Assessing students' motivation, learning, and skill transferability in a real-world project: Insights from the ETH Assistive Technology Challenge

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Abstract

Challenge-based learning addresses socially relevant real-world challenges and requires students to work closely together with stakeholders in a highly engaging and interdisciplinary manner. The newly established 'Assistive Technology Challenge' course at ETH Zurich promotes challenge-based learning by exposing Health Sciences and Technology students to diverse disciplines and skills of importance in the field of assistive technology. During the course, the students without an engineering background work together with a person with a physical disability to (co-)develop a personal technical solution for an individual challenge that the person encounters in their own daily life or during leisure activities. This work describes the course format, student assessment, and outcomes of the first edition of the course executed during the spring semester 2024. Further, it describes the outcomes of an online survey collecting students' feedback on the course and investigates how the chosen course format affected the learned competencies and students' motivation. Results show that the course format enabled students to achieve a successful project outcome, promoted high student motivation, and strengthened their competencies in areas expected to be relevant for their future careers.

Introduction

Project-based learning has been shown to result in significant improvements in learning outcomes compared to conventional teaching approaches (Moreno-Ruiz et al., 2019) and to be beneficial for acquiring transferrable competencies such as, e.g., teamwork, communication, problem-solving, and self-directed learning (Sukacké et al., 2022). To maximize students' engagement and learning of such competencies, implementing project-based courses tackling projects in real-world conditions is expected to be highly beneficial (Li et al., 2019). Challenge-based learning even goes one step further by addressing actual real-world challenges. By working collaboratively with relevant stakeholders (e.g., from industry or from the public), students identify, analyze, and design solutions for socially relevant problems in a highly engaging and interdisciplinary manner (Sukacké et al., 2022).

The user-centered design (UCD) process (Abras et al., 2004; International Organization for Standardization, 2019; Norman & Draper, 1986) is a powerful framework for implementing challenge-based learning. An area where UCD is crucial is the development of assistive technologies (AT). AT aim to increase the functional capabilities of people with disabilities, thus increasing their independence and enabling them to engage in various daily and social activities. This is especially important as acceptance of many AT is low, mainly because they do not satisfy the users' needs and show low usability in daily life (Sugawara et al., 2018). Further, a single design is often not suitable for all users of AT. Hence, solutions need to be tailored to individual users (Kintsch & Depaula, 2002) and their individual context of use (i.e., personal needs, preferences, and usage environment). Thus, involving target users throughout the development process is crucial (Shah & Robinson, 2007). However, users are often only

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involved at the very end of the development phase when incorporating their feedback is resource-intensive or no longer possible. As such, the benefits of applying UCD of AT in an educational context are twofold: On the one hand, there is a strong need to educate future AT developers already early in their career about the benefits of UCD to maximize the usability and, thereby, acceptance of the developed technologies. On the other hand, it offers an ideal use case for challenge-based learning, as students do not only work on real problems with high social relevance but are also required to extensively exchange and work together with the target users in order to (co-)develop meaningful solutions.

The 'Assistive Technology Challenge', offered for the first time in the spring semester of 2024 in the context of the newly established major in Rehabilitation and Inclusion of the Health Sciences and Technology (HST) curriculum at ETH Zurich, is a hands-on, project-based course introducing students to the principles of iterative UCD and diverse disciplines and skills of importance in the field of AT (e.g., mechanical design, programming skills, accessibility, and the translation of user needs into technical requirements). Beyond those subject- and method-specific skills, the project-based nature of the course also promotes social and personal competencies, such as teamwork and critical thinking, as identified of crucial importance by the ETH Competence Framework (ETH Zurich, 2024; La Cara et al., 2023). In groups of four, students without an engineering background work with a person with a physical disability (challenger) to develop and evaluate a personal technical solution for a real-world challenge. The challengers were recruited through our extended network. Notably, the challenges tackled during the course are not intended to solve big problems across a broad population but are based on personal hurdles the individual challengers encounter in their daily lives or during leisure activities. Accordingly, due to the strongly personal nature of the challenge, the interaction between students and challengers goes beyond engagement or consultation only. Instead, the challengers are strongly involved during the whole design process, and critical design decisions should be taken together, following the principles of co-design and even co-production, the highest levels of user involvement on the ladder of co-production (Think Local Act Personal & National Co-production Advisory Group, 2021). Following this approach, we expect that meaningful and usable solutions can be created which, ideally, are kept by the challengers and used in their daily lives after the end of the course.

