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Rektorenkonferenz der Schweizer Universitäten
Conférence des Recteurs des Universités Suisses
Conferenza dei Rettori delle Università Svizzere
Rectors' Conference of the Swiss Universities

Program SUC 2013-2016 P-2 „Scientific information: Access, processing and safeguarding“

Strategy for e-Learning

Version 1.0: 11.10.2013

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1. National Services Within the Field of Action

- S-2: e-Portfolio
- S-15: Exams with electronic support (e-assessment)
- S-16: Knowledge transfer with electronic support
- S-17: Management and delivery of electronic educational content

2. Foundations, Key Functions and Services

2.1. Overview

Higher education institutions face fundamental changes in the area of technology-enhanced learning. Advances in cloud services, personalization approaches and mobile technologies open up new opportunities for creating complex and large scale learning environments that were not feasible with conventional approaches before (think about MOOCs). This has implications for all areas of educational activities in higher education institutions and affects likewise course organization and management, production and distribution of learning material, didactics, and assessment. Such technology-enhanced learning has strong implications for the Swiss Higher Education Institutions (HEI) as courses, books, textbooks, exams and other didactical content (including the Open Educational Resources), as well as personalized data, have to be adapted along with many challenging issues to solve, such as data privacy, copyright clearance, plagiat, obsolescence of the formats, interoperability between the applications, etc.

To face these challenges, we propose to concentrate our efforts on four national services (in close match to S-2, S-15, S-16, and S-17):

1. e-portfolio;
2. e-assessment;
3. Learning and teaching with new tools for more efficient knowledge transfer;
4. Management and delivery of electronic educational content.

Such national services should contribute to lower the costs: complex learning environments are expensive to develop and difficult to maintain for a single organization. Many educational functions and tools are of shared interest for all institutions.

Besides costs, those national services will enhance the learning and teaching experiences and in some cases bridge the existing gap between research and education (through for instance case based learning, inquiry based learning, project based learning, etc.). Furthermore, the current approaches do not allow reusing and repurposing solutions in different contexts, and in many cases suffer from usability issues. This is why we must at national level:

- Promote learning from anywhere at any time;
- Improve teaching interactivity;
- Provide tools to manage all digital learning resources collected during and beyond the students’ studies, which include students’ learning outcomes and reflections, semester and master works, e-certificates, OER, links to MOOC courses, eBooks, self-assessments, virtual labs, simulation results, etc.;

- Promote active and collaborative learning made through peer-coaching, interactive content, and technology-enhanced learning spaces, in respect with students' identified needs, based on efficient authoring tools;
- Further develop e-assessment (formative and summative) to improve the quality of exams through innovative, competence-oriented e-assessment formats, better objectivity and control of confounding factors in e-assessments, and higher efficiency of exam administration and correction (automatic and manual) in face of growing student numbers.
- Help to cope with the increased diversification of technologies and tools so as to provide the Swiss running e-learning platforms (Moodle, Olat, ILIAS, Mahara, Chamilo, docendo, etc.) with enhanced functionalities (e.g., e-assessment-tools, e-portfolio-systems, mobile OS platforms, etc.).

2.2. Existing services and ongoing projects

Since 2000, e-learning in Switzerland could benefit from several programmes: the Swiss Virtual Campus (2000-2008), the "AAA/SWITCH e-Infrastructure of e-Science" (2008-2013), and the "Learning Infrastructure" (2013).

Within the SUC cooperation and innovation project AAA/SWITCH, 68 out of 116 projects were done in the domain "e-learning" (http://www.switch.ch/projects), making it the domain with the largest number of projects. Furthermore, it turned out that this domain also had the largest number of institutions of the Swiss higher education sector involved: all cantonal universities (except the University of Lucerne), both Swiss Federal Institute of Technology, as well as all seven Universities of Applied Sciences. This can be taken as a clear sign that e-learning today is vital for the entire academic sector and is of essential interest to all institutions.

The AAA/SWITCH e-learning projects were followed in 2013 by the transitional one-year project "Learning Infrastructure", which is part of the CRUS P-2 cooperation project. The two main thrusts of "Learning Infrastructure" (due by the end of 2013) are:

- "New learning environments", devoted to analyzing students' lifecycle, as well as the concept of personalized working and learning environments using e-portfolios and PLEs;
- "e-assessment", for creating a portal in order to establish an e-assessment culture and practice at the institutions, the improvement of solutions, deployment of products, field tests, dissemination, common concepts (e.g. Virtual Desktop Infrastructure - VDI), best practice scenarios for lecturers and other stakeholders.

