Next-Lab

Next Generation Stakeholders and Next Level Ecosystem for Collaborative Science Education with Online Labs

Innovation Action in European Union's 2020 research and innovation programme

Grant Agreement no. 731685

Deliverable D4.6

Releases of sustainable Sharing and Tutoring Platforms (M36)

Editor	D. Dikke (IMC)
Date	13 December 2019
Dissemination Level	Public
Status	Final

The Next-Lab Consortium

Beneficiary Number	Beneficiary name	Beneficiary short name	Country
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Executive Summary

The Next-Lab project aims at promoting inquiry-based science education (IBSE) with online labs in schools, by implementing the Go-Lab Ecosystem, building teacher communities and providing teacher training and support in 30 European countries. The Go-Lab Ecosystem, originally developed in the Go-Lab project, currently counts more than 18,000 teachers creating Inquiry Learning Spaces (ILSs) and a monthly platform's visitor number of around 10,000 visitors[1]. More than 1,800 ILSs have been implemented in the classroom and around 110,000 students benefit from the use of the Go-Lab Ecosystem. This success puts high requirements on the reliability, performance, and usability of the platform. Also, aspects relevant for the sustainability of the Ecosystem grow in their importance in the view of the project's end.

The Deliverable D4.2 (M12) reported on the migration of the Go-Lab Sharing Platform (Golabz) to the new technology (Drupal 8) with the aim to assure the availability, scalability, and the technical fitness of the Ecosystem in the long term, as well as its ability to handle large number of users and data. The current Deliverable reports on the new features and improvements implemented in the second and third years of the Next-Lab project.

The two main directions of the Golabz' development in the past two years were:

(1) Improvement of the basic processes and existing features with the aim to provide better user experience and address users' feedback we received from training and implementation activities, as well as usability evaluation activities. For example, the authentication process, ILS publishing and updating processes, but also search and recommendation functions fall under this category.

(2) Implementation of new features, relevant for the sustainability of the Go-Lab Ecosystem. These are, for example, the integration of premium online labs, implementation of a website presenting Go-Lab premium offers as well as security updates. Also, the social features contributing to the user interaction and additional quality assurance of the content play an important role for the sustainability of the platform.

The development of the Go-Lab Sharing Platform was an agile, iterative process. Users' feedback was considered in urgent bug-fixing, mid-term improvements, as well as planning for the new features. In this Deliverable, we do not report on all the small changes that were made to the platform but focus on the most critical features. Also, we relate these features to the feedback on Golabz' usability documented in D4.3 (M18) and sustainability efforts presented in D5.5 (M36).

[1] Average number of Golabz visitors in the last twelve months (as of December 10th, 2019). The maximum number of visitors was reached in November 2019 and counted around 16,000 visitors in that month.

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1 Introduction

The Go-Lab Sharing Platform (Golabz) originally developed in the Go-Lab project was migrated from Drupal 7 to Drupal 8 in the first year of Next-Lab in order to assure the availability, scalability, and the technical fitness of the platform in the long term. In course of the migration, the platform's architecture, data structure, and user interface were significantly improved, which is reported in the Deliverable D4.2 (M12). In the present Deliverable, we report on the new features and improvements implemented in the past two years of the project, which arise from the three main sources of requirements presented below.

1.1 Initially planned features

In the previous Deliverable D4.2 (M12), a list of features was documented, which had the status "work in progress", "planned" or "to be estimated/decided" (see D4.2, Section 4). Most features with the status "work in progress" and "planned" were implemented; one feature was discarded, as the use case has been considered invalid[2]. Out of the three features with the status "to be estimated/decided", one feature (implementation of reactive frontend) was discarded due to high effort and low priority. Table 1 provides an overview of the features that were remaining after the migration of the platform (as of D4.2) together with their current implementation status and a link to the section of this Deliverable, where the work is documented.