This work describes the course format and outcomes of the first edition of the ETH 'Assistive Technology Challenge'. Further, based on the results of an online survey, it reports on and discusses the students' assessment and perception of the course. As a primary outcome, the survey investigated whether the challenge-based format of the course positively affected students' motivation and the learning of transferable competencies. As a secondary outcome, the transferability of the used skills, i.e., the students' perceived relevance of the course content for their project and their future career, was investigated.

Methods

Course design and schedule

When participating in the AT Challenge, students will:

- Create innovative assistive technologies for a real-world use case.
- Evaluate the usability and effectiveness of their developed solutions.

To do so, they will learn to:

- Understand key concepts of UCD and accessibility.
- Analyze the specific needs of individuals with disabilities in real-world scenarios.
- Apply UCD principles, accessibility guidelines, and engineering principles such as design thinking, product innovation, and rapid prototyping.

A summary of the most important course information is provided in Appendix A. During the course, the students are guided through (at least) two iterations of a UCD process. Each full iteration consists of five distinct phases: 'empathizing', 'defining', 'ideating', 'prototyping', and 'evaluating', as depicted in Figure 1, corresponding to the respective working phases during the semester. The course follows a similar structure and aims as the 'Assistive Technology Challenge' organized by the HackaHealth Association as part of the MAKE Initiative at EPFL Lausanne (École Polytechnique Fédérale de Lausanne & Association HackaHealth, 2024). However, the course at EPFL mainly targets engineering students, whereas the course at ETH Zurich is designed for HST students without an engineering background. Accordingly, an important additional element of the course at ETH Zurich is to equip students with the necessary engineering skills and tools to enable them to design and build functional prototypes and to design course materials (e.g., templates for deliverables) that build upon the students' background.

The course schedule and the respective covered phases of the UCD process are listed in Table 1. The first half of the semester consisted mainly of applied lectures and hands-on workshops to provide students with the practical tools and skills required for their project. The workshops were held during two weeks, with three workshops happening simultaneously, see Table 1, i.e., Workshops I (User-centered design & usability; mechanical design & manufacturing; electronic prototyping) and Workshops II (Electrical design & manufacturing; coding; audiovisual documentation). Students were asked to attend the workshops they deemed most relevant for their specific task in the project, whereas the lectures were targeted at all students. In parallel to the lectures and workshops, the students started to work independently on their project. In the second half of the semester, the time was dedicated entirely to independently working on their project. During the regular lecture and exercise slots, on-site support from the supervisors was provided, including scheduled progress meetings every two weeks. Additional support outside those slots was offered upon request, either via email or scheduled extra meetings. In the last week of the semester, the closing event took place, where the videos and prototypes were showcased to challengers, other students, external guests, and the teaching staff.