The organizational outcomes of these three programmes (Swiss Virtual Campus, AAA/SWITCH, and Learning Infrastructure) were on the one hand the setting-up of e-learning centers (CCSPs, one for each institution) along with the ETWG assembly serving as the CCSP board, and on the other hand the launch of the eduhub community. This community, coordinated by SWITCH, encourages the sharing of best practices through:

- Regular webinars;
- The distribution of a newsletter and other information on a blog (http://www.eduhub.ch);
- An annual meeting (regrouping over 100 participants);
- Specialists of a specific e-learning topic in Special Group Interests (SIG), to allow in-depth discussions and developments on expert level;

- Sharing of resources;
- Partnerships to launch new projects;
- The promotion of national and foreign events;
- etc.

From these programmes and communities a set of services progressively emerged, for instance:

- Some e-assessment tools (SEB, SIOUX, e-OSCE, etc.) along with a community of practice;
- e-voting tools for improving interactivity in auditoriums;
- Self- and peer-assessment tools;
- Lecture recording and video management systems (SWITCHCast, Matterhorn, and other homemade systems), along with video annotation tools;
- The DICE community for copyright in e-learning;
- Swiss LMS (Moodle, OLAT, ILIAS, etc.) and e-portfolios (Mahara) communities.

2.3. International references and standards

The above-mentioned e-learning areas are of concern beyond Switzerland, and largely discussed for instance within the EDUCAUSE U.S. association (which counts over 260 non-U.S. institutions) during regular annual events and in journals. At the European level, in addition to the JISC association and SURF foundation, which are both very active in e-learning, there is the LERU and COIMBRA e-learning task forces, in which all these areas are actively discussed, and best practices shared. The Gesellschaft für Medien in der Wissenschaft (GMW) offers roughly the same for all German-speaking countries. In Germany, there is e-teaching.org, an e-learning community (platform) and in Austria the Forum Neue Medien (FNM) playing a similar role in the national academic sector.

As for the standards, some exist for making e-learning objects interoperable (i.e., SCORM, QTI, IMS, LTI, and more recently “Experience API”, EPUB3, etc.), and they should be applied as much as possible in the future national services for importing and exporting content so as to maximize exchange and sharing of e-learning material as well as the interoperability between tools and services. However, standards that are usually a sort of lowest common denominator in e-learning topics should not be used to stifle innovative services.

2.4. Required innovation

The first area in need of actions is **e-assessment** (S-15). Indeed, the practical use of e-assessment tools is far from easy if there is no well-established local service and faculty members have to implement and operate e-exams on their own. On the other hand, e-assessment offers a large potential for improving the quality of exams, and in some assessment scenarios substantial cost savings could be realized due to automation in distribution, correction and grading of examinations.

Today, the current e-assessment solutions, already in place at various Swiss institutions, need to be consolidated at the national level to be easier to deploy and become more robust to various environments (less prone to errors). Under this action, two main thrusts should be pursued:

(1) A well-focused mix of centralized and local services should be made available, which allows the institutions to adapt them to their needs, which vary not only due to the existing local IT infrastructure but also due to the different requirements from the various departments (e.g. Staatsexamen for medical students vs. multiple choice examinations for biology students vs. written discourses in essay question types). So, the services offered need to be flexible enough to cope with the huge variety of curricula, disciplines and courses at Swiss HEIs, each with their own and very unique requirements for the implementation of exam tasks. In addition, these services must not only support the examinations themselves, but also their preparation and post-processing.

(2) A national e-assessment consultancy service (like the DICE project for copyright in education and research, see below) should be established for a certain period of time in order to support the establishment of common, standardized solutions as well as support local adaptations. This service can either be provided in a decentralized model or through a service broker.