Table 1: **Overview of the features implemented after the migration of Golabz**

Nr.	Status as of end of Year 1	Feature	Current status as of end of Year 3	Section in this Deliverable
1	In progress	Bug-fixing based on user feedback	Done	Section 2
2	In progress	Reimplementation of the Next-Lab project website	Done (plus Premium website)	Section 6
3	In progress	Reimplementation of the Support page	Done (plus Support 2.0)	- (reported in D2.5, D2.8, D2.9)
4	In progress	Improvement of the authentication process	Done	Section 2
5	In progress	Improvement of the lab publishing process	Discarded	Section 2
6	In progress	Improvement of the ILS publishing process	Done	Section 2
7	In progress	Implementation of the ILS-updating mechanism	Done	Section 2
8	In progress	Improvement of the reviewing process	Done	Section 2
9	In progress	Content display by a user	Done	Section 3
10	In progress	Enhancement of the search function	Done	Section 3
11	In progress	Automated update of language information	Done	- (small feature)
12	In progress	Disabling not functioning labs	Done	- (small feature)
13	In progress	Implementation of the content badges	Done	- (small feature)
14	In progress	Extension of the REST interfaces	Done	- (small feature)
15	Planned	Introduction of HTTPS protocol	Done	Section 7

[2] The requirement was to give the users rights to create new users, e.g. to create a "user" for a colleague, who has never logged in to Golabz, but contributed to the creation of a lab or an ILS: see Section 2 (bullet point 2) for details.

Nr.	Status as of end of Year 1	Feature	Current status as of end of Year 3	Section in this Deliverable
16	Planned	Implementation of social features	Done	Section 4
17	Planned	Implementation of a badges system	Done (Publishers)	Section 4
18	To be decided	Implementation of a reactive frontend	Discarded	-
19	To be decided	Implementation of a cross-platform navigation	Done (Megamenu)	Section 6
20	To be decided	Implementation of ILS owner history	Done	Section 3

1.2 Features arising from the users' feedback

In addition, the Golabz platform has been continuously improved based on the feedback we received from the following sources:

(1) *Teachers' feedback*: feedback was provided by the organisers and participants of the teacher trainings, as well as by the users of the Go-Lab Ecosystem using it beyond the training activities. It was forwarded to us by e-mail or sent via Intercom and usually reported some bugs or usability issues, which were checked and fixed by the development team.

(2) *Feedback from the PD[3] team (ULEIC)*: in September 2017, the PD team tested the new Golabz platform by conducting an "analytical walkthrough" and documenting usability issues related to the platform in general and specifically to the lab and ILS submission processes. The list of identified issues and respective improvement suggestions can be found in D4.3 (M18), Annex FF (also attached to this Deliverable as Annex A).

There is no dedicated section in this Deliverable describing all the small changes that have been made. Instead, we refer to the users' feedback, where applicable, while talking about improvements described in all sections of the Deliverable. Annex A provides the list of requirements arising from the usability evaluation and including comments on how the issues have been addressed.

1.3 Features related to the sustainability

Finally, several extensions of the platform have been planned and implemented with the aim to support the sustainability efforts of the project:

(1) *Premium website*: the new website (https://premium.golabz.eu) presents the Go-Lab Initiative and its commercial offers, providing information tailored to the different target groups and regions. This website is planned as the main selling point for services aiming to assure the sustainability of the Go-Lab Ecosystem. (Section 6)

(2) *Megamenu*: in order to reduce the complexity of Golabz' navigation and to seamlessly integrate the premium website into the Ecosystem, a megamenu has been implemented providing an overview and access to the most important information. (Section 6)

(3) *Premium labs*: one pillar of the Next-Lab business model focuses on providing access to premium labs for schools as a yearly subscription. To support this, online labs of commercial provider LabsLand have been integrated into the Ecosystem[4]; mechanisms for access control and usage analytics have been implemented. (Section 5)

[3] PD = Participatory Design

[4] Online labs of further providers will be integrated in 2020; see Section 5 for details.

