Techno-pedagogical aspects of the Up2U learning ecosystem

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Abstract — **The "Up to University" (Up2U) Project – coordinated by GÉANT – is to bridge the gaps between secondary school and university by providing European schools with a Next Generation Digital Learning Environment (NGDLE) that helps students developing the knowledge, skills and attitudes they need to succeed at university. This student-centered digital learning environment forms the Up2U ecosystem, which integrates formal and informal learning scenarios and applies project-based and peer-to-peer learning methodology to develop transversal skills and digital competences crucial for success at university. Up2U believes in a digital learning ecosystem that is a set of autonomous tools represented by portable containers integrated together via open standards and protocols. Tools can be picked by the user in any shape and form to best support their individual learning path.**

Keywords — *Up to University, Up2U, Next Generation Digital Learning Environment, Schools, Pedagogy, Platform Deployment*

I. CONCEPT

The concept is to develop an innovative ecosystem (Fig. 1) that facilitates more open, effective and efficient co-design, co-creation and use of digital content, tools and services specially adapted for personalized, collaborative or experimental learning by students preparing for university. The creation of a NGDLE requires the integration of formal and informal learning as a global learning experience, and needs to identify and assess informal activities and promote transversal competences through them.
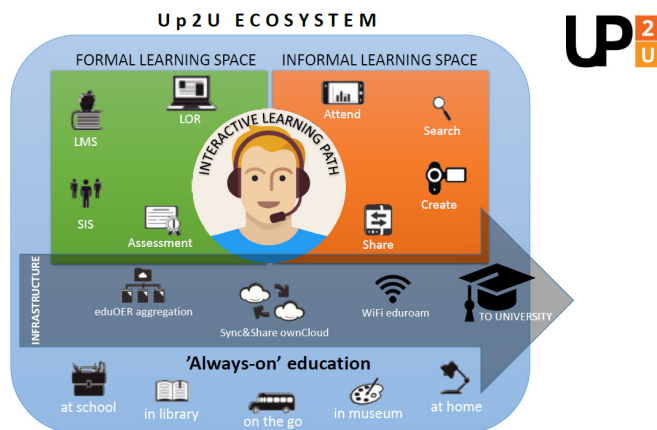

Fig. 1 Ecosystem

The Up2U learning context from the perspective of the students is the intersection of formal and informal spaces, a dynamic hybrid learning environment where synchronous activities meet in both virtual and real dimensions.

II. PEDAGOGY

It is appropriate to investigate to which extent transversal skills are emerging in European school and university curricula, and whether informal learning is effectively considered as an important part of school and university learning process. Online surveys have been designed by the Up2U Consortium wherein 281 data sets have been collected from 80 pilot schools in 9 countries taking part in the study. In this way, it was possible to clarify school trends (S) and university needs (U) with regard to transversal skills and informal learning, and at the same time to identify the technological tools and infrastructures available in the pilot schools (Fig. 2).
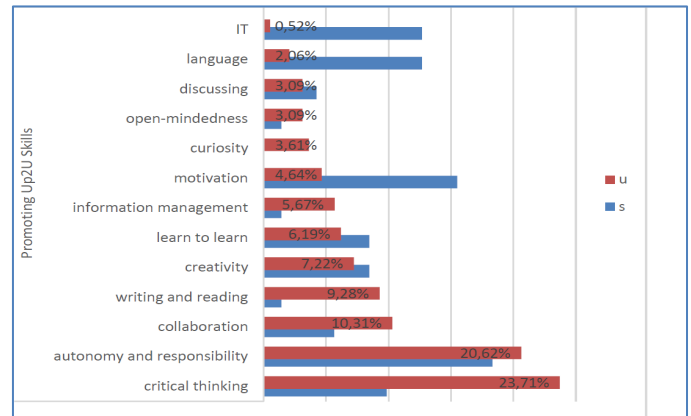

Fig. 2 Promoting Up2U skills

Perhaps the most important similarity that emerged is that university lecturers as well as high school teachers clearly understand that, in order to help their students make a transition to university, new teaching models are required to promote the skills they themselves identify as being critical. The target "Up2U skills" include:

- socio-relational skills (collaborative problem-solving, team-working, appreciation of diversity, project management),

- cognitive skills (critical thinking, constructive commenting, languages),

- character-based soft skills (autonomy, resilience, motivation, self-esteem, flexibility) and

- knowledge skills (media and information literacy, selection and validation of digital content).

A very important aspect to consider is that teacher training should propose to the teachers themselves the same learning path that they will offer to their students. The contents don't need to be the same, but the model has to be experienced by the teachers themselves in order to be understood, assimilated and replicated to the students.

III. ARCHITECTURE

There is no single system or tool that can support all the Up2U pedagogy and crucial skills development at once! Up2U believes in a digital learning ecosystem that is a set of

autonomous tools integrated together via open standards and protocols. The Learning Management System (LMS) should no longer be the center of the universe (Fig. 4).

LMS-based architecture
Tools are integrated into the LMS via specific plug-ins or lately LTI. Learning Analytics is happening inside the LMS.

Transitional architecture
LTI becomes the predominant Learning Tool Integration method. More tools are interacting directly with each other. LA is getting information from connected tools.