With the rapid development of the cloud, there is now a plethora of web sites where students can find tools, apps, MOOCs, multimedia content, simulation tools, etc. ready to be used. Such resources contribute to autonomous and reflective learning strategies, transferable and showcasing skills development, professional identity building, etc. These are buzzwords representative of what civil society is expecting tomorrow from learners. The European community is currently investing massively in lifelong learning, which is believed to be key in ensuring a healthy economy. At the HEI level, those ideas can be fostered through the **e-portfolio** (S-2), which before being a tool, is a process that students, accompanied/coached by lecturers, must be trained with to apply during their studies and beyond. Consequently, it becomes urgent for the Swiss HEI to be able to offer official services through a national e-portfolio to bridge the informal and formal student’s knowledge and offer the student a mean to host portfolio documents in one place throughout their educational, life-long career.

The large-scale adoption of smart **mobile technologies** (S-16) marks a major change in creating, using, and sharing information in all areas of life. Mobile technologies have significantly influenced and empowered new forms of information services. However, until this point many solutions in the higher education sector are vendor specific or custom tailored, which challenges the wider adoption of new mobile practices through high costs and limited interoperability. Therefore, it is necessary to reduce the need for custom-tailored vendor-specific solutions and provide interoperable solutions. Thus, two strategic action points should be pursued: Firstly, greater flexibility and better integration of mobile applications with LMS is required for creating complex learning and working environments. Secondly, the provisioning of better production facilities for high quality knowledge resources that is accessible to the academic community on a wide range of devices.

“Access to remote labs, scientific data, and simulation and game tools for educational purposes” (S-16) will offer added-value services to students, lecturers and researchers and bridge the existing gap between research and education. This is still an emerging field, but coupled with the OER trend, it has great promise and could largely benefit from the actions proposed by the other groups (cloud computing, data management, working environment and e-publishing).

New solutions for **producing educational content** (S-17) in a more user-friendly and collaborative way be it for regular courses or MOOCs to enhance the attractiveness of the educational resources and complement existing Open Educational Resources (in collaboration with librarians who can promote e-books and other pertinent electronic resources needed by students). For instance, there is a real need for annotation tools (textual and video), and for integrating authoring tools with existing e-book producing environments, which will serve lecturers, students, but also researchers in their everyday work.

Because the web is transnational, never as before **copyright issues** (S-17) have become more vital to address. Fortunately, within the previous AAA programme the Digital Copyright in Education (DICE) project developed all the necessary tools to render attentive teaching staff to these issues. Yet, this is clearly not enough because so far of limited scope and involving only few Swiss institutions. Therefore, regained efforts to further develop DICE are necessary through the setting up of a national-level competence center on legal issues in both e-learning **and** e-research (this latter, central to the CUS-P2 programme, having specific copyright issues).

MOOCs have attracted the attention of many institutions as being an important vector of delivery of electronic educational content. Because it involves several thousands of students per course, there are new needs in the way students are tutored (besides e-assessment techniques), and this is referred to as “**self-service tutoring engine**” (S-17), a tool related to data analytics and intelligent agents. With the development of **lifelong learning**, this kind of technology will increasingly be demanded, along with access to OER and other educational resources.

Last, but not least: e-learning is a very dynamic field in constant evolution, and thus for all the proposed new national services, the community of practice must stay tuned and reactive to the current and next innovation waves in learning and teaching methods. To that end, we included an action concerned with the **consolidation of the existing eduhub community** (S-17). This is to ensure that the realization of all actions remains in line with the identified needs on a long-time period.

2.5. Action items

A. An e-Portfolio service with the following features
    1. Lifelong identity building (in link with e-identity services) and learning certification solutions to manage informal learning;
    2. A national instance of e-Portfolio with import and export functionalities to work with separate HEI local instance platforms (including LMS) and professional and social platforms;
    3. Tutoring materials and guidelines for promoting the e-portfolio in the academic community;
    4. Advanced functionalities to support reflexive practices (through for instance visualization tools, annotation tools, templates and wizards).
B. e-assessment services providing a well-focused mix of centralized and local services and an e-assessment consultancy service / national competence center
    1. Centralized and local services featuring

