Agile, Versatile, and Comprehensive Social Media Platform for Creating, Sharing, Exploiting, and Archiving Personal Learning Spaces, Artifacts, and Traces

Denis Gillet, Andrii Vozniuk, María Jesús Rodríguez-Triana, and Adrian Holzer

Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland
{denis.gillet, andrii.vozniuk, maria.rodrigueztriana, adrian.holzer}@epfl.ch

Abstract. Nowadays, students bring their full ecosystem of social media platforms and their own devices to school, while teachers benefit from and contribute to local or global repositories of educational resources. As a consequence, educational institutions have to better align their digital infrastructures and support schemes with these personal ecosystems and social practices. They also have to offer resources at a level of granularity aligned with targeted activities rather than full-fledged courses to ease personalization. Institutions finally have to ensure control of learning traces and persistence of learning outcome. To meet these needs, this paper presents *Graasp.eu*, a social media platform supporting digital education from primary and secondary school to higher education. Participatory design, fitness for active learning, and adoption are discussed as well.

Keywords: Collaborative learning, inquiry learning, personal learning environment, social media, ePortfolio, learning analytics, participatory design.

1 Introduction

In the framework of three consecutive European initiatives in Technology Enhanced Learning (TEL) aiming at defining online support for communities of practice (CoPs) [1], personal learning [2,3,4] and inquiry learning at school [5], the need to provide a versatile and agile social media platform strengthening digital education has emerged. The main features of such a platform mimicking the social media solutions people are using daily include the ability (i) to **create** online spaces targeting dedicated learning activities by aggregating resources from various cloud or local sources, (ii) to **share** these spaces with peers (either teachers or students), (iii) to **exploit** these spaces by interacting with the integrated resources, available tutors, and collaborating peers, as well as (iv) to **archive** these spaces together with the learning outcome (produced artifacts) for later use or as proof of personal achievements in lifelong learning. Such features are usually offered by different platforms in typical academic infrastructures.

However, to provide control of the full life cycle to the end-users, it appeared that offering a single platform increase adoption, efficiency, and effectiveness.

This paper presents how the TEL trends have guided over the last decade the design and deployment of learning environments for science and engineering education from primary and secondary school to higher education. A special attention is put on solutions enabling teachers to design and personalize themselves or with peers the resources they need for their own teaching activities and to equip students with solutions enabling them to carry out active and collaborative learning activities for the acquisition of core and transversal competences, as highlighted by the digital education objectives of the European Commission in its IST H2020 Programme [6].

2 Evolution Towards Agile Social Media Platforms for Education

Despite their broad acceptance and dissemination, Learning Management Systems (LMS) only tackle the delivery of course material at school (in some countries or regions) and in higher education (in most universities). They provide very little support for content creation and collaborative activities, as well as no support for sharing across institutions and between educators. Content produced by students and activity traces are also generally deleted at the end of the course. To cope with this limitation, ePortfolio systems have emerged. The social media platforms that both educators and learners are using daily enable them to co-create content, share it with people selected by themselves, as well as to keep access as long as they wish. Hence, there is a clear need to offer additional facilities to better support a broad range of educational scenarios and activities.

Investigations carried out in the framework of three European projects in digital education have contributed to better elicit the requirements for effectively supporting not only blended and active learning, but also the acquisition of the digital skills necessary for both educators and learners to take a full advantage of the information and communication technologies for better teaching and learning experiences.