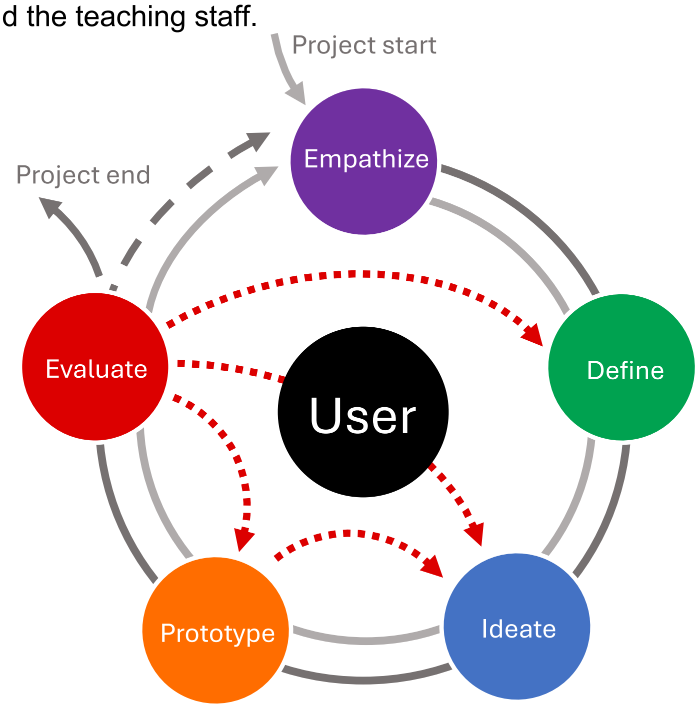

Figure 1: User-centered design (UCD) model. In an iterative process consisting of multiple cycles (grey circular arrows), the technology maturity is continuously improved. Each cycle consists of five phases: empathize, define, ideate, prototype, and evaluate. The intended target user is involved in each of those phases. In addition, the evaluation or prototyping phase can initiate smaller iterations leading back to previous phases (red dashed arrows). Adapted from Meyer, 2022.

Week	Lecture	Exercise	Graded deliverables	Phase in UCD process
1	Introduction	Teambuilding	n/a	n/a
2	Project management	Workshops I	Project plan	Empathize
3	Digital accessibility	Workshops II	List of requirements*	Define
4	User-device interaction demos		n/a	Ideate
5	Office hours		Budget plan	Ideate/ Prototype
6	Risk assessment	Office hours	n/a	Prototype
7	Office hours		1st requirement evaluation* Video idea	Evaluate/ Empathize
8	Midterm presentations		Risk analysis	Define/ Ideate
9	Office hours		n/a	Prototype
10			Video script	Prototype
11			n/a	Prototype
12			2nd requirement evaluation*	Evaluate
13			Video rough cut	n/a
14	Final video presentations and demos		Final prototype Final video	n/a

*Table 1: Course schedule covering the 14-week semester. Colours indicate the respective phases in the UCD model according to Figure 1. *Deliverables based on mandatory in-person meeting with the challenger.*

Learning assessment

The students' final grade was based on four equally weighted aspects, each assessed by the lecturers and teaching assistants using customized grading rubrics: i) the handed-in deliverables, following a typical project management structure (project plan, budget plan, list of requirements, two iterations of requirement evaluation, risk analysis), ii) the working phase during the semester (e.g., organization, teamwork, and communication), assessed based on progress meetings and interaction of students with supervisors, iii) the final video including relevant accessibility features (e.g., subtitles, audio descriptions, appropriate colour contrasts, etc.) showcasing the challenge, the development process, and the description of the final prototype, and iv) the final prototype.

Survey design

To capture the students' personal perception related to their perceived learning, motivation, and skill transferability, a self-assessment survey was administered. The survey was performed at the end of the semester after students received their project grades. The survey consisted of 16 questions covering five main themes: perceived relevance of individual lectures and workshops, factors influencing students' motivation for the course, factors affecting a successful project outcome, competencies learned, and overall perception of the course. The questions were phrased based on previous surveys performed with students (Gassert et al., 2013), on the feedback from an expert in teaching and learning at the university level, as well as on the 'ETH Competence Framework' (ETH Zurich, 2024; La Cara et al., 2023). All questions were checked for understandability and face validity by both authors.

All questions were answered on a 5-point Likert scale or as free text. Respondents had the option to skip any question or to add any additional comments. The detailed survey questions can be found in Appendix B.

Data collection and analysis

The survey was administered using the online tool SelectSurvey.NET v5.0 (ClassApps Inc., Appolo Beach, FL, USA) in July 2024, i.e., 1-2 months after completion of the course. All 12 students who participated in the course were invited via email to participate. Data analysis was performed in Python, and no statistical analyses were performed due to the low and varying sample sizes.

Results

Course outcomes

During the final week of the semester, all three groups were able to showcase their work in a video (Rehabilitation Engineering Laboratory ETH Zurich, 2024), a physical demonstration, and handed over a working prototype to their challenger. However, all groups and challengers identified some room for improvement or additional functions of the prototype which would be useful to implement if the project were to continue.

No dropouts occurred, i.e., all 12 students who enrolled in the course also completed it. During the official course evaluation conducted by ETH, students reported an average overall satisfaction with the course of 4.3 out of 5 (standard deviation sd=0.9, N=8) and an average weekly workload between 8 and 15 hours.

