# Designing new learning environments at ETH-Library

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## *Abstract*

One of, if not the most important factor of successful student learning is self-directed learning, either individually or with peers. Students spend a lot of hours beside their lectures with searching for literature, reading, working on a group project, preparing for assessments or writing a thesis. For all these learning activities suitable learning spaces are required.

At ETH there is a twofold lack of learning spaces in two respects: First, there are not sufficient learning spaces in general and second, the existing places seldom match the students' needs. ETH-Library is going to develop a new set of services to students, combined with a great variety of learning spaces. These new learning spaces are planned as learning environments, extending over different learning situations, such as learning individually, learning in groups or conducting a project in a team.

At the beginning of our designing process we had to reflect our service design: How do students learn and how can ETH-Library promote them? In this paper, I will trace our designing process, starting from the analysis of learning situations in the meaning of use cases, proceeding with service clusters, which ETH-Library can provide to support students in these situations. The service clusters were transferred into spatial scenarios, where the mentioned services can take place. These scenarios can be used as a model kit: Depending on disciplines and needs of the target groups they can be combined with several library spaces.

The empirical database for the analysis originates in a qualitative comparative case study (2008–2014)[2] and was supplemented in the following years on several occasions, such as site visits, interviews, and design thinking workshops. From this comprehensive triangulative database, the initial use cases of learning situations were generated[3]. They are characterised by five dimensions: social setting (individual vs. collaborative learning), context of planning (spontaneously vs. planned), duration, type of learning (organisation/information vs. reception vs. expression), and local dependence.

Based on the learning situations ETH-Library started to develop service clusters – combining existing and new services – to support students in their learning processes in the best possible ways. To ensure both, a good variation of services and a good fit to the different departments and disciplines at ETH, we invited delegates from our target groups and experts from several administrative departments at ETH to participate in this designing process. Up to now we are still in the planning phase, but we want to share some of our findings and our work in progress. The three-step-process from use cases via service clusters to spatial scenarios may work as a role model for other people and institutions who provide learning spaces for students.

This is not a research article but a work in progress report. It is a description of our practical approach which aims to develop new learning environments at ETH-Library within an appropriate period of time.

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[2] Edinger 2015.
[3] First presented here: Edinger 2019.

## *1 Introduction*

In the past libraries were first and foremost places for borrowing books from. Today the lending statistics are decreasing. However, the number of people who come into libraries is increasing – is this a contradiction? Not at all! In the age of digitalisation and mobile learning, there are two main requirements that libraries fulfil: They provide a wide range of services around information, media, and data literacy and they provide environments for inspiration, reading, learning, and working. Browsing through programs of international conferences in 2019 like the User Experience in Libraries Conference (UXLibs)[4] or the International Association of University Libraries Conference (IATUL)[5] it becomes obvious that library space is of increasing importance. A recent survey in Germany confirms that libraries are the most favourite learning spaces at university campuses.[6]

At ETH-Library, we face the above-mentioned changes and the fact that we do not provide enough learning spaces. Recent calculations have recommended that the number of learning places at campus should meet 13-15% of the number of students. 2/3 of these places should be situated in the library.[7] ETH-Library provides 491 learning spaces (December 2018) for 21‘400 students (2,3%!).[8] About 280 more learning spaces are provided by Fluid Dynamics Library, Chemistry Biology and Pharmacy Information Centre, Computer Science Library, Mathematics Library, and Physics Library. They do not belong to ETH-Library. Furthermore, the few spaces provided only occasionally match the students' needs. In the student evaluation of 2015 39% of the students responded that the learning spaces are not well equipped enough. 53% responded that they did not always find suitable learning spaces.[9]

A recent and crucial discussion focuses on whether universities like ETH should provide learning spaces for students or not. Since Bologna students spend a greater amount of time at the university. In the context of curriculum development with a focus on new learning and teaching settings like problem-based learning or project-orientated learning we have to anticipate that our students spend even more time on campus. At ETH it should be self-evident that we enable our students to invest most of their time in their study and not in travelling around to find suitable learning spaces (maybe at home, in a café downtown, in a (paid) co-working space and so on).

Our aim at ETH-Library is to develop new library spaces as learning environments suiting primarily the needs of our students. These learning environments are planned as a combination of a set of new and established services and a wide range of learning spaces. Our perspective is holistic: We have got a library and learning landscape in mind covering all ETH-Library sites. There is no ‘one size fits all’ or ‘one library for all’, but library spaces that follow the disciplinary logic of the departments both in research and teaching.