(4) *Smart Gateway and App Composer:* these two services were migrated from UDEUSTO to IMC in order to allow their sustainable maintenance and delivery in the long term. During the migration, the components were optimized to fit IMC's technical infrastructure and IMC's technical team was trained in handling the components. (Section 7)

(5) *Reliability, scalability, and security:* some changes and updates were introduced on the server-side of the platform in order to assure its stability and capability to handle larger number of users and data; the HTTPS protocol was introduced to make the communication between the Ecosystem's components more secure. (Section 7)

1.4 Structure of the Deliverable

In order to provide an easy-to-read structure to this Deliverable, we group the implemented features *by topics* and provide links to the sources of feedback and other Deliverables, where necessary. Thus, this Deliverable has the following structure:

- Section 2 focuses on the improvement of the ***main processes*** in Golabz: the authentication process, the lab and ILS publishing processes, the ILS updating process, as well as the content reviewing process.
- Section 3 describes the enhancement of the ***search and recommendation functions***, including the ILS-owner history, which presents the users with a list of previously published versions of an ILS and, thus, invites them to check related content.
- Section 4 presents the new ***social features*** of Golabz: the content rating and commenting functions, which aim to facilitate users' collaboration as well as the content quality control by peers; furthermore, it provides an update on the implementation of the recognition scheme.
- Section 5 focuses on the integration of ***premium labs*** into the Go-Lab Ecosystem, starting with the concept and architecture, over the implementation of the components, to the presentation of the target-group-focused use cases.
- Section 6 describes the new ***premium website,*** which presents the commercial offers of the Go-Lab Initiative, such as paid teacher training and premium lab subscription.
- Section 7 presents the work done in relation to the platform's ***scalability and security***; it also reports on the migration of crucial components.

2 Improvement of the basic processes

After the migration of the Sharing Platform to Drupal 8, the main processes have been reviewed and fine-tuned. On the one hand, the bugs have been identified (by the technical team during testing, but also reported by the users) and fixed; on the other hand, feedback from the usability evaluation activities has been considered and the usability of the interfaces has been improved.

The main processes that have been improved include:

1. *Authentication process*: after having released the platform, several usage scenarios have been reported, which we have not foreseen. Originally, the Single Sign On (SSO) was using the user name as a unique identifier for authentication. In some rare cases, it produced errors, as some users had identical user names. So, the unique identifier was changed to the user's email address. This was not an optimal solution either, as some users changed their emails in Graasp and could not access Golabz after that. In response to this, the authentication process was revised, so now a numerical unique identifier (a combination of numbers not visible for the user) along with email address is used in order to handle the SSO, avoiding the issues mentioned above.

2. *Lab publishing process*: as reported in D4.2 (M12), the implemented lab publishing process functions well. The only possible improvement we wanted to investigate was the possibility for the users to add new users (for example, a lab owner wants to add further lab owners, who do not have a Golabz account yet; currently, only an admin can add new users, or the users have to register themselves via Graasp). The usage scenario and its technical implementation turned out to be quite complex. First, such procedure could easily lead to the duplication of user accounts and cause conflicts in the future (for example, if a teacher has an account in Graasp but has never logged in to Golabz; if a colleague creates a "user" in Golabz, it will cause conflict when the teacher tries to login to Golabz from her existing Graasp account). Second, the procedure of creating accounts by one person for other people is not clear as a usage scenario, but also from the data protection point of view. Taking into account these considerations, it was decided to discard the feature.

   On the other hand, the usability evaluation activity conducted by ULEIC in September 2017 delivered a detailed feedback on the usability of the lab publishing process. Out of 27 identified issues, 20 were addressed and the usability of the process was improved (see Annex A for the list of issues and comments on how they were addressed). The remaining 7 issues were discarded, in most cases, as they were related to the standard Drupal forms, which cannot be easily changed (too high effort compared to the potential use).