        i. Enable a fully digital end-to-end e-assessment workflow (with a national public key infrastructure for digital signing of an exam before submission (student) and after grading (faculty) and for archiving (faculty, HEI);
        ii. Propose tools supporting peer-assessments in different scenarios (scaling for groups, classes and MOOCs);
        iii. Support e-assessment client-side tools such as lockdown browsers and their mass-deployment as well as tablet-based e-assessment solutions to deliver exams to students and/or support examiners (e.g. in oral exams) ;
        iv. Support standardized and well documented interfaces (APIs) for importing data between different services;
        v. Improve existing export functionality (e.g. csv-export) in e-assessment tools for storing the assessment results for future analysis;
        vi. Improve existing e-assessment possibilities in LMS and build connectors to extend their e-assessment functionalities in a more flexible way;
        vii. Implement or improve didactical and/or psychometric best practice standards of LMS e-assessment functionalities;
        viii. Propose tools supporting the preparation of e-assessments;
        ix. Propose tools supporting the post-processing, analysis and presentation of e-assessments.
    2. An e-assessment consultancy service providing
        i. Identification and implementation of common needs;
        ii. Technical and procedural recommendations and advice to the institutions on the organization and execution of e-assessments;
        iii. Clarification on legal and security issues on e-assessments.

C. Knowledge transfer with electronic support
    1. Support for Mobile services through
        i. Development of a mobile app clearing house for a mobile learning app certification across organizations (currently, no commercial solutions for inter-organizational app-certification exist on any platform);
        ii. Provisioning of frameworks, guidelines and recommendations for integrating mobile apps into the learning environments and campus information system of the Swiss higher educational sector;
        iii. Identification of interface requirements between LMS and mobile applications based on a review of the current situation;
        iv. Development of educational guidelines for creating integrated multi device learning environments.
    2. Access to remote labs, scientific data, and simulation and game tools for educational purposes;
    3. and integration of video, textual and rich media annotation Development tools supporting interaction and knowledge building processes, including (among others):
        i. Possibility for teachers to use these tools to mark students' productions (e.g., in medical clinical exams to document students' performance);

ii. Promotion of analytical or observation students' competences based on the analysis of various types of media;
iii. Students' self-evaluations to identify their own weaknesses in oral production in autonomous learning contexts;
iv. Annotations of students' and researchers' readings to spot out important knowledge.

D. Management and delivery of electronic educational content
1. E-Book publication pipeline support and authoring of educational/research content, featuring:
   i. Peer-review, collaborative work, quantitative evaluation, and transcription mode;
   ii. Better integration of learner interaction with LMS;
   iii. Repository integration for storing, organizing, and sharing of digital publications, interoperable widgets for interactive multimedia content for e-books (potential synergies with S-8);
   iv. Integration with existing e-book authoring environments and production pipelines for platform independent interactive e-books;
   v. Development of educational guidelines for using e-books in higher education and recommendations of state of the art e-book readers on the different mobile platforms.
2. A competence center on legal issues in both e-learning and e-research, featuring:
   i. Free access to online resources and tools to allow lecturers, researchers, and staff of Swiss HEI to quickly and easily find specific information on legal aspects and to apply this information in their everyday teaching and research contexts;
   ii. Delivery of training activities (online and in presence forms);
   iii. A first-level help-desk support to all Swiss HEI staff to solve legal issues.
3. Self-service tutoring engine featuring:
   i. A decision tree to help students follow an adequate learning path with the right ICT tools;
   ii. A "Tutoring Profiler" to support students in their development of ICT competences needed to succeed in their studies.
4. Consolidation of the Swiss eduhub community to allow:
   i. Techno-pedagogical best practices to be capitalized and shared within the academic community through the Swiss CCSP e-learning centers and international collaborations ("techno-pedagogical watch", "expertise in setting MOOCs", etc.);
   ii. Promoting special interest groups (SIG) to address at national level key topics (eg, e-assessment, MOOCs, e-portfolio, OER, student voice, game-based learning, etc.).

3. Dependencies and Interfaces

3.1. Prerequisites from other strategy projects

- **e-identity platform** for ensuring lifelong identity for the e-portfolio service;
- **data management** for the questions of long-term data preservation and access to scientific data for educative purposes;
- **cloud computing** to provide an environment based on virtual machines for simulation and game environments (for educative purposes);
- **e-publishing tools** for authoring teaching content, e-books, etc., and a coordinated legal approach to copyright issues between e-learning and publishing;
- **working environments** for:
    - a coordinated effort between personal learning environments (PLE) in the e-learning domain and the action item “WE-2: personalized environment”;
    - a joint effort to support mobile functionality between e-learning and the action item “WE-4: Functions for mobility”.

3.2. External interfaces

APIs when necessary.