The theoretical state of the art is quite obvious: Learning spaces for the present and the future have to take into account that technological and didactical advancement lead to a combination of material and virtual/digital spaces for learning and teaching. In self-learning settings students build their own learning environment, they are used to choose those digital tools and physical spaces, which suit their needs best.[10] Consequently, we have to understand learning environments as augmented spaces. They have to meet criteria, such as accessibility, usability, user experience, and learner-centred design from both perspectives, the built and the virtual/digital environment.

[4] http://uxlib.org/2019/07/01/uxlibsv-presentations/
[5] http://www.iatul2019.org/index/program
[6] Vogel 2019, pp. 92 and 96.
[7] Vogel 2019, p 102.
[8] ETH Zürich 2019, p. 2.
[9] ETH Zürich 2015, section „Infrastruktur“, p. 20.
[10] Edinger & Reimer 2015, pp. 208ff.

Our practical approach at ETH-Library follows three main steps: Firstly, analysis of learning situations as use cases. Secondly, deviation of a set of modular service clusters to support every use case the best possible support. The service clusters were transferred into spatial scenarios, where the mentioned services can take place. These scenarios can be used as a model kit that allows thirdly, a tailored implementation of the scenarios at several library spaces, depending on the requirements of the particular place, the department and its disciplines. This is an innovative approach even though there are some other institutions that developed similar tool kits, for instance *TU Delft Cookbook Education Spaces*[11] or *Lernwelt Hochschule*[12]. In contrast, our approach is human centred; it starts with the analysis of our target group and the question: Why do students[13] come to a library?

## *2 Why do students come to a library? Five dimensions of learning situations*

Since the 1980s libraries have been named as learning places or learning spaces. Even though it took more than two decades until empirical research concerning library spaces as learning spaces has started.[14] Since about 2015 user experience research in libraries has becomes increasingly popular. At ETH-Library we decided not to conduct more general user research but to use existing findings that can be complemented if needed. The empirical data originates in a qualitative comparative case study (2008–2014)[15] among several university libraries in Switzerland, the United Kingdom, Norway and Germany and was supplemented in the following years on several occasions like site visits, interviews, and design thinking workshops. The case study and the following data collection combines reactive and non-reactive methods, such as interviews, mental maps, group discussions, participant observation, floor plans, maps, aerial views and photographs.[16]

Based on this data we extracted visiting/learning situations. A visiting or learning situation describes a use case of a learning environment. Every contact to a library can be seen as a learning situation: The learner (student, researcher) wants to know/learn more about a specific topic and therefore comes to see a librarian, to browse in a catalogue or to sit down and read for a while. Thus, learning situations can be supported in different ways: with library services like lending books and media, counselling, courses, tutoring or even special learning spaces.
Learning situations are characterised by five dimensions: context of planning (spontaneously vs. planned), duration, social setting (individually vs. pair (2 students) vs. group (co-learning with others) vs. collaborative learning in a team)), type of activity (administration/ organisation/information vs. reception vs. expression), and local dependence (locally dependent vs. locally independent). The combinations of dimension values vary in their reality and relevance. Some combinations of dimension values are more realistic and relevant than others.
In principle it can be said that the local dependence doesn't make any difference for the design of a learning environment. The provided learning spaces in one library may have the same elements than somewhere else. But the provided library services and the inventory of an open access library represent a difference. Students often use the library spaces where their subjects are situated.[17] This can be illustrated by the following quote from an interview with a master's student in Oxford: *„I would go to one place in the morning and somewhere else in the afternoon and then I would go home. I just moved around a lot and ... a lot of my friends did the same thing according to where the books they needed were […]".* Bachmann, Brandt and Kaufmann (2014) call this practice of moving around and looking for suitable learning spaces

[11] van den Zanden, Bogerd, & van Loon 2018.
[12] http://leho.blog/leho/
[13] We asked this also for our other target groups like researchers, academic teachers and the public.
[14] Stang 2019, p 141.
[15] Qualitative data base: approximately 150 hours participant observation, 9 expert interviews, 13 user interviews, 40 mental maps (for further details see Edinger 2015).
[16] Likewise, there are many similar studies, for instance: Dippelhofer 2014, Freeman 2005, Jochumsen, Rasmusen & Skot-Hansen 2012.
[17] Edinger 2015, p. 159.