2.1 Supporting online communities of practice and collaborative learning

The FP6 European project PALETTE (2006-2009) aiming at eliciting requirements and validating prototypes to support online communities of practices and learning communities clearly demonstrated the need to offer **agile** platforms able to adapt to the various levels of interaction required between the members, which can range in the lifespan of a community from basic **synchronous or asynchronous discussions** to **co-creation of resources** through **resources and best practices sharing** [1]. Enabling the creation of a common online **identity** in communities composed of members from different institutions or organizations is also a key requirement to build a sense of belonging. The online support platforms should be **opened** to enable anyone sharing the same interests to join a dedicated community and potentially to lead or facilitate some activities through self-organized **memberships, access rights and roles** management; independently of their main affiliation. Such open platforms nowadays often rely on *Facebook* or *Google* identities as de facto single-sign-on (SSO) credentials. If nonprofit organizations controlled by citizen would offer a unique or alternative digital identities at birth (as states provide a unique social security number), SSO not tight to monopolistic commercial companies could be enabled. This model of connecting people **across organizational and institutional boundaries** corresponds well to the model of teacher communities sharing interests in a common discipline and in a given language. They should be the drivers to enable the broad co-construction and sharing of educational resources. The current MOOC trend is a first step towards the world-wide sharing of online educational resources in higher education. It however currently lacks the co-creation dimension, most of the MOOCs being prepared and delivered by a single educator. At the school level, the Go-Lab repository is an interesting initiative to enable co-creation and sharing of resources for inquiry learning as detailed in Section 4. Keeping an online community alive is always challenging. A proper combination of face-to-face meetings and online interaction is the key to achieving this objective, providing enough interaction is happening online thanks to an "animator" and providing **notifications** keeping people aware of the ongoing activities are delivered. As a matter of fact, not only contributors but also passive consumers of information are important to sustain a community. Hence, the ability for them to give their opinions through SALT features should be possible. SALT is an acronym adopted to describe the social media actions of Sharing, Assessing (i.e. rating and commenting), Linking, and Tagging that can be performed by users on shared resources [3].

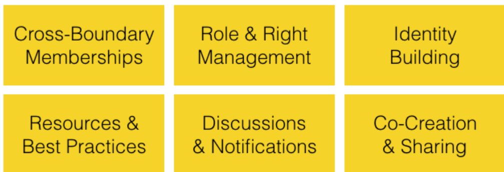

Fig. 1. Agile support for online communities of practice and collaborative learning

Ultimately, the requirements elicited to support online communities of practice also cover the case of collaborative learning when managed by the students themselves and when involving experts or tutors from external institutions or organizations.

2.2 Supporting personal and informal learning

The FP7 European project ROLE (2009-2013) aiming at investigating and prototyping platforms to support responsive, personal, informal and self-directed learning clearly demonstrated the need to offer **versatile** solutions enabling educators and learners to freely **aggregate resources and services** from personal collections, legacy repositories or from the cloud [2,3,4]. Services can be offered as embeddable Web applications or loosely coupled online platforms. In such a rich ecosystem, powerful **search** and **recommendation** features are required [7], not only to discover suitable resources and services, but also to find peers or experts with competences and willingness to share knowledge or collaborate on dedicated activities.

Personal learning is self-directed and opportunistic (i.e. initiated when a need materializes), focusing on **targeted activities or topics** rather that courses or complete syllabus. In that sense, it is quite in line with the typical patterns of use observed on social media platforms where people share and consume small chunks of information. As a consequence, the creation of personal learning environments should be free of any intervention of managers from institutions or organizations. In personal learning, the activity is triggered by the learner (it is learner-centered), but often it is carried out collaboratively. Due to its opportunistic nature, access to personal learning environments might be irregular and not so frequent. In such a case, it is important to rely on mainstream social media **communication channels** to reach and notify members when new content is available or new actions happened, as well as to facilitate sharing through **unique Web links** to ease accesses.

Most of the time, personal learning objectives are implicit, i.e. they are not formalized and even not consciously expressed by the learners. As an example, someone having to use a statistical software package to analyze data will look for online support resources when required.

Personal learning is not a new way of learning. It has always existed on the side of formal education in different forms. However, the development of information and communication technologies is empowering personal learning and it should be better recognized by the educational institutions to build on it and also to contribute to equipping students with the digital skills required to take full advantage of it.

Fig. 2. Versatile support for personal and informal learning

The most basic personal learning environment is just the ecosystem of the social media platforms a learner uses daily to interact with resources and people for educational purposes. However, to enable **sharing**, **archiving**, and **retrieval**, interoperating platforms (through loose coupling or interoperability standards) or a dedicated platform for personal learning could be required, like the one presented in Section 3. As a matter of fact, the IMAILE project (http://www.imaile.eu) is currently running a competition for the ultimate platform to support personal learning in primary and secondary schools for STEM education. One should notice that the requirements elicited for personal learning, due to its social and resource-based nature, are quite similar to the ones of **knowledge management** in organizations.