3. *ILS publishing process*: the ILS publishing process has been simplified, so it requires less clicks from the user in order to be redirected from Graasp to Golabz and to submit an ILS. The redirection process was revised to allow smoother communication between the platforms while sending less requests; this had a positive impact also on the content reviewing process, reducing the number of "false alarms" (notifications) about submitted content resulting from recurring submission requests. Furthermore, some issues have been fixed related to the failing SSO during the ILS publishing or updating process as well as related to the caching. Now the ILS publishing process works smoothly.

   Also here, the usability of the process was improved based on the feedback from the usability evaluation activity in September 2017. Out of the 32 reported issues, 24 were solved and 8 were discarded (typically as they were related to the standard Drupal forms or functions, which cannot be easily changed). The list of identified issues and comments on how they were addressed can be found in the Annex A. Users' and partners' feedback sent to us per

e-mail and via Intercom was very helpful to identify and resolve technical issues (as described in the previous paragraph).

4. *ILS updating process*: this process was implemented at the beginning of the second project year and has been improved and fine-tuned over the past two years based on the users' feedback. Several bugs related to the SSO in the course of updating, but also some other errors, were reported, so we were able to identify and fix them. Importantly, a new usage scenario was identified and implemented: some teachers create an ILS together, but it is only one teacher who clicks the "publish" button and submits the content to Golabz. When an ILS needs to be updated, it's not always the same teacher who resubmits it to Golabz; in some cases, the first author is not even involved. Originally, only the technical author (who clicked the "publish" button) was able to update the submitted content. In order to address the needs of the co-creators, now it is possible for any of them to update the content afterwards. This is especially welcomed by the participants of the Summer Schools and other training events, as they usually create ILSs together and publish and update them after the training.
5. *Content reviewing process*: as described above, the ILS submission process was simplified, which led to the improvement of the content reviewing process as well. Furthermore, a notification mechanism has been implemented, so the reviewers receive an email once a new ILS has been submitted. There are two views available to the reviewers: (1) list of content by type (e.g. list of all ILSs or labs or apps) and (2) list of content by user. To provide the second view, the user profiles have been adapted; the list of user's content is also visible for other users. A contact button is available (only for authenticated users), so the reviewers or other users can approach the author of an ILS, lab, or app. (See Annex A for the adaptations made to the user profiles based on the feedback from usability evaluation activities).

To summarize, the main processes in Golabz have been tested in many iterations by the project team (technical team and PD team), as well as by the users is scope of multiple training events. This allowed to improve and fine-tune the processes, so by now they provide a reliable functionality, which does need attention of the technical team and can smoothly function after the project end.

3 Content search and recommendation

The Go-Lab Sharing Platform currently contains more than 600 online labs and more than 1,000 ILSs. Sometimes, searching for content using the sort and filtering functions may be quite time consuming, therefore, it is crucial to have a reliable search function. Furthermore, recommendation of content based on the currently selected item provides additional help to the teachers in identifying online labs and ILSs suitable for their classroom activities.

3.1 Enhancement of the search function

After the migration of Golabz to Drupal 8, it was only possible to search content by the terms contained in the content name and description, which made the search results quite limited. In order to close this gap, the structure of the search API was modified, improving the back-end database indexing (to make the search results more reliable) and including taxonomy terms (such as subject domains) into the search mechanism. Unfortunately, it was not possible to include the relationships between the content items into the search (for example, if searching by lab name, display also ILSs containing that lab) due to a bug in the original Drupal module. However, this lack is compensated by the recommendations provided on the dedicated resource pages: “Recommendations” (based on similarities in the metadata taxonomy) on the lab and ILS pages as well as “Used in these spaces” on the lab pages (see Figure 1). The recommendation mechanisms have been revised in order to assure their accuracy and timely update.

