supported accordingly.
- It should be noted that these adjustments may also have structural effects on the university as a place of teaching and learning (see also Section 1.3).

This recommendation is ***addressed*** in particular to the office of student affairs, the UZH Vice-Rectorate for Teaching and Studies, and comparable institutions at other universities.

2.2 Increased integration of student data for the individualization of teaching

The database on students' competencies (including knowledge and skills) is to be significantly expanded beyond the pure act of the examination (which conceptually has only a very few data points) and made more accessible to the learning partners (i.e., learners and teachers). This will make it possible to better record the competencies, educational preferences, and wishes of students in the light of learning objectives and to determine which learning elements are conducive to learning success, which can form the basis for (individualized) educational pathway design. However, it should be noted that excessive individualization of learning can also lead to isolation and fragmentation of student groups.

The implementation of this recommendation should be accompanied by the following activities:

- AI tools should be created that allow *teachers* to use the above-mentioned database to identify students' strengths and weaknesses in such a way that they can be optimized or minimized through more individualized teaching. This will also require appropriate training for teachers.
- Create AI tools that will enable *learners* to use the above-mentioned database to identify their strengths and weaknesses and support them in their educational pathway planning.
- Parallel to the creation of AI tools, corresponding data from students and teachers should be examined to identify how it can be used in accordance with data protection regulations to improve learning success. This may mean adapting university regulations on data protection to enable further use of this data for the benefit of students (with a possible opt-out option).

The addressees of this recommendation are in particular the management of the respective university and the (cantonal) legislation (data protection).

2.3 Rethinking the educational content and degrees taught at local universities

Universities should systematically examine the content, skills, and competencies taught in their teaching operations to determine whether they should primarily be *taught on-site*, or rather *reflected upon and discussed on-site*. For the pure teaching of content, the extent to which external offerings (such as those from other institutions, YouTube learning videos, etc.) can be integrated into teaching should be examined (AI can play a role here, e.g., in the form of the aforementioned AI-Buddy). The findings of this analysis can then be used and reflected upon in the university context; for example, in interdisciplinary group work. The degrees certified by the university will be adapted to this new structure of educational content in the long term.

The implementation of this recommendation should be accompanied by the following activities:

- Whenever It makes sense, large introductory lectures should be replaced by virtual offerings or flipped classroom formats (distant/online learning), which will be created in-house or purchased externally.
- The degrees/certificates awarded by the university should be modularized and no longer be purely discipline-oriented in every case.

The addressees of this recommendation are in particular the management of the universities and the cantonal and federal legislation (e.g., the Medical Professions Act).

2.4 Change in teachers' motivation and social integration

The partial relocation of teaching to virtual and AI-supported systems will require teachers to adapt, and this must be accompanied by a suitable change in the extrinsic and intrinsic motivation and social integration of teachers.

The implementation of this recommendation should be accompanied by the following activities:

- Teachers and students use the university together as a forum for mutual learning and teaching; where appropriate, this should be with AI-based learning tools (e.g., chatbots participating in discussions as sparring partners). The university promotes the necessary social interactions between teachers and learners (such as the infrastructure for AI-based actors) for the transfer of knowledge and skills. Formats that contribute to the exchange of knowledge and skills between teachers, mutual learning in teaching, etc., should be promoted accordingly.
- Teachers should increasingly be seen as representatives of the university's learning culture.
- Students should already be involved in teaching as self-responsible partners.

The addressees of this recommendation are in particular the management of the universities and the cantonal legislation (Universities Act).

3 Recommendations on the Topic "Research"

AI Scenarios for Researchers

AI tools will undoubtedly have a major impact on research practice in all disciplines—from the generation of data to the analysis of the respective research subject and the presentation of research results. The following scenarios were discussed during the workshop:

- *AI-assisted scientific publishing will become widespread, with long-term effects on the evaluation of research output and careers.* It can be assumed that AI will exacerbate the problem of mass publication in the short term and lead to AI taking a role in the peer review of publications. In the medium term, how results are published will change, with new modalities such as simulations becoming more important. This will also affect the composition of author teams and lead to questions about whether an AI system should be considered as an author (which is currently explicitly not the case; however, this could change as technology progresses). One possible long-term effect is the reassessment of outputs and thus the career criteria of researchers. The idea of the individual genius will become less important; research will increasingly be seen as a matter for collectives.
- *AI is becoming an increasingly autonomous player in the scientific community.* It is already foreseeable that AI will become a central tool for the creation of models and scenarios; this means that researchers will increasingly become assessors instead of the creators of such models. AI is also likely to increasingly recommend relevant scientific questions without prompting. The consequence may be that every researcher will have an AI companion as a permanent partner in the research process, which will result in a new responsibility for researchers: namely, to ensure the validity of AI support.
- *Disruption of research due to the economic scarcity of AI expertise.* It is also foreseeable that the AI specialists urgently needed in research will largely be absorbed by industry. This will increase the dependence of academic research on industry. Rapid innovation cycles in technology are increasingly colliding with long-term research.
- Fundam*ental adjustments to scientific methodology and theory formation.* AI enables new methods for introducing complexity into the subject of research by making broad use of synthesis as a new methodological tool. Researchers must learn how to deal with answers they cannot understand. Ultimately, this will require the development of new metrics for gaining knowledge.