Survey outcomes

Survey completion

Eight out of 12 enrolled students completed the survey. For each project team (consisting of four students each during the semester), at least two and at most three responses were received.

Factors influencing students' motivation

Students reported that the project-based nature of the course, compared to a more traditional course format (e.g., regular theoretical lectures and on-paper exercises), contributed highly to their overall motivation for the course (average 4.875 out of 5, sd=0.33). A similarly high contribution to the motivation was stated as a result of the real-world challenge (average 4.75, sd=0.43) and the prospect that the resulting prototype will actually be used by someone after completion of the project (average 4.875, sd=0.33).

Learned competencies

The competencies learned/used by the students, grouped according to the ETH competence framework (ETH Zurich, 2024; La Cara et al., 2023), are listed in Figure 2. Students reported to have used or learned competencies from all groups, but more for social (communication, cooperation and teamwork, leadership and responsibility) and personal (adaptability and flexibility, creative thinking, critical thinking) than for subject-specific (mechanical design and manufacturing, electrical design and manufacturing, accessibility, assistive technology needs, user-centered design, risk management) and method-specific competencies (project management, problem-solving, decision-making, video editing). Social and personal

competencies were considered more relevant than subject- or method-specific ones for the students' future careers but were also considered less challenging during the project.
The specific competencies reported to have been learned/used the most were 'user-centered design' and 'cooperation and teamwork' (mean 4.5 out of 5), and the least learned/used was 'video editing '(mean 2.88). The challenges related to the respective competencies during the project were considered the highest for 'risk management' (mean 3.71) and the lowest for 'cooperation and teamwork (2.62). The competencies 'communication', 'cooperation and teamwork', 'creative thinking', and 'critical thinking' were considered to be the most relevant (mean 4.75), and 'video editing' was considered the least relevant (mean 1.8) for the students' future career.

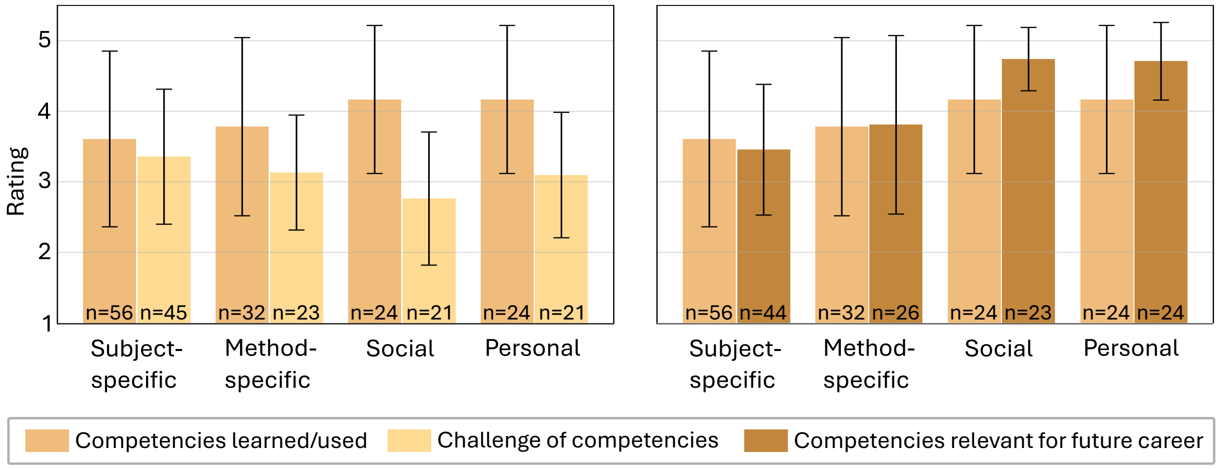

Figure 2: Learned competencies during the course compared to related challenges and their relevance. Left: Used/learned competencies during the course compared to the challenge students perceived for each competency. Right: Used/learned competencies during the course compared to the expected relevance of the respective competencies for the students' future career. All ratings were given on a range from 1 (not at all) to 5 (very much). Coloured bars indicate mean value across all responses and all competencies related to a specific group according to the ETH Competence Framework. Error bars indicate mean ± standard deviation. Number of responses per group (n) differs due to varying number of competencies per group and instructing students to answer only for competencies they learned/used during the course, i.e., those aligned with their specific assigned task within their project.