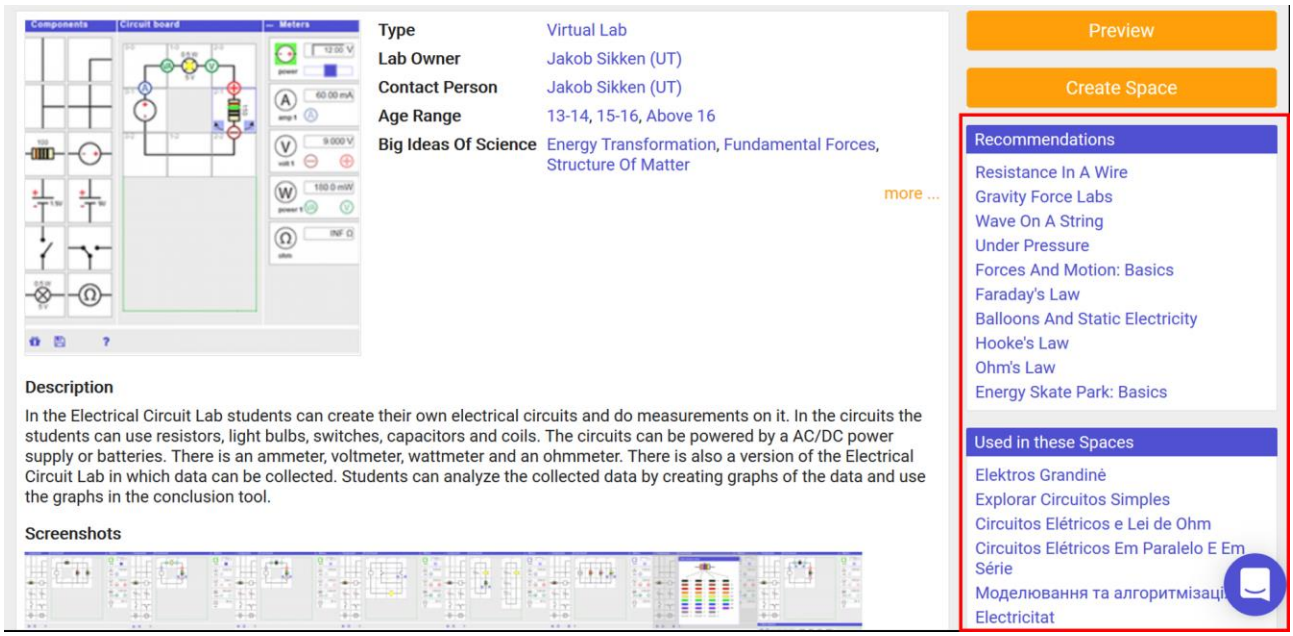


Figure 1: “Recommendations” and “Used in these Spaces” tabs on a lab page

In addition, a simple mechanism to sort the search results by content type (lab, app, ILS) has been implemented (see Figure 2 on the next page). Furthermore, now it is possible to search the content by user. Thus, if typing user’s name, the content assigned to this user is displayed (the user is the creator/owner of the content or a contact person). (See Figure 2 demonstrating the search for “phet” online lab provider and displaying the results for labs).