"wandering for learning"[18]. For students it is worth it to invest time for finding suitable learning spaces.

Furthermore, the particular requirements of different disciplines have also to be taken into account when we try to design customer tailored library services for our library spaces in several ETH departments.
The local dependence in connection with the duration of a learning phase can differ in choosing and finding learning spaces. For short learning periods no one is willing to walk long distances. In those situations, learning environments have to be nearby and easily to access.
The planning context is also relevant when choosing and finding learning spaces. Students want to have bookable places for planned learning sessions over longer durations. Especially for spontaneous learning sessions they want to use a navigation system to quickly find available spaces which suit their needs.

The three dimensions duration, social setting and type of learning are merged in Table 1. The cells name specific requirements for the several learning situations.[19] Improbable learning situations are shown greyed out. For example: Short expressive learning sessions are unlikely, because it doesn't make much sense to go deep into a task like writing a thesis when you have an hour or less to do so. Long administrative tasks of more than 2 hours are unlikely, too.

<table>
<tr><th colspan="2" rowspan="2">social setting & type of activity</th><th colspan="3">duration</th></tr>
<tr><th>< 1h</th><th>1-2h</th><th>> 2h</th></tr>
<tr><td rowspan="3">individually</td><td>administrative</td><td rowspan="2">• easily accessible<br>• silent</td><td>• silent</td><td></td></tr>
<tr><td>receptive</td><td colspan="2">• silent</td></tr>
<tr><td>expressive</td><td></td><td colspan="2">• silent<br>• ideation space/facilities</td></tr>
<tr><td rowspan="3">pair</td><td>administrative</td><td rowspan="2">• easily accessible<br>• opportunity to speak and exchange</td><td>• opportunity to speak and exchange</td><td></td></tr>
<tr><td>receptive</td><td colspan="2">• opportunity to speak and exchange<br>• digital team facilities (e.g. team display)</td></tr>
<tr><td>expressive</td><td></td><td colspan="2">• opportunity to speak and exchange<br>• digital team facilities (e.g. team display)<br>• ideation space/facilities</td></tr>
<tr><td rowspan="3">team</td><td>administrative</td><td rowspan="2">• easily accessible<br>• opportunity to speak and exchange</td><td>• opportunity to speak and exchange<br>• digital team facilities (e.g. team display)</td><td></td></tr>
<tr><td>receptive</td><td colspan="2" rowspan="2">• opportunity to speak and exchange<br>• digital team facilities (e.g. team display)<br>• ideation space/facilities</td></tr>
<tr><td>expressive</td><td></td></tr>
<tr><td rowspan="2">group</td><td>administrative</td><td rowspan="2">• easily accessible<br>• mostly silent, with the opportunity to speak and exchange</td><td>• Mostly silent, with the opportunity to speak and exchange</td><td></td></tr>
<tr><td>receptive</td><td colspan="2">• Mostly silent, with the opportunity to speak and exchange<br>• digital team facilities (e.g. team display)</td></tr>
</table>

[18] Original in German: "Lernwandern".
[19] Hygienic factors like opening hours, fresh air, daylight where possible and individually adjustable table lamps, electrical sockets, W-LAN are excluded from the table. They are fundamental requirements and should be fulfilled at every learning space.

| | | | |
|---|---|---|---|
| | **expressive** | | • Mostly silent, with the opportunity to speak and exchange<br>• digital team facilities (e.g. team display)<br>• ideation space/facilities |

*Table 1: Combination of the three dimensions duration, social setting and type of learning.*

By summarising Table 1 the main learning situations and the corresponding requirements are:

- Learning individually, for a short time (max. 1 hour), conducting administrative or receptive activities (like checking e-mails, looking for information concerning courses, taking notes, searching for literature, reading.) This needs an easily accessible, ideally silent, space nearby.
- Learning individually, for a longer time (1-2 hours or longer), conducting receptive or expressive activities (like reading, preparing for assessments or writing a thesis). This needs a silent space with some ideation facilities as for instance a pinboard or a (digital) white board.
- Learning in a pair or a team, for a short time (max. 1 hour), conducting administrative or receptive activities (like making appointments, checking e-mails, looking for and exchanging information concerning courses, taking notes, searching for literature. This needs an easily accessible space nearby, with the opportunity to speak and exchange.
- Learning in a pair or a team, for a longer time (1-2 hours or longer), conducting receptive or expressive activity (like reading, working on a project, preparing a presentation or writing a report). This often happens in curricula elements like problem-based learning or service design learning. Such a learning situation requires the opportunity to speak and exchange, digital team facilities (e.g. team display, touch tables) and ideation space/facilities.
- Learning mostly individually in a group, for a short time (max. 1 hour), conducting administrative or receptive activity (like checking e-mails, looking for information concerning courses, taking notes, searching for literature, reading.) This needs an easily accessible space nearby, mostly silent, but with the opportunity to speak and exchange.
- Learning mostly individually in a group, for a longer time (1-2 hours or longer), conducting receptive or expressive activity (like reading, preparing for assessments or writing a thesis). This needs a mostly silent space, with the opportunity to speak and exchange. Digital team facilities (e.g. team display, touch tables) and ideation space/facilities are a plus.

In comparison to other typologies of learning spaces we focused not on teaching settings,[20] but on learning settings like learning individually or with peers. These settings may occur in the context of course participation or independent of it. And they are even quite similar to working settings, as Carl Barrow illustrated in his study concerning university staff.[21]

Our analysis of learning situations was the starting point. Based on this we began to develop a set of modular service clusters to support every learning situation at its best.

## *3 How to develop a set of modular service clusters?*

Based on the above described analysis, ETH-Library started to develop service clusters of established and new services to support students' (and researchers) learning processes. To ensure both, a good variation of services and a good fit to the different departments and

[20] A well-known example for a typology of teaching spaces is: van den Zanden, Bogerd & van Loon 2018..
[21] Barrow 2017.

disciplines at ETH, we invited students and academic teachers from different departments, experts from several administrative departments and some of our librarians in the first half of the year 2019 to interviews, workshops and focus groups. In addition, we will perform a student sounding board.

During these meetings we presented the mentioned learning situations and asked our participants to collect ideas for services to support our target groups. A huge amount of services has been gathered like for instance lending books, media and parts of the collection, lending materials and tools, counselling like book a librarian and a tutoring service, and also using multimedia to browse our catalogues. We clustered the services according to the learning situations and spatial requirements. The service clusters were transferred into 9 spatial scenarios. The following paragraphs describe these scenarios.

1. Service centre: everything for everyone at the department. This scenario may be the first starting point for lots of our users. Here you can book a librarian, borrow books, media and tools, subscribe for courses concerning information and media literacy, grab a coffee and ask all the questions about organisation and orientation within the department. Typically, users spend no more than an hour here. They can come individually or in company, spontaneously or planned. The main activities are administration, organisation and information (compare to the row “duration <1h” in Table 1).