Influence of deliverables on project outcomes

The influence of individual deliverables across the semester on helping the students to structure their project to achieve a successful project outcome is given in Figure 3. All deliverables were considered to have an average influence between 3.25 out of 5 (sd=1.28, Final video) and 4.0 (sd=1.07, List of requirements). Two selected quotes from the free text comments are provided below:

- *'Having the deadlines for the different deliverables was very helpful. As we never did such a project before, it was good that someone else told us when to do what. The deadlines were like a guide through the whole project.'*
- *'I liked the idea of an assistant help (was also very necessary), but during the meeting with the challenger, the assistant was sometimes too much involved (like an additional team member).'*

Figure 3: Influence of deliverables on project outcomes. Influence of deliverables on helping the students to structure their project to achieve a successful project outcome on a range from 1 (not at all) to 5 (very much). Bold lines denote mean value across responses. Transparent areas indicate mean ± standard deviation (n=8).

Perceived relevance of lectures and workshops

The perceived relevance of the individual lectures and workshops is shown in Figure 4. The ‘Electrical design and manufacturing’ workshop was considered to have the highest relevance for the project (mean 5 out of 5, sd=0, n=3) as well as for the students' personal interest/professional future (mean 4.66, sd=0.57, n=3). For the project, the ‘Web- and app-accessibility’ lecture was considered to have the lowest relevance (mean 2.43, sd=1.40, n=7), for personal interest/professional career, the ‘Risk assessment’ lecture was considered to have the lowest relevance (mean 2.86, sd=1.07, n=7).

The absolute differences between the perceived relevance of the individual lectures/workshops for the project and their relevance for the students' personal interest or professional future ranged between 0.08 and 1.23 (mean 0.6). The largest differences were found for the ‘Risk Assessment’ lecture (more relevant for the project than interest/professional future) and the ‘Web- and app-accessibility’ lectures (more relevant for interest/professional future than for the project). Two selected quotes from the free text comments are provided below:

- *‘The Web- and App Accessibility and User-Device Interaction lectures were nice to hear a little bit about, but overall, it was too long, and the subject was not covered in enough depth for me.’*
- *‘Workshop session 2: Coding would have been very relevant for me but didn't cover the topic enough to be of much help for the project.’*