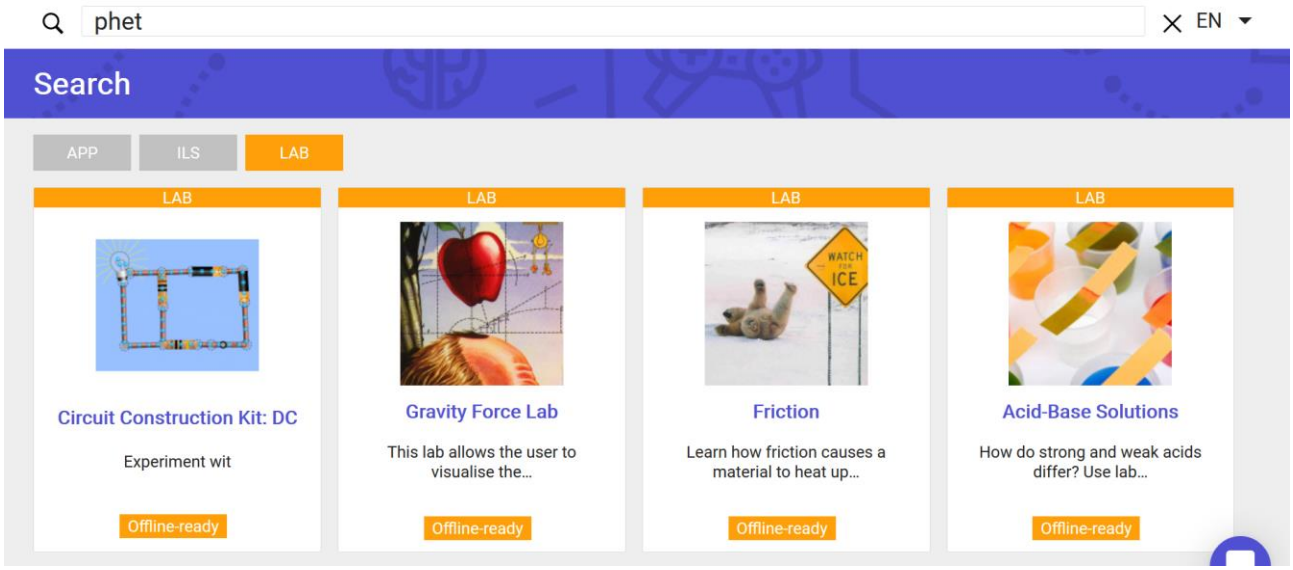


Figure 2: Search by user and sorting search results by content type

This function is closely related to the changes made to the user profiles. After the migration to Drupal 8, only the content was displayed in the user profile, which the user has published him- or herself (co-creators and contact persons were not considered). Now the list of content in the user profile presents all items assigned to the user (including the “creator” or “contact person” roles). Furthermore, an interface has been added, allowing the user to access and edit all content, in which (s)he has the “creator” role, even if this content was not published by this user. This has been done to allow co-creators of an ILS to update already published content (as described in Section 2). Figure 3 presents an updated user profile including “My content” and “Edit content” tabs.