Based on these scenarios, recommendations were developed regarding the use of AI as a research infrastructure, the role of AI in the assessment of research outputs, and the integration of AI into the research process.

3.1 Understanding AI as a critical research infrastructure

Data and the associated AI processes are critical research resources. The corresponding financial and organizational requirements must be seen as critical infrastructure for research activities and universities and are necessary to help create or proactively shape them in collaboration with other (public and private) stakeholders.

The implementation of this recommendation should be accompanied by the following activities:

- Universities are actively involved in developing the framework conditions for trustworthy data spaces and digital self-determination.
- Universities develop joint governance for the data they produce as part of their research activities. In particular, this governance should regulate access to the data for other researchers and the private

sector and distinguish between the different types of use (e.g., academic/commercial). Data protection and security are taken into account.
- Universities are generally committed to ensuring that *open access, open data*, and *open science* are increasingly promoted and that rights of use also exist for data from private parties (in both directions; i.e., private parties also have access to university data). Data protection and security are taken into account.
- Universities promote subject- and discipline-specific solutions that are developed in international collaborations outside the university's direct sphere of influence, provided they meet certain criteria.
- Universities create guidelines for research partnerships with the private sector that are related to analyzing data or developing AI models. These guidelines are intended to help universities:
  - Guarantee scientific freedom and freedom of research;
  - Define the allocation of rights and access to the outputs of these partnerships (the analyses themselves, but also the models created, the know-how developed, the data sets created, the retention rights, and the deletion obligations, etc.);
  - To set an appropriate price for their services.
- Through inter-cantonal and international cooperation, universities ensure that license rights are created for software, infrastructure, and methods of processing, storing, and securing data, and that the provenance of data is also taken into account.
- When collaborating with private companies for the use of critical AI infrastructures, the universities ensure that freedom of research is safeguarded.
- Universities are setting up specialized departments to support researchers in the use of AI. Universities should receive more resources for these activities so that the relevant expertise is also available outside the private sector. Cooperation between the cantons should be strengthened in this regard and finances pooled.

The addressees of this recommendation are in particular the management of the universities and swissuniversities.

3.2 Clarification of the role of AI in the assessment of research outputs

The already high number of publications and other research outputs (data, models, visualizations, etc.) will continue to increase through the use of AI, which will make the integration of AI systems in review and evaluation processes (including research proposals) indispensable. If the use of AI is transparent and controlled, it has the potential to improve the quality of evaluation processes. For this reason, the role of AI in the assessment of research outputs needs to be clarified.

The implementation of this recommendation should be accompanied by the following activities:

- Scientific publishers, funders, and similar stakeholders must make the use of AI in their evaluation processes transparent and comprehensible through independent third parties.
- Particular attention should be paid to naming and clarifying resulting biases in AI methods when they are used in assessment processes (e.g., when AI suggests reviewers, subjects manuscripts to pre-selection, writes assessment texts, etc.).
- In general, such assessments should not be fully automated but should be a mixture of assessments by AI and human expertise.

This recommendation is ***aimed*** in particular ***at*** publishers, universities, and research funding institutions.

3.3 Promote understanding of the impact of integrating AI into the research process

It is foreseeable that AI systems will play a role in the practice of research in a variety of ways. Such systems can already now or in the foreseeable future subject large amounts of literature to meta-analysis, identify research questions, carry out automated analysis, serve as instruments of knowledge (e.g., by

employing models and simulations), co-author publications, etc. This will impact the social practice of research and related aspects such as careers, intellectual property, etc. Precise forecasts are difficult—universities should therefore proactively recognize the mechanisms of these rapid change processes early on to help shape the processes in a timely and targeted manner.

The implementation of this recommendation should be accompanied by the following activities:

- The inclusion of AI in the research process must be declared transparently in the corresponding outputs (publications, etc.); the definition of *good scientific practice* must be adapted accordingly.
- The social effects on productivity and collaboration between researchers and increasingly autonomous AI systems will need to be examined more closely (e.g., with regard to appointment decisions or newly emerging social inequalities in terms of (non-)access to AI tools).
- The issue of intellectual property protection must be reassessed.
- In methodology, the use of AI tools for generating or testing hypotheses, for example, and the epistemological role of synthesis (and not just analysis) in the research process must be addressed and discussed.
- Researchers should be sufficiently informed about the generic limitations of AI tools that support the research process (e.g., bias in the literature search given that the scientific literature corpus before around 1990 is largely not digitized).
- The creation of original data should be promoted so that AI systems have sufficient data material to generate meaningful results.

This recommendation is ***aimed*** in particular ***at*** universities, higher education policy organizations such as swissuniversities, and authorities.

Further information: dsi.uzh.ch/strategy-lab