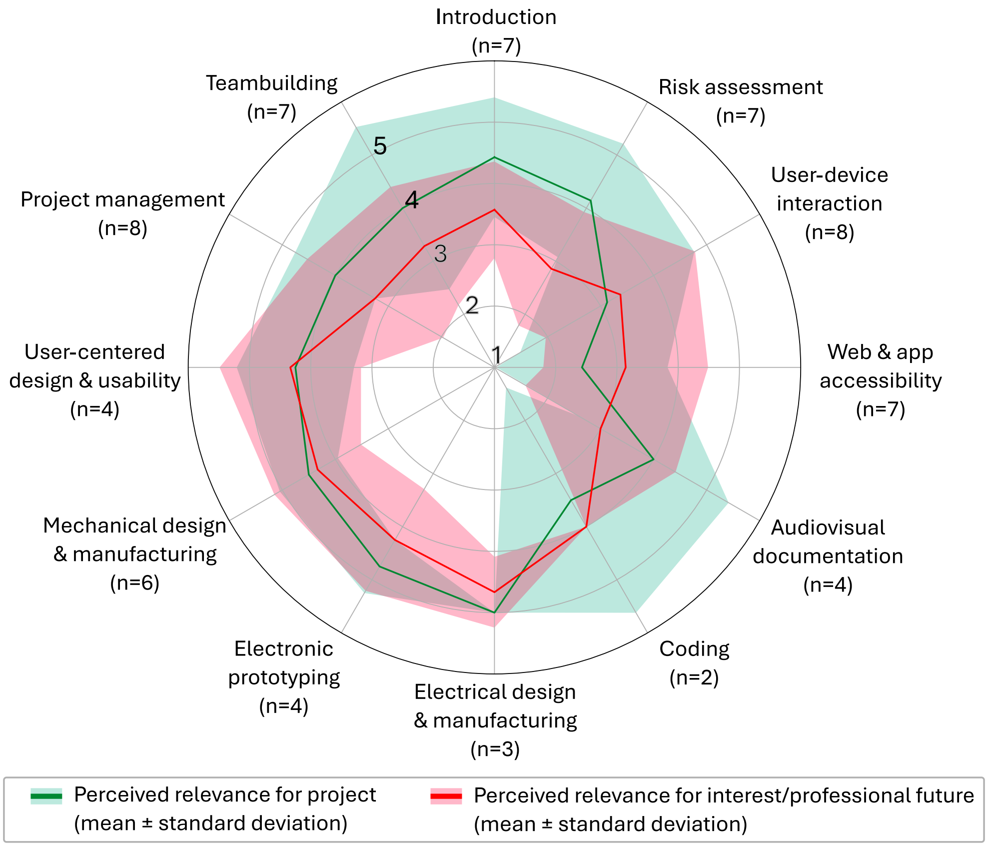

Figure 4: Perceived relevance of lectures and workshops. Relevance for project (green) and for personal interest/professional future (red) on a range from 1 (not relevant at all) to 5 (very relevant). Bold lines denote mean value across responses. Transparent areas indicate mean ± standard deviation. Numbers of responses per lecture/workshop (n) differ, as not all students attended each lecture/workshop.

Discussion

This work provides a comprehensive overview of the newly established 'Assistive Technology Challenge' course, in which students without an engineering background worked together in teams with a person with a physical disability to develop and evaluate a personalized technical solution for a real-world challenge. Further, it reports on the results of a survey conducted with students who have attended the course to inform about their motivation, their perspectives on the course format and content, and the competencies they learned during the course.

The students stated their motivation for the course as very high overall. Specifically, the project-based format of the course was reported as highly beneficial to their motivation. The fact that the course addressed a real-world challenge, and that the outcome might be used in someone's real life after the course completion had a similarly high, but not higher, impact than the project-based format. While both project- and challenge-based learning are considered strong drivers of motivation (ETH Zurich, 2024; La Cara et al., 2023), we had expected that the real-world challenge would contribute more strongly to the overall motivation. However, as project-based learning alone was already stated to be highly beneficial, this deviation can most likely be explained by a ceiling effect.

The course primarily aimed to teach students about the importance of UCD and accessibility, as well as the analysis of user needs and the application of relevant engineering principles such as design thinking, product innovation, rapid prototyping, and usability evaluation in order to receive a successful outcome. However, according to the ETH competence framework, it is not only desirable to equip students with subject-specific competencies, but also method-specific, personal, and social competencies are expected to be relevant for their future careers (ETH Zurich, 2024; La Cara et al., 2023). In the survey, students reported moderate to high learning and use of competencies across all groups. However, as the students' competencies at the beginning of the course were not recorded, it is not possible to make a meaningful estimate of the learning through the course alone. Still, interestingly, social and personal competencies were reported to have been used or learned even more than subject- or method-specific competencies. This is surprising, given the hands-on nature of the projects relying strongly on accessibility, user-centered design, and engineering. However, it matches the findings that students expect those competencies to be more relevant for their future careers. It is further well aligned with the fact that social and personal competencies have been identified to become the most in-demand competencies in the professional world within the coming years (La Cara et al., 2023). Previous research indicated that students who do not have any hands-on project experience often struggle or feel insecure about proactively learning new skills (Du et al., 2019). While some students mentioned similar concerns at the beginning of the semester, the challenges related to individual competencies were reported to be generally low, indicated otherwise at course completion. This suggests that students tend to underestimate their capabilities to quickly acquire new skills and apply them effectively.