The initial passion for personal learning environments [8] that emerged around 2007 was a bit tempered recently when the research community realized the challenges for learners, especially pupils, to have the necessary digital skills and level of autonomy to take full advantage of this concept. However, pilot activities in deploying platforms to support the creation and exploitation of personal learning environments have demonstrated that an interesting target public are not school students but teachers who are often left alone to develop new practices and resources. In the next Section, we show how personal learning environments can support the co-creation of learning resources by science teachers and their exploitation with their students.

2.3 Supporting inquiry learning

The FP7 European project Go-Lab (2012-2016) aiming at promoting inquiry learning with online laboratories (labs) at school clearly demonstrated the need to offer **comprehensive** solutions supporting educators from the creation to the evaluation through the exploitation of rich and interactive learning resources for STEM (Science, Technology, Engineering and Mathematics) education [5,9].

Numerous conditions have up to now impaired the broad dissemination and exploitation of online resources at school. (i) The need for schools to install technical infrastructures or, when available, the need for teachers to go through cumbersome installation or configuration processes requiring IT managers. (ii) The little incentive, recognition, or just practice of sharing resources between teachers, which is a prerequisite to avoid everyone reinventing the wheel alone. (iii) The challenges of building online resources going beyond simple electronic multimedia documents. (iv) The complex copyright schemes or costs associated with the few resources available. (v) The difficulty to personalize resources from others to different contexts. (vi) The challenges of following the activities of the students and the associated privacy requirements when using external platforms.

It happened that a personal learning environment can be easily extended to be co-created, shared and exploited as an **Open Educational Resource** (OER). The co-creation should be carried out individually or collaboratively by teachers, which are free to aggregate all the resources required for a given activity. There is no need to develop resources to cover an entire course. As in most blended learning scenarios online resources should be seen as a complement to enrich the ones available locally. Activities with online resources accessed from a computer room or using tablets should not last for more than 2 hours. The full creation and exploitation of the resources should be carried out in the cloud with seamless access for students requiring no predefined or preassigned credentials. **Personalization** of resources created by peer teachers should be achieved at various levels, such as translation to other languages, adaptation to different notations or more or less sophisticated terminology, as well as modification of the content or embedded resources to better fit the local curricula or objectives. **Privacy** should be controlled online using a model similar to the physical access control implemented in a classroom. The storage and retrieval of student-generated content and activity traces required to offer **learning analytics**, should also be fully controlled by the teachers and confined at the right access level to avoid unwanted dissemination. Teachers should be free to use privately the resources they have created or personalized, but they should also be encouraged to share them more broadly for the benefit of the educational communities. The best scheme currently available for such sharing is based on **licensing** using Creative Commons that, if properly selected, enables recognition and repurposing of resources by others. Well-defined OERs and adequate licensing should allow a more significant development of **federated repositories** able to cross-reference and offer resources for the worldwide educational communities. The LTI standard (www.imsglobal.org) looks currently like to best way to enable the delivery and the integration of such resources in various learning environments, including LMS, MOOC platforms or PLE.

Fig. 3. Comprehensive support for inquiry learning

3 Holistic design and implementation of shared spaces

The type of Open Educational Resources described above goes beyond typical multimedia material. A PLE exploited as an OER is a placeholder of lower-level components necessary to be combined to support a given learning activity [10]. Such components could integrate wikis, Web links, pdf documents, images, *YouTube* videos or external services offering serious games, didactic simulations or more advanced applications. In addition to the **content** mentioned, a given instance of an OER can also be exploited as a **container** of the content produced by students (as example discussions in an embedded blog or the output of a simulation) that represent the tangible **learning outcome** and a repository of their **activity traces**.

The learning analytics that can be constructed based on learning outcome and activity traces are valuable for supporting **formative and summative assessment**, depending if they are visualized by the students themselves during the learning process or by the teachers or even parents in the course or at the end of an activity [9, 11]. **Peer assessment** can also easily be supported if proper access control to outcome and traces is available.

The trend is currently also to offer through an OER accesses to big data or connected objects from the Internet of things.

Following what was presented in the previous Sections, we can propose the following 7-level model to represent the nature of data offered or collected in next-generation learning environments and possibly embedded in an OER.