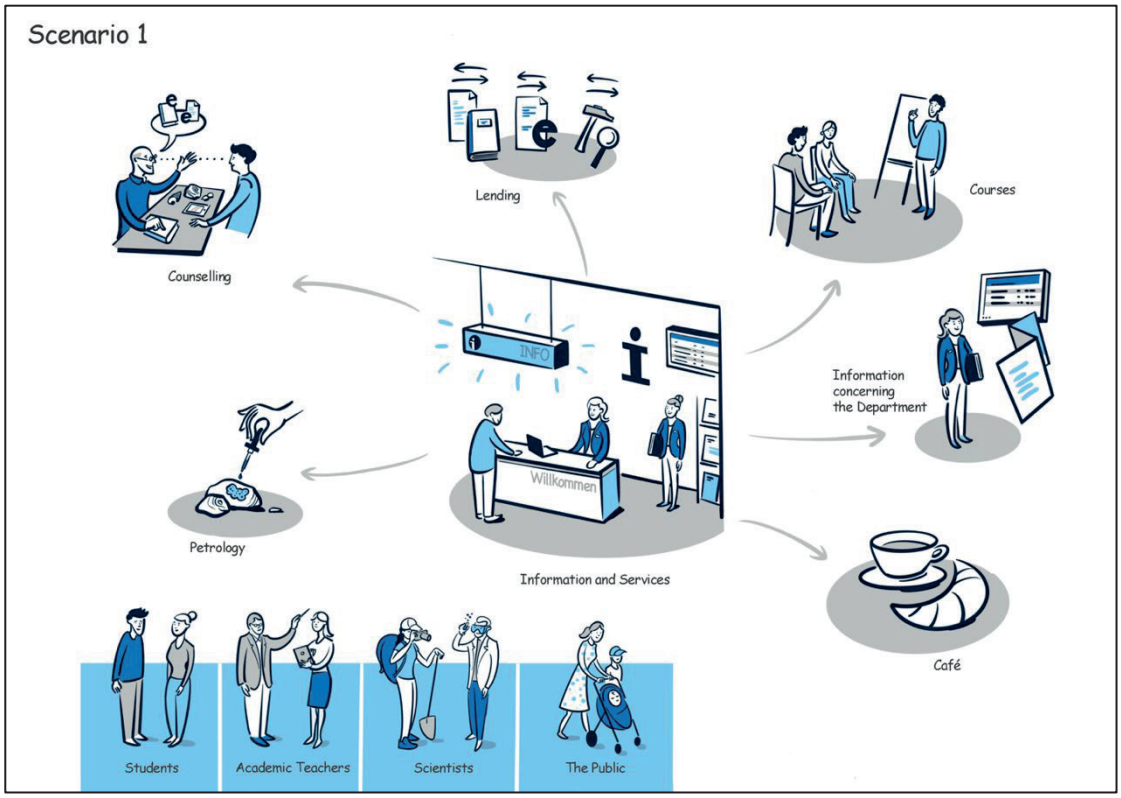


*Figure 1: Scenario 1 - Service centre: everything for everyone at the department*

2. Presentation of the book stock and collection like books, media and exhibits, as far as possible in an open shelf system. This is nothing new, but often not considered. In some places at ETH-Library we for instance present new arrivals of books in closed vitrines. That doesn’t make any sense. People who are interested in a particular book want to browse through the abstract, the table of contents and maybe the bibliography. A key of success of such an area is the user guidance. Orientation and navigation in an open shelf area have to be easy.[22] Furthermore, a thematic open access library

[22] Edinger 2014, pp. 193ff.

follows the postulation of accessibility, usability, and learnability in the meaning of competence orientation.[23] The obvious argument that people prefer to browse in catalogues and not in shelfs is not proven. Often shelf browsing in a thematic open access library is a starting point for researchers.[24] Typically, users come individually and spend an hour or two here. They can come spontaneously or planned. The main activities are shelf browsing, information, inspiration, and reception.

3. World of inspiration. In the past it was the function of libraries to provide access to their book stack. Today we want to go further: Libraries can even provide new ways of access and presentation of their holdings and they can provide interrelated information, e.g. combining articles with GIS (geographic information system) and exhibits of their collection by using augmented reality. Books, e-journals, data can be presented for browsing on devices, such as screens, team displays, touch tables, virtual shelfs, digital panorama and so on.[25] The learning situations this scenario is established for are nearly the same as in the ones of scenario 2. It can be seen as the digital/virtual version and enhancement of scenario 2.