3.3. Further dependencies and relevant external factors

Learning objects deposited into repository should use standard metadata.

Legal questions will be dealt with by service eL-4-2 (“A competence center on legal issues”); other legal questions related to e-assessment will appear but should be coordinated through the legal departments of each institution (cantonal laws as well as institutional local rules apply).

4. Economic Efficiency/Availability of Funding

4.1. Implementation costs

See Table in Section 6

4.2. Operational costs

See Table in Section 6

4.3. Customer benefit

For the University:

- S2: Possibilities to establish a network for alumni and associated services through e-Portfolio;
- S15:
    - Improved quality of exams: in many cases e-assessments can help make exams more objective, reliable and valid;
    - Improved efficiency and time savings for the examiners.

- S2, S16 and S17:
    - More efficient use of the e-learning resources available at the institutions, reduced costs for individual institutions in apps development (first mover potential for next generation apps integration on a Swiss scale), improved collaboration between different universities and between different types of universities in particular, including improvement in the dissemination of concepts, standards, and tools;
    - Mitigation of the risk of having to pay fines for illegal use of digital resources by teachers, lecturers and staff.

For the lecturer:

- S15:
    - Decrease in manpower needed for examinations through the use of a well-established (local) e-assessment service;
    - Quality improvements of exams.
- S2, S16 and S17:
    - Replacing the large number of e-learning tools and services, which do not have proper maintenance, with established, well-maintained and standard e-learning services at national level adapted to lecturers;
    - Reducing fears and raising confidence about allowed behaviors in the use of copyrighted digital material for teaching activities.

For the researcher:

- S16 and S17:
    - Putting research-based teaching and learning into practice (e.g., case based learning, inquiry based learning, project based learning, etc.);
    - Applying research skills in teaching, and vice versa (e.g., visualization and presentation of new findings, working with students' groups in virtual environments, etc.);
    - Get quick and easy transfers between research and teaching through the use of digital media;
    - Enlarging scientific digital collections with students' input;
    - Getting inspiration for further research from pertinent students' questions;
    - Reducing fears and raising confidence about allowed behaviors in the use of copyrighted digital material for research activities.

For the student:

The role of students is essential in the success or failure of any tool, and whichever tool that will be developed we should include students (for example a student committee) for its conception, testing and implementation (be it the student of the future or the student from today). Also,

- S2:
    - Availability of a modern personal learning and working environments adapted to the interests and needs of each student;
    - Support for an e-portfolio, which remains available beyond the university studies and allows students to keep their certificates, work results and personal information, if desired, in one place.
- S15: Benefit of well-aligned, competence-oriented e-examinations. Improved objectivity and thus exams that are fairer.
- S16 and S17:

    - Well-maintained e-learning tools accessible to students with the same credential for all universities;
    - Ease of mobility between institutions.

For the IT services departments and e-learning support facilities of the Swiss universities (CCSP):

- S15: Support in setting up a robust and scalable e-assessment service at the institutions;
- S2, S16 and S17:
    - Advantage of being able to concentrate on the services that have to be offered locally, with referring to the national services for non-local tasks;
    - Pooling of the services and reinforcing of the community (eduhub).

5. Implementation Plan and Risks

S2: Action A2:

- The main e-portfolio service is developed and maintained by the already planned SWITCH e-portfolio service. Functionalities that would be developed on local instances must be designed so as to be easily integrated/interoperate with the national instance.

S15 - Exams with electronic support (centralized and local e-assessment services):

- With a call for proposals, existing e-assessment tools (e.g., e-OSCE, SIOUX, SEB, etc.) should be consolidated and new functionalities as well as tools developed (e.g., peer-assessment tools, SEB-Server, digitally signed submission and marking of exams, etc.).
- From the third year of the program onwards (consolidation), one institution should be mandated to provide the central services (e.g. VDI-Infrastructure for exams, SIOUX, SEB-Server, peer-exams toolbox etc.) and the HEIs would be accounted on a subscription model. Costs may vary considerably, depending on the type of e-assessment service implemented (a decision towards which services should be offered centrally should be made collegially between the relevant stakeholders (i.e., the institutions using the service, the SIG e-assessment, ETWG, etc.).
- Further development of the central services as well as of the local tools (e.g., SEB, e-OSCE, peer-assessment tools) should be geared by the SIG e-assessment and the provider of the central services and would be financed by cooperative innovation projects of the HEIs.
- Risks:
    a. Establishing local services at HEIs, which do not yet operate e-assessment services is a delicate undertaking. Exams are typically high-stakes situations for all people involved, and there is very little tolerance for failures. Thus the implementation of new e-assessment services should produce results as early on as possible, with a basic and easy to manage e-assessment service, in order to secure local support for e-assessments at HEIs. More ambitious exam environments and scenarios should only be implemented after a basic local e-assessment service has successfully been established.
    b. Risks may be taken in account on the side of commercial providers for proctored exams, as we observe it overseas as well as in Germany. These services could compete to central services offered on the level of basic