- **User Data**, encompassing user identity, relevant user profile information and user access permissions.
- **Content Data**, including multimedia resources and big data, gathered from legacy sources, the cloud or connected objects.
- **Metadata**, describing the **context** of creation and exploitation, elicited from the underlying services and activity traces.
- **Opinions**, capturing the **relevance** of the data, elicited from popularity indicators and comments using data mining and natural language processing technologies.
- **Processes**, summarizing the **journey** towards knowledge and competences acquisition through activities, elicited from implicit or explicit scenarios followed, as well as from linked data.
- **Analytics**, expressing the **impact**, built from the above for awareness and reflection, elicited from log analyses and machine learning algorithms;
- **Outcome**, expressing the acquired **skills**, elicited for learner-generated content.

The core resource fulfilling the objectives mentioned above is what we call an online learning space (OLS), or just a **Space**. A space can be freely structured and exploited directly by learners as a PLE or structured by teachers following predefined pedagogical scenarios and exploited by their students. Depending on the enforced scenario, it can be defined as an inquiry learning space (following inquiry learning phases) as an eBook (structured with chapters) or as a MOOC (structured as weekly modules).

The *Graasp.eu* open platform has been designed following the requirements elicited through participatory design [12] in the three projects described above. Anyone can first sign up and then sign in to use it for free for educational propose. Once logged into the platform, the "+/-" button (Fig. 4) enables to create either an empty online space (PLE) or a structured one enforcing inquiry learning scenarios and referred as an Inquiry Learning Space (ILS). The side pane provides settings, notifications, and recommendation of resources and people.

Users can add information in their profile (shoulder and head icon). Spaces can be set as favorites (star icon) for easy access. Spaces are like online folders that can be shared individually with people selected by entering their name or email on the side pane (Fig. 5). The role of any members can be set to owner with the right to invite other people, editor with the right of adding resources or viewer with the right to contribute to discussions. Each space can be set as Private to be accessible by members only or as Public. The content of a space that can be added using the "+/-" button includes other spaces (regular sub-spaces or inquiry learning spaces), standalone rich-text documents, files that can be previewed as pdf, links to external Web pages or services, Open Social Web applications, or discussions.

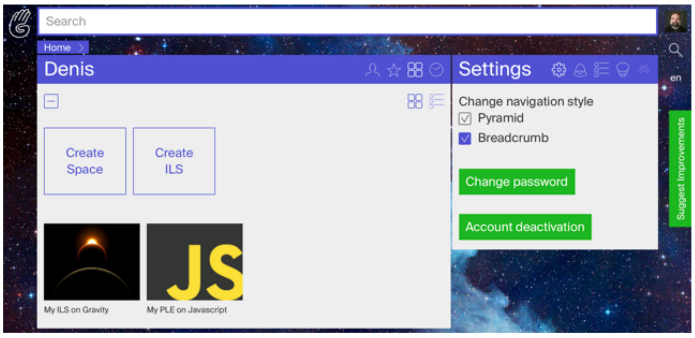

Fig. 4. Space creation in *Graasp.eu*

Once added, content can be renamed, reordered, moved or commented and displayed in various ways, including as a grid of icons, as a list or an expanded list on a single page using the change view buttons (Fig. 6).

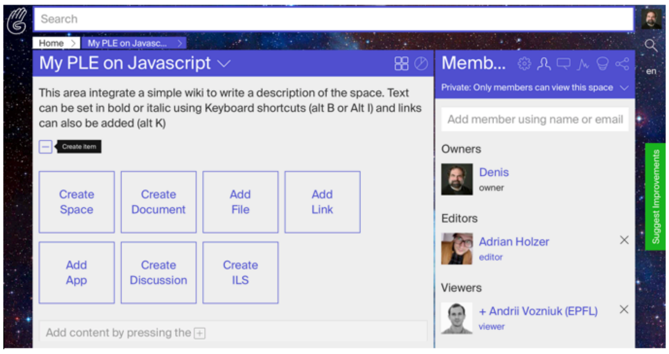

Fig. 5. Adding content and inviting members in *Graasp.eu*

All recent actions are visible in the corresponding side pane (Fig. 6), which also includes sharing options (Fig. 8).