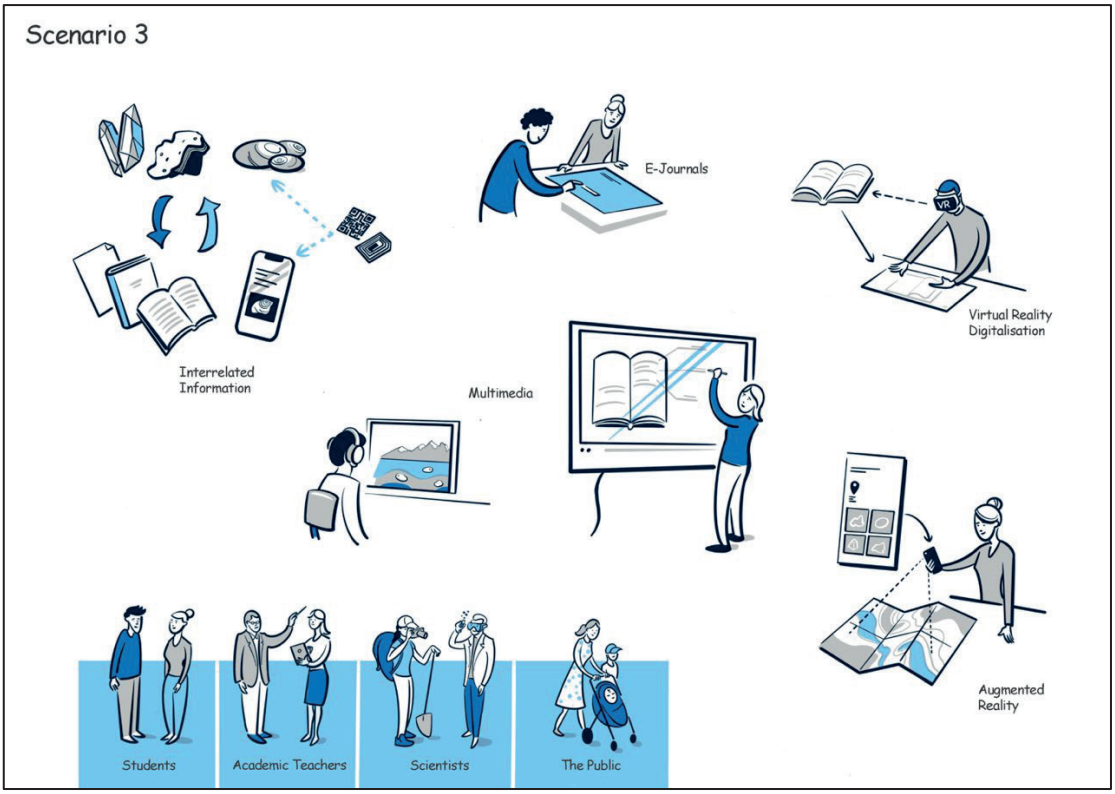


*Figure 2: Scenario 3 - World of inspiration*

4. Full service for academic teaching. ETH-Library can support academic teachers in different ways, e.g. by providing a teaching area within the library for settings like problem-based learning. This area could combine a digital learning space with team displays or multi touch tables with provided holdings from the collection and also books and media. Group working spaces from the learning landscape could be booked additionally to enable working in groups during the lecture. A librarian and/or tutors could attend the lecture and support the lecturer and the students. The learning situation is a formal one, embedded in a lecture.

[23] Edinger 2016, pp 96ff. and 102 ff.
[24] Edinger 2015, pp. 150ff.
[25] As an example for such an interrelated information presentation see the picture gallery of David Rumsey Map Center, Stanford, https://library.stanford.edu/rumsey (07.09.2019), especially pictures 1,8 and 9.

5. Full service for students, researchers and research groups. Students and researchers can book a full service for individuals or groups, either within the library (e.g. in group working spaces) or in their departments. The library provides everything from the collection (books, media, data, exhibits and much more) in this space. In advance this material could be stored in a mobile stack, which individuals or groups could use over a period of time. A librarian could attend and support group sessions with counselling and further material. The typical learning situation has an average duration of 2 hours, and it is planned for receptive learning.
6. Counselling+. This means more than just a conventional counselling. This is a counselling for academic teachers, researchers and students in their department or in the library, where the library provides support and facilitation in every step of a research project – starting from the first literature research, covering literature management, data management, knowledge management up to scientific writing and publishing. In comparison to scenario 5 this is an individual learning situation.
7. Learning landscape. The learning landscape should meet the requirements of all learning situations listed in Table 1. There should be quickly accessible places including standing desks for learning situations with a duration of up to one hour, and also individual and collaborative working places for sessions over some hours in a stretch. Ideation facilities and digital team facilities should be provided. Silent zones, mostly silent zones with the permission to speak and chatty zones for team work should be arranged and organised in such a way that there are no noise emissions. The intended usage and the desired behaviour (silent vs whispering and low-voice talking vs. chatting and discussing) has to be clearly communicated. The environment has to be designed in a way that the users understand which social setting is requested.[26]