NGDLE architecture
Ecosystem of integrated, interoperable set of tools. LMS is not that important, if exists at all. Learning Analytics is an externalized function collecting all learning data from tools
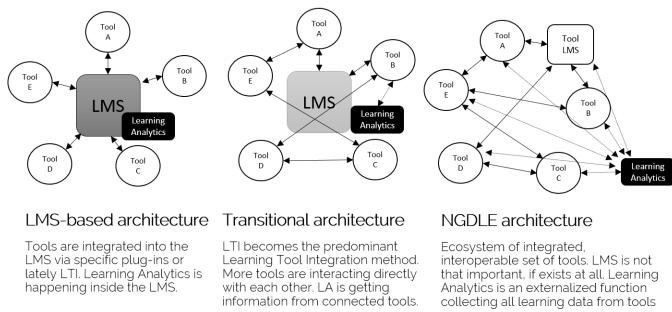
Fig. 4 Next Generation Digital Learning Environment

Tools can be picked by the user in any shape and form to best support their individual learning path. The integrity of the ecosystem makes sure that both formal and informal learning scenarios contribute to the overall learning objectives of users (e.g. assessed by advanced learning analytics).
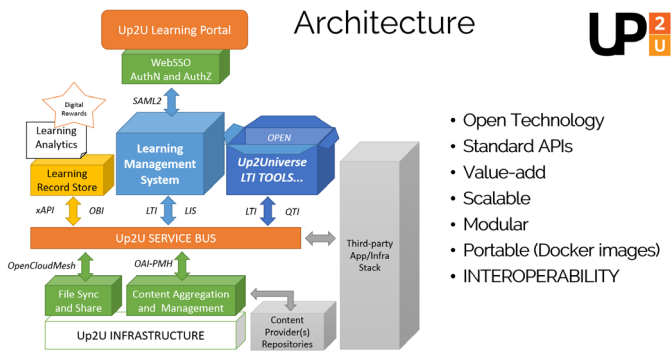

Fig. 5 General architecture

Our *"Up2U Service Bus"* constitutes the backbone of our NGDLE architecture (Fig. 5). It includes a defined set of standard protocols and APIs (in coordination with IMS Global and other standards) to ensure seamless interoperability of the functional building blocks. Our "Up2Universe" is an open container of Learning Tools Interoperability (LTI) based tools and services accessible via the Learning Management System (LMS). Our ecosystem has unique added-value functionalities such as; federated access and externalized group management, enhanced file sync and share capabilities, Open Education Resource aggregation and inclusions, and integrated learning analytics function supporting open badges.

IV. IMPLEMENTATION

Our first Minimum Valuable Products (MVP) implementation (Fig. 8) has the following functional components:

An LMS typically has the ability to represent courses (and learning materials within them), assignments, student registrations and timetables, results, and so on, and usually provides interfaces for both educators and learners. We envisage that the bulk of user interactions with the Up2U platform will be mediated by an LMS; users will log in (via a federated Authentication and Authorization Infrastructure) and use, create, share, mash up and modify educational resources via tools integrated with an LMS.
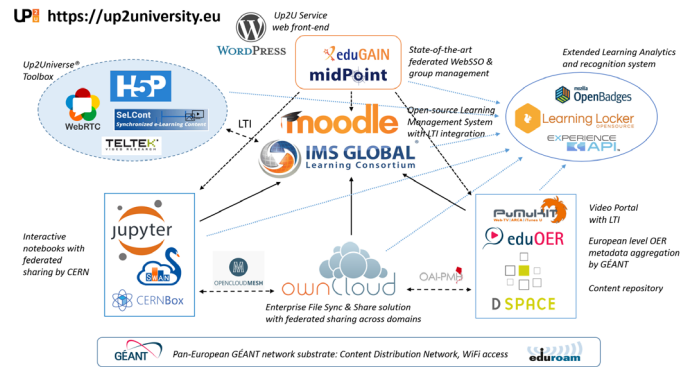

Fig. 8 Minimum Valuable Product #1 design

When it comes to authentication (AuthN) and authorization (AuthZ) solutions for the federated and integrated Up2U next generation learning platform and its services, Up2U follows the state-of-the-art architecture and guidelines recommended by the flagship project AARC (and lately AARC2) [9].

The federated File Sync & Share functionality of the architecture is implemented by the ownCloud software [10]. CERNbox is a particular File Sync & Share platform developed by CERN using the ownCloud engine. SWAN is based on the technology provided by Project Jupyter and it uses CERNBox as the home directory for its users [11]. As a consequence, all the files (e.g., pictures, videos, datasets) available in CERNBox can be easily imported in a SWAN notebook and, vice versa, the notebook itself will be synchronized and stored in the cloud.

The eduOER Metadata Repository (i.e. referatory) is a platform for aggregating and providing a federation of learning object metadata across multiple connected repositories [12]. The eduOER aggregation engine is based on the ARIADNE Tools. The Up2U eduOER metadata repository will be the main learning object feeder (i.e. "content gateway") to the Up2U LMS. The communication between them in the initial pilot phase is proxied by PuMuKit, described below, via the Learning Tools Interoperability protocol.

PuMuKIT is an Open Source Video Platform that provides organization, flexibility, accessibility, and scalability, designed and engineered to handle large collections of video or audio assets [13]. This platform will act as a frontend layer to display Up2U eduOER content as a web-portal and to integrate this content into the Up2U LMS and other possible platforms.

To provide the LMS component of the Up2U prototype, the Moodle platform [14] was selected, as a very widely used and supported LMS, of which multiple partners in the project have experience. Learning Locker [15] is a PHP-based xAPI-compatible Learning Record Store (LRS) which can be used to collect Learning Analytics data from a variety of learning platforms and which can serve as a data store for Learning Analytics and visualization software. Currently we have developed a Dockerised version of Learning Locker to be deployed alongside the Moodle installation, but it has not yet been deployed or integrated with Moodle until the data protection policies related to Learning Analytics have been fully developed.