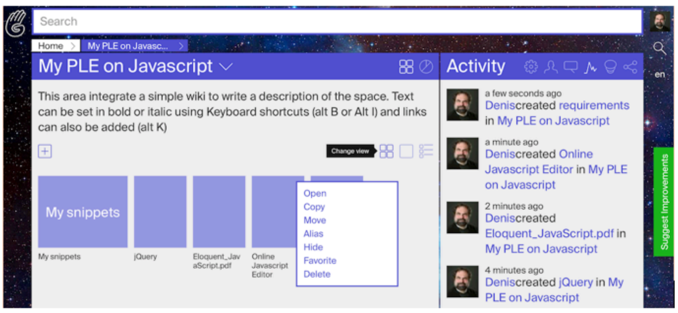

Fig. 6. Possible actions and recent activity in *Graasp.eu*

4 Use case: *Graasp* in action

In Section 3, the notion of Space has been introduced and its exploitation for the creation of a personal learning environment has been illustrated. In primary and secondary education, such activities cannot be carried out by the students themselves due to the high level of digital skills required. Hence, *Graasp.eu* enables teachers to co-create inquiry learning spaces and shared them, once completed, with their students and with teacher communities if wished. By clicking on the create ILS square in Fig. 5 and selecting the preferred inquiry learning scenario in the list proposed, the teacher gets a prefilled space with sub-spaces corresponding to the basic inquiry learning phases, which can be feely renamed, reordered, or even deleted. Alternatively, the teacher can visit the Go-Lab Repository (Golabz.eu) and select and existing ILS to be personalized, like the GearUp one (Fig. 7). In addition to the sub-spaces populated with the content and the services supporting the inquiry learning activities, the ILS has two special spaces invisible to the students. The About space which is a place where teachers can share instructions and best exploitation practices, and the Vault, which is the place where all the content created by the students will be stored. In addition to the creator owning a space, other colleagues interested to contribute to its preparation can be invited as co-owners or contributors. Last but not least, a virtual agent called AngeLA (the guardian angel for learning analytics), is automatically invited to make explicit the fact that activity traces will be recorded during the exploitation of this space [13]. If the owners do not want such tracking, they just need to revoke the membership of AngeLA in the space by clicking on the "x" button located next to its name.

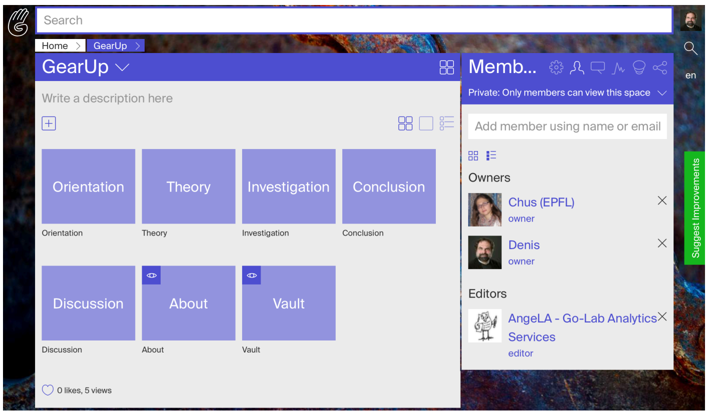

Fig. 7. Space supporting a basic inquiry learning scenario in *Graasp.eu*

Once fully populated, including as example with a simulator of gears in the investigation phase (Fig. 8), and the adjunction of an additional sub-space exploited as a learning analytics dashboard and populated with learning analytics visualization apps that can also be selected from the Go-lab repository (using the Add App button), the ILS can be shared with the students using a secret URL (obtained using the green standalone view button or the associated QR code).