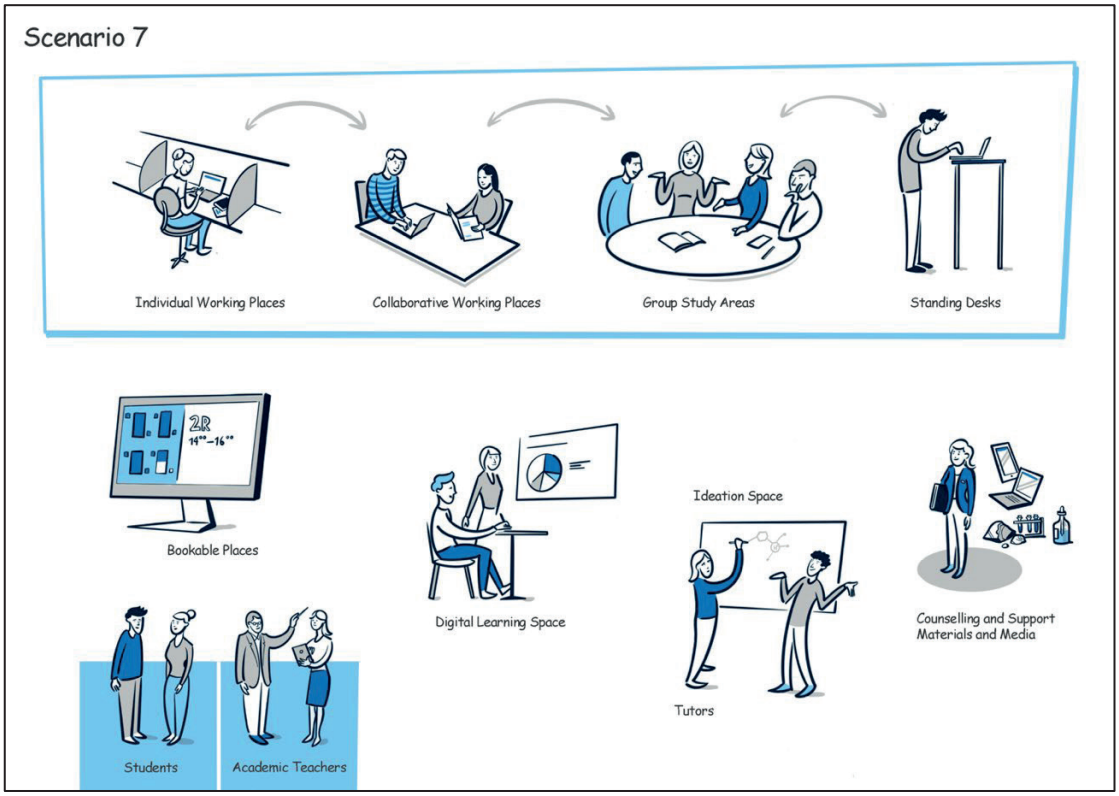


*Figure 3: Scenario 7 - Learning landscape*

[26] For detailed information about mistakes to avoid when designing a coherent environment behaviour setting see Edinger 2018.

8. Science lab. This scenario is a small one. It should be a preferential space for the public, for pupils and teachers, to try things out, to experiment a little bit with data and exhibits from the collection.
9. Library Café. This scenario is well-known from bookstores. Since about a decade it has been common to integrate a café in a bookstore. This place may fit to lots of the above-named learning situations, with some limitation concerning the requirement of silence. The loudness of a café normally depends on the time of a day and the people who are there. But situated in a library the environmental setting can be designed in a way that it communicates that this is a low-voice area with the permission to speak in a reduced volume. In our interviews, workshops and focus groups this scenario was mentioned every time. The library users wish to have place within the library, where they can combine a coffee break or a little snack with exchanging with colleagues or fellow students, getting administrative tasks done, browsing through recent journal issues and so on. Where there is no such a café provided, library users are more or less willing to go to another place nearby, if the atmosphere there is better and worth the way and time. Thus, the general lack of such a library café is always pointed.

These scenarios can be used as a model kit. Several scenarios can be combined with each other for particular library spaces, depending on the place, the discipline and the local context. There is no need to implement all scenarios in every library space at ETH-Library. In the following section a user journey will illustrate how scenarios can be combined – based on the floor plan of ETH Earth Sciences Library.

## *4 Ideation of library spaces: a user journey in an existing place*

For ideation and as a starting point for further discussions we traced user journeys that combine several scenarios and illustrated them exemplarily in existing built environments at ETH. One of these user journeys is created around a possible teaching situation in a fictional redesigned Earth Sciences Library. Up to now there are no precise plans to redesign this library. But a user journey like this is a way of ideation, enabling more practical discussion about the requirements of new learning environments and corresponding library services.

The mentioned user journey focuses on a lecture with approximately 15 students. The lecture is conduced as an active learning setting (e.g. problem-based learning). It spans over four waypoints, combining the scenarios 1, 4, and 7. In Figure 4 all four waypoints are illustrated. The floor plan in the upper left shows in which part of the building the scenarios may come to reality.