The course content was generally perceived positively and considered mostly relevant for the students' future careers. Specifically, the deliverables, which were defined based on typical tasks when managing an (engineering) project, were acknowledged and appreciated by the students as guidance throughout the project. Still, the actual influence of the deliverables on a positive project outcome was mostly rated as being only moderate to slightly positive. According to oral feedback from the students during the course, preparing the deliverables required a lot of time and effort. Hence, the deliverables might have distracted them from working on developing their technical solutions, thus decreasing the overall positive influence. Most of the lectures and workshops were considered highly relevant for both the project and students' future careers. This good alignment suggests that the course format is well suited to promote the transfer of the learned skills to the students' careers. The reported high relevance of the more technically oriented lectures and workshops for their future careers might be interpreted twofold: on the one hand, the experience that students gained in this area during their previous education might not have been perceived as sufficient for their intended career. On the other hand, this course might have encouraged students with a background in health sciences and technology to consider more technically oriented careers. However, both of these assumptions need to be taken with care and would need to be confirmed with dedicated questions in a potential follow-up survey. It should be underlined that, by the course design, some of the workshops were not attended by all students but were selected by the students themselves based on their prior experience and their focus area within their specific project. Also, not all projects required the same competencies, i.e., some of the workshops were already expected to be irrelevant for specific projects, likely explaining the high variability in responses. The risk assessment lecture was perceived as having little relevance for the students' professional future. This was surprising, given that analyzing the risks of any device or procedure is generally considered a crucial part of every development project. When human users are involved, analyzing the risks to ensure safety is even more important (Bahr, 2018). Accordingly, the lecture either did not sufficiently underline the topic's importance, or its content was not perceived as useful for students to transfer the knowledge to future projects.

The survey results should be interpreted with care due to multiple reasons. With only two thirds of the students who attended the course filling in the survey and not all students answering all questions (e.g., since students were responsible for different aspects of the project, which was intended by the course design), the sample size for some of the questions was relatively small with high variability. The time gap of 1-2 months between completion of the course and the survey could have resulted in a recall bias. Further, when filling out the survey, students had already received their final grades. While this was done on purpose to avoid any risk of biasing the grading based on the survey responses, the received grades could have affected the responses by students. Lastly, there might have been a social desirability bias due to the strong interactions and resulting personal connections built between course organizers and the students during the semester, leading to overall more positive responses.

Conclusion

Overall, teaching not only the principles of user-centered design, but also engineering competencies in dedicated workshops enabled students without any previous engineering background to achieve a successful project outcome, achieve high student motivation, and strengthen their competencies in fields expected to be relevant for their future. This will hopefully equip HST graduates with appropriate tools to fill the missing link between engineers and end-users in the AT- and healthcare sector.

The learnings gained during the first edition of this course and through the survey can also help to shape future educational formats in various disciplines. Specifically, the following aspects should be considered when aiming to transfer a similar course format to a different academic setting.

- Framing the project around a real-world challenge, which includes the building of a personal connection between the students and the intended recipient of the project outcome, promotes students' engagement and motivation.
- Making social and personal competencies an integral part of the project and clearly communicating this to the students fosters the learning of those competencies. This is expected to be most relevant for students' future careers.
- Offering the course to a small number of students allows for targeted supervision tailored to the individual projects and teaching of the specific competencies required for the diversity of the offered challenges. Accordingly, if a similar course should accommodate a notably larger number of students, the offered projects would need to pursue a common challenge, and significantly more resources (e.g., workshop access, supervisors, hardware budget) would need to be provided.

Implementing course formats similar to the Assistive Technology Challenge in a study curriculum may contribute to a higher educational quality in project- or challenge-based learning and, therefore, optimally prepare students to conduct highly interdisciplinary projects in their future careers.

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The survey was conducted anonymously and approved by the ETH Ethics Commission (2024-N-210).

Appendix A: Course summary FS24

Abstract (see course catalogue)	Assistive technologies can increase the independence and quality of life of persons with disabilities. This hands-on, project-based assistive technology challenge exposes students to the user-centered design of a dedicated assistive technology solution adapted to the specific needs of a person with disability and prepares them for a career in the field of assistive and medical technologies.
Learning objective (see course catalogue)	• Expose students to user-centered design of an assistive technology adapted to the needs of a person with disability. • Understand the principles of user-centered design, storyboarding with personas, and usability evaluation and be able to apply these principles in a real-world use case. • Get introduced to topics relevant to the field of assistive technologies such as needs definition, accessible design, web/app accessibility, and assessing solution efficiency. • Get introduced to relevant engineering topics such as design thinking, product innovation and rapid prototyping.
Content (see course catalogue)	The course covers the interdisciplinary topics relevant to the development of assistive technologies, including user needs derivation, innovation and rapid prototyping, user-centered design, usability, and efficiency evaluation. It is framed around a user-centered design challenge for a real-world use case (in groups of four students) in tight collaboration with persons with disabilities (challengers), with the goal of realizing an assistive technology solution adapted to the specific needs of each challenger.