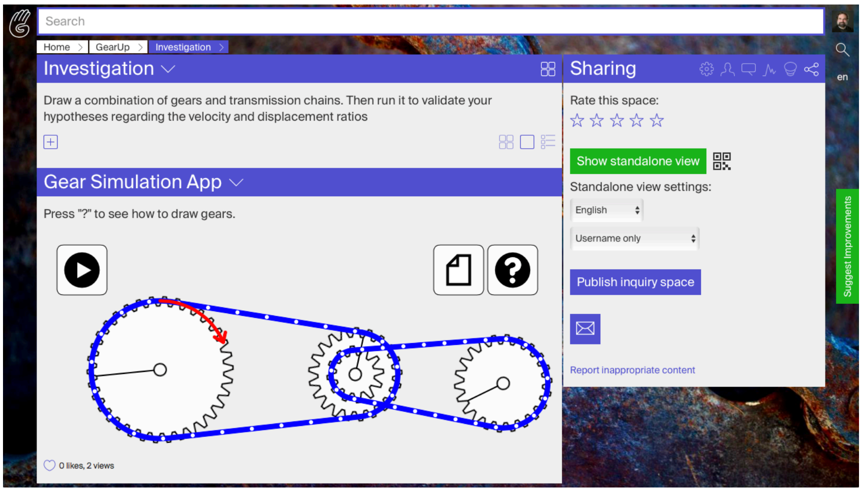

Fig. 8. Content of an investigation phase including a Gear simulator in the expanded view mode and the Sharing pane

Students do not need an account on the platform. The teacher is free to request them to provide just a nickname (username only popup), or a nickname and a password. Anonymous access is also possible for demonstration purposes. Thanks to the combination of the AngeLA tracking agent confining the collection of traces in the selected space, the sharing only with known people of the secret URL, and the seamless logging of students with a nickname, a very high level of privacy is guaranteed under the full control of the teacher.

The student view accessed using the secret URL is a single Web page in which each inquiry learning phase is represented with a corresponding tab (Fig. 9).

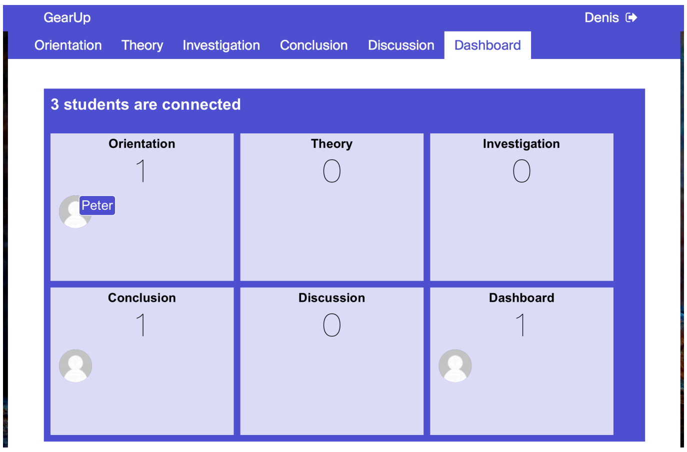

Fig. 9. The student view of the Inquiry Learning Space (Learning Analytics Dashboard tab)

5 Conclusion

Successful active learning scenarios implemented at school or in higher education require empowering teachers to (co-)create, personalize, exploit and share their own rich interactive resources (Fig. 10). They also require enabling students to interact with dedicated online resources to acquire core and transversal competences, while producing meaningful learning outcome embedded in artifacts that can be shared and stored for lifelong exploitation. Typical LMS only focus on the exploitation phase, missing the most important and resources intensive ones.

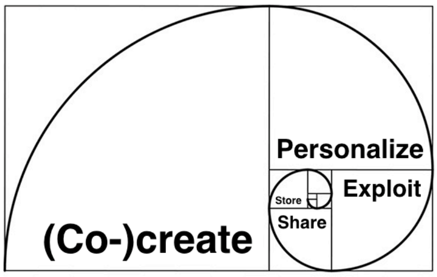

Fig. 10. Holistic life-cycle support for open educational resources (the area of the respective sectors represent how time-consuming the corresponding activity is)

The *Graasp.eu* platform designed with and for end-users has been well adopted by European teachers to build and shared Inquiry Learning Spaces. Starting in 2006, more than 9000 teachers from all over the world have created an account in *Graasp*. Taking the last academic year (2015-2016) as a reference of the current usage, over 4000 new teachers have joined the platform, 3000 teachers have created inquiry learning spaces, and about 200 have already exploited them with a group of at least 10 students. In this period, the average number of teachers and students interacting daily with the platform has been 125, reaching peaks of 558 users.