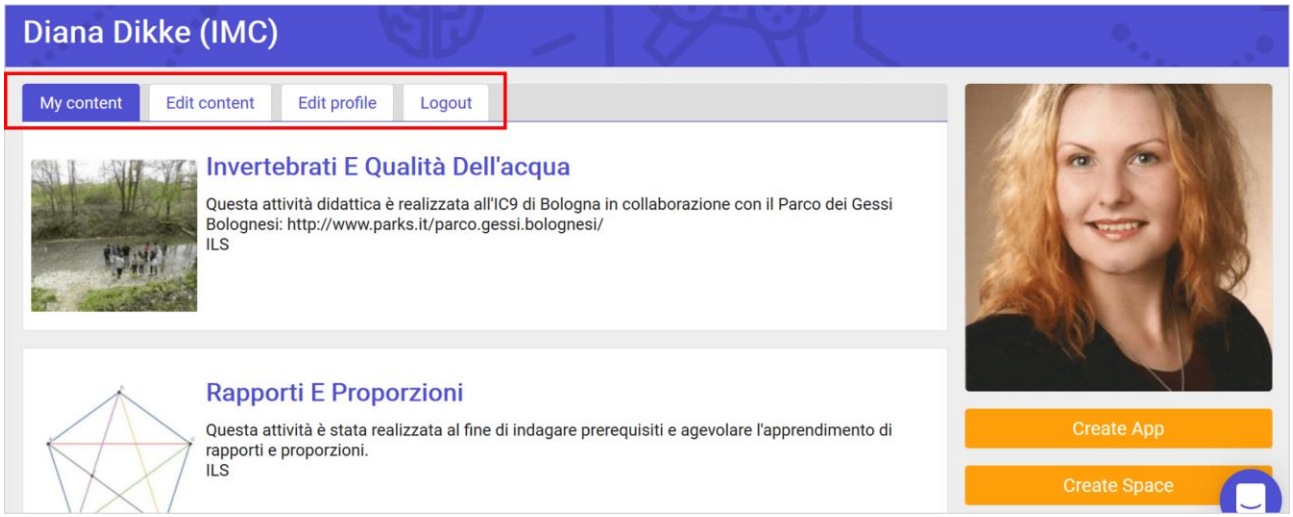


Figure 3: Updated user profile including list of content

3.2 ILS-authorship tracking and history

The Go-Lab Sharing Platform allows teachers to copy published ILSs of their colleagues, adapt them and publish these adapted ILSs back to the platform. Previously, giving credits to previous authors was handled with the help of the “Owner” (publisher of the current version of the ILS) and “Creator” (author of the original ILS) fields, which were filled in by the author publishing the current version of an ILS. This procedure had several disadvantages: (1) the differentiation between “Owner” and “Creator” was quite confusing for the users, (2) the information entered into the fields was not always reliable, and (3) the authors of all previous versions could not be considered.

In order to close this gap, a mechanism has been implemented, allowing to track the authorship of the published ILSs. In particular, this mechanism:

(1) Tracks all authors and co-authors of an ILS, from the moment of its first publication in Golabz over all following versions published in Golabz;

(2) Displays the list of all previous versions of an ILS on the right of the current ILS page (see Figure 4 below); any previous versions of an ILS which were removed from the platform are removed from the list automatically;

(3) On the page of the current ILS, only the authors of the current ILS are displayed, so there is no confusion between the “Owner” and “Creator” fields (the authors of the original and intermediate versions can be viewed on the respective ILS pages).

Importantly, the list of previous versions of an ILS serves also as an additional recommendation for the users willing to find similar ILSs to the topic.

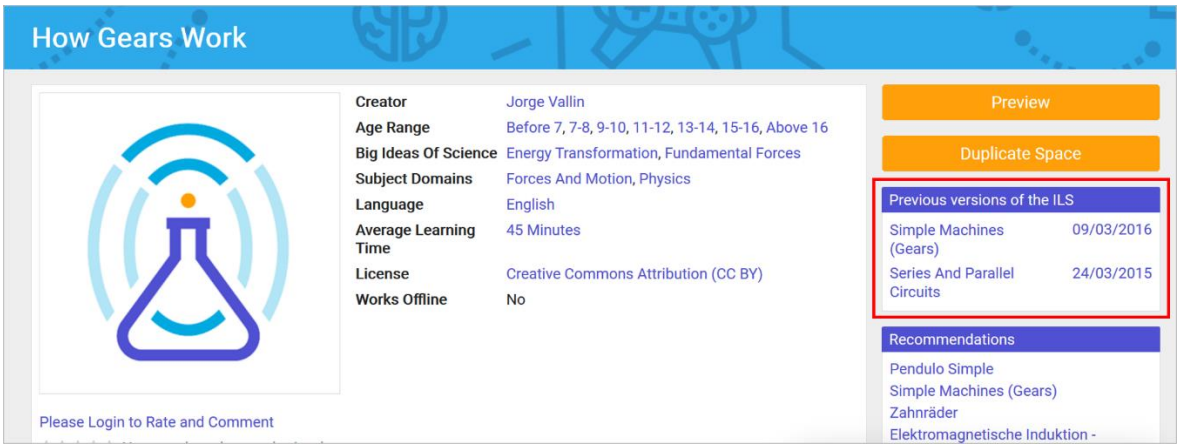


Figure 4: Example of “Previous versions of the ILS” recommendation list

From a technical point of view, the authorship tracking process has been implemented as follows. To track an ILS-authorship and history two values are stored and shared between Graasp and Golabz platforms: each ILS has (1) an ID that is used in Graasp as a unique identifier and is a key reference to that ILS in Golabz and (2) a provenance, which is a list containing IDs of previous versions of the ILS (i.e. starting from original to the latest copies). Figure 5 visualises the authorship tracking process from the technical perspective.