exams (multiple-choice questions and regular questions). On the side of advanced examination formats (peer-assessment, competence-oriented exams), it seems hard to imagine a business case on this for a commercial company.

S15 - Exams with electronic support (e-assessment consultancy service):

- Mandate to an institution to be selected to act as Service Broker, ETHZ (Online Examinations with LMS/SEB, SEB-Server and competence-oriented exams with VDI), UniBe (e-OSCE, MEASURED) and UNIGE (peer-assessments), which are the leading houses in the particular subjects.
- After a period of 3 years either all HEI have an e-assessment service or there are enough HEIs with a regular service, which could help on a peer-to-peer level. Further coordination of e-assessments subjects is part of the regular work of the SIG E-Assessment and the eduhub community. Further operational costs are not expected.
- Risks:
    a. An essential prerequisite is that a HEI is willing to initiate and finance a project “e-assessment”. So the decision of the institution board is necessary. Without such a backup the project risks to fail due to missing internal support.
    b. There exist no commercial solutions for such a consultancy service and it is hard to believe that such would be a future business case for a consultant company.

S16: Action C1:

- Developing frameworks for interoperable mobile apps that can be used in different organizational settings without considering the specific system architecture (for instance by engaging educational technology industry to provide interoperable solutions that are available to all Swiss organizations (e.g. through certification)).

S17: Actions D2, D4:

- Competence center on legal issues: a service centrally provided by a competence center or an association to be constituted (e.g., by the partners of the DICE project, together with SWITCH and other interested institutions, such as other Swiss HEIs or collecting societies). Note: no risk that international solutions are superior, as the center will necessarily focus mainly on the Swiss regulation.
- **eduhub** is the forum of the e-Learning community in Switzerland and is coordinated by SWITCH. Each institution contributes manpower to the joint activities such as the SIGs. SWITCH offers its coordination effort as part of the “SWITCH basic services”, covered by the institutional contributions to SWITCH as approved by the Foundation Council.

6. Conclusions and Priorities

Action Item	**Impor-tance**	**Alignment with program goals**	**Availability of funding / business case**	**Implement ation risks**	**National benefit**	**Implement ation effort 1 <= 1 FTE 2 = 2 FTE … 6 >= 6 FTE**	**Operationa l effort 1 <= 1 FTE 2 = 2 FTE … 6 >= 6 FTE**
Scale	**1 (high) – 6 (low)**	**1 (high) – 6 (low)**	**1 (easy) – 6 (difficult)**	**1 (low) – 6 (high)**	**1 (high) – 6 (low)**	**1 (low) – 6 (high)**	**1 (low) – 6 (high)**
A1. Lifelong Learning	1	1	N/A	2	1	2	1
A2. National e-portfolio	1	1	3	3	1	3	1
A3. Tutoring material and guidelines	2	2	N/A	1	2	1	1
A4. Reflective practices	1	2	N/A	1	2	2	1
B1. Centralized and local services	1	2	4	1	1	6	3
B2. e-assessment consultancy	1	2	3	2	1	2	1
C1. Mobile services	1	1	3	3	1	5	3
C2. Access to remote labs, scientific data, and simulation and game tools for educational purposes	1	1	N/A	4	2	6	1
C3. Annotation tools	1	2	N/A	1	2	2	1
D1. E-Book publication pipeline support and authoring of educational/ research content	1	1	N/A	2	2	5	1
D2. Competence center on legal issues	1	1	1	3	1	3	2
D3. Self-service tutoring engine	2	2	N/A	3	2	2	1
D4. Consolidation of the Swiss eduhub	1	2	1	1	1	1	1