Based on the existing trends in digital education at the political level together with the needs and interests reported from expert teachers, future learning environments should include: (i) open access resources and federated platforms; (ii) management and contributions directly in the hands of teachers and learners; (iii) a fine-grained privacy control and enforcement; (iv) an ecosystem of interoperable services rather than monopolistic cloud providers; (v) incentive mechanisms proposed by institutions and organizations to encourage contributions and sharing.

Acknowledgements. This work was partially funded by the European Union in the context of the PALETTE (grant no. 028038), ROLE (grant no. 231396) and Go-Lab (grant no. 317601) integrated projects under the ICT theme of the 6th and 7th Framework Programmes for R&D. Special thanks to Alex Wild and André Nogueira, the software engineers working on the *Graasp.eu* social media platform.

References

1. Rekik, Y., Gillet, D., El Helou, S., Salzmann, Ch.: The eLogBook Framework: Sustaining Interaction, Collaboration, and Learning in Laboratory-Oriented CoPs. International Journal of Web-Based Learning and Teaching Technologies, vol. 2, no. 3, pp. 61-76 (2007)
2. Gillet, D., Law, E., Chatterjee, A.: Personal Learning Environments in a Global Higher Engineering Education Web 2.0 realm. 1st IEEE Engineering Education Conference (EDUCON), Madrid, Spain, April 14-16 (2010)
3. Li, N., El Helou, S., Gillet, D.: Using Social Media for Collaborative Learning in Higher Education: A Case Study. 5th International Conference on Advances in Computer-Human Interactions (ACHI'12), Valencia, Spain, January 30 - February 4 (2012)
4. Gillet, D., Li, N.: Designing PLE for Higher Education. In: Responsive Open Learning Environments. Sylvana, K., Alexander, M., Wolpers, M. (Eds.). Springer, pp. 115-133 (2015)
5. de Jong, T., Sotiriou, S., Gillet, D.: Innovations in STEM education: The Go-Lab federation of online labs. J. Smart Learning Environments, vol. 1, no. 3, pp. 1-16 (2014)
6. Horizon 2020, Work Programme 2016-2017, Information and Communication Technologies, `http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-leit-ict_en.pdf`
7. Vozniuk, A., Rodríguez-Triana, M.J., Holzer, A., Gillet, D.: Combining Content Analytics and Activity Tracking to Identify User Interests and Enable Knowledge Discovery. 6th International Workshop on Personalization Approaches in Learning Environments (PALE), Halifax, Nova Scotia, Canada, July 16 (2016)
8. Attwell, G.: The Personal Learning Environments – the future of eLearning? eLearning Papers, vol. 2, no. 1 (2007)
9. Rodríguez-Triana, M.J., Holzer, A., Vozniuk, A., Gillet, D.: Orchestrating Inquiry-Based Learning Spaces: an Analysis of Teacher Needs. 14th International Conference on Web-based Learning (ICWL 2015), Guangzhou, China, November 5-8 (2015)
10. Rodríguez-Triana M.J., and al.: Rich Open Educational Resources for Personal and Inquiry Learning Agile Creation, Sharing and Reuse in Educational Social Media Platforms. International Conference on Web & Open Access to Learning (ICWOAL'2014), Dubai, United Arab Emirates, November 25 (2014)
11. Vozniuk, A., Rodríguez-Triana, M.J., Holzer, A., Govaerts, S., Sandoz, D., Gillet, D.: Contextual Learning Analytics Apps to Create Awareness in Blended Inquiry Learning. 14th International Conference on Information Technology Based Higher Education and Training (ITHET 2015), Lisbon, Portugal, June 11-13 (2015)
12. Bjögvinsson, E., Ehn, P., Hillgren, P.-A.: Design Things and Design Thinking: Contemporary Participatory Design Challenges. J. Design Issues, vol. 28, no. 3, pp. 101-116 (2012)
13. Vozniuk, A., Govaerts, S., Bollen, L., Manske, S., Hecking, T., Gillet, D.: AngeLA: Putting the Teacher in Control of Student Privacy in the Online Classroom. 14th International Conference on Information Technology Based Higher Education and Training (ITHET 2014), York, England, September 11-13 (2014)