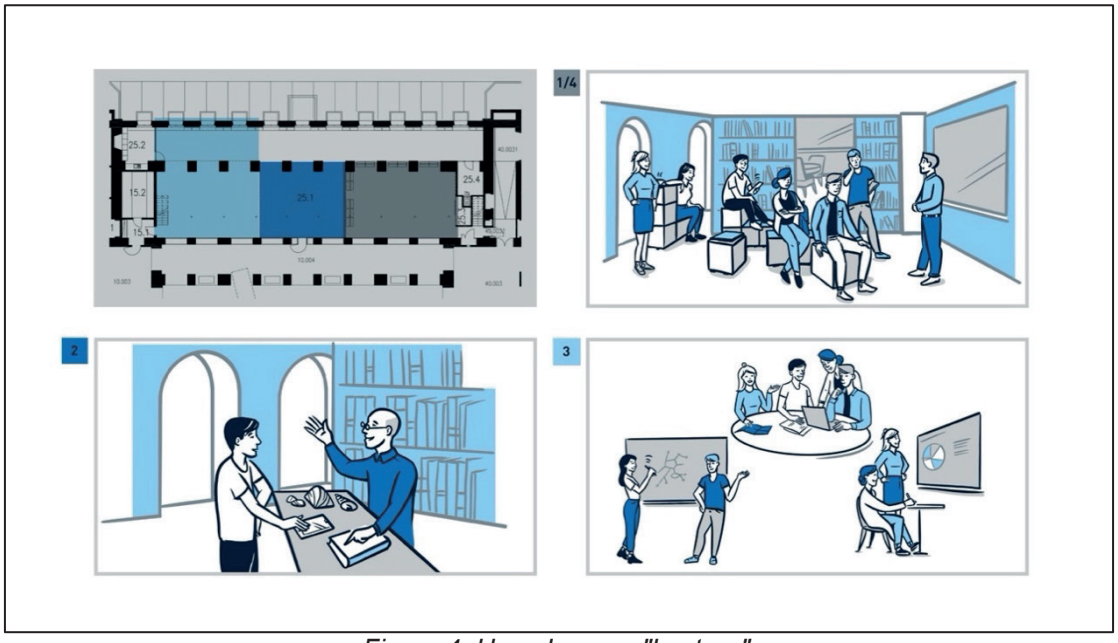


*Figure 4: User Journey "Lecture"*

A user journey of students and their lecturer may look as follows:

Waypoint 1: Lecturer and students meet at the library. The lecturer gives an input (this corresponds to scenario 4). The students are assigned with a learning task (e.g. gather information and resources, investigate solutions). For this a designated teaching area is needed with a big display and some flexible furniture like stools. The flexible furniture should enable different didactical settings.

Waypoint 2: Students fulfil the named learning task either individually or in pairs or teams. They can ask the librarian for help (see scenarios 1 and 4). For literature and data research media (digital and analogue), maps, plans and other objects from the collection can be used (e.g. stones, reliefs).

Waypoint 3: Students continue their learning in groups by discussing their findings and preparing a presentation of their results. For this they may find suitable group learning spaces, digital learning spaces and ideation spaces in scenario 7. A librarian or a library tutor may support them.

Waypoint 4: Lecturer and students meet again. The results are presented. This happens at the same place as waypoint 1.

This user journey gives a brief insight into the plans of ETH Library. The aim is to provide a well-equipped learning environment and services that are tailored to the learning and teaching situations at ETH.

## *5 What is next? The way to tailored implementation*

There is still a lot of work to be done at ETH-Library. First of all, we are conducting our sounding board with students. In this sounding board we are going to test the user acceptance of new planned services and learning environments at an early stage. At the same time we are in the mid of a designing process for a new learning environment in the main building of ETH.

For the implementation of new services and learning environments we want to apply our service clusters and scenarios as a model kit. Factors for a tailored implementation are the particular department with its disciplines, the location and the local context. In some places the library is a part of a building (complex) with lots of related services like restaurants and cafés, learning spaces in the departments and so on. And in all our libraries the target groups are represented in different rates.

Our key premises have to be human centred design, innovation and cooperation to achieve a good user experience. We want to continue and establish the cooperation with the departments and administrative departments. Together we want to figure out which services appeal to our customers. Our services are planned to combine a general part that is applicable everywhere and for every department, combined with a specific part that is tailored to the disciplinary requirements of every particular department. All this we have to take into account to develop a library and learning landscape over all our ETH-Library sites.

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