Target group	MSc in Health Sciences and Technology
ECTS	6
Weekly hours	Scheduled: 4 hours Independent work: ~6-8 hours
Number of students	12
Number of groups	3
Number of lecturers	2, plus guest lecturers
Number of teaching assistants	2
Provided infrastructure and resources	Access to fully equipped makerspace (manual tools, power tools, 3D printers, lasercutters) Budget: CHF 600

Appendix B: Survey Questions

1. In order to be eligible to participate in the survey, you must first confirm the following statement:
   - □ I confirm that I was enrolled in the course 376-1224-00L Assistive Technology Challenge at ETH Zurich during the spring semester 2024.
2. Which project did you work on? (Be aware that answering this question will make your responses less anonymous.)
   a. Daniele
   b. Giuliano
   c. Lila
   d. Prefer not to disclose

All of the following questions are to be answered on a 5-point Likert scale, each with optional space for free text comments

3. How relevant did you find the following lectures/workshops for your specific project? (answer only for attended lectures/workshops)
   a. Introduction
   b. Team building
   c. Project Management
   d. Workshop: Usability & user-centered design
   e. Workshop: Mechanical design & manufacturing
   f. Workshop: Electronic prototyping basics
   g. Workshop: Electrical design & manufacturing
   h. Workshop: Coding
   i. Workshop: Audiovisual documentation
   j. Web & app accessibility
   k. User-device interaction
   l. Risk Assessment
4. How relevant did you find the following lectures/workshops in view of your personal interests and/or professional future? (answer only for attended lectures/workshops) *(same options as in question 3)*
5. How much did the fact that the projects focused on a real-world problem of a challenger contribute (positively) to your overall motivation for the course?

6. How much did the fact that the result of the project might be actually used in someone's real-life contribute (positively) to your overall motivation for the course?
7. Comparing to a more traditional course format (e.g., regular theory lectures and on-paper exercises), how much did the project-based format contribute (positively) to your overall motivation for the course?
8. Comparing to a more traditional course format (e.g., regular theory lectures and on-paper exercises), how much did the project-based format contribute (positively) to your understanding of the potential and challenges in the field of Assistive Technology?
9. How much did the regular deliverables help you in structuring your project to get to a successful result?
    a. Project plan
    b. Budget plan
    c. List of requirements
    d. List of requirements / evaluation iteration 1
    e. List of requirements / evaluation iteration 2
    f. Risk analysis
    g. Final video (including idea, script, and rough cut)
10. How much did the regular progress meetings with your assistant help you in structuring your project to get to a successful result?

11. To what degree do you feel like you learned/used the following competencies during the course?
    a. Mechanical design
    b. Mechanical manufacturing (e.g., 3D-printing)
    c. Electrical design
    d. Electrical manufacturing (e.g., soldering)
    e. Accessibility / assistive technology needs
    f. User-centred design
    g. Risk management
    h. Project management
    i. Problem-solving
    j. Decision-making
    k. Video editing
    l. Communication
    m. Cooperation and Teamwork
    n. Leadership and Responsibility
    o. Adaptability and Flexibility
    p. Creative Thinking
    q. Critical Thinking
12. Comparing the competencies you brought into the project to the competencies you had to learn during the course, how challenging were the tasks you encountered? (answer only for competencies relevant to your tasks within the project)
    (same options as in question 11)
13. To what degree do you expect the following competencies you used/learned during the course to be useful in your future career/projects? (answer only for competencies relevant to your tasks within the project)
    (same options as in question 11)
14. Could you imagine working or performing research in the field of Assistive Technology someday?
15. Would you recommend attendance of the course to your peers?
16. If you had to pick only one, what aspect/moment of the semester will likely stick in your mind the longest and why? E.g., the most surprising, most challenging, most fun, biggest learning… could be anything!
    (Free text only)