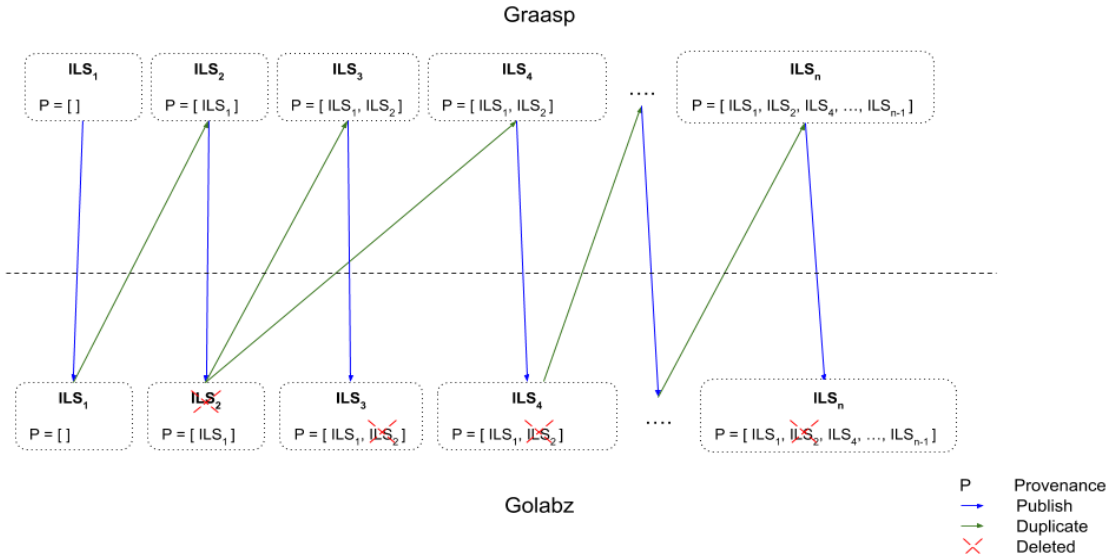


Figure 5: ILS-authorship tracking process overview

There are two possible cases why an ID might not be found in the database: (1) the ILS was previously published in Golabz and it has been deleted later, (2) the ILS was created in Graasp but not published in Golabz. In the first case, the deletion of a published ILS in Golabz results in the deletion of its ID in all other ILSs' histories. In the second case, if an ILS is created in Graasp as a result of duplication of an ILS from Golabz, the duplicated ILS' ID is added to the provenance list at Graasp to facilitate the tracking of the ILS-authorship; however, if the duplicated ILS is not published in Golabz, it won't be publicly displayed in the ILS history.

Similarly, all these processes apply to the update of an ILS.

4 Social features and recognition scheme

In order to facilitate users' collaboration and allow for quality check by peers, the rating and commenting function has been introduced; the "sort" function has been adapted accordingly. Furthermore, the mechanisms behind the "sort" function have been improved, now providing more accurate results.

4.1 Rating and commenting function

Each authenticated user of Golabz can rate content of other users (labs, apps, ILSs) using a five-starts scale; it is also possible to leave comments, which can address other users (like "I highly recommend this lab for the physics class!") or the author (like "The conceptualisation phase of the ILS can be improved by adding questioning scratchpad"). A notification feature sending an email to the author, when a new comment gets published, is currently being implemented. Figure 6 visualises the rating and commenting function on a dedicated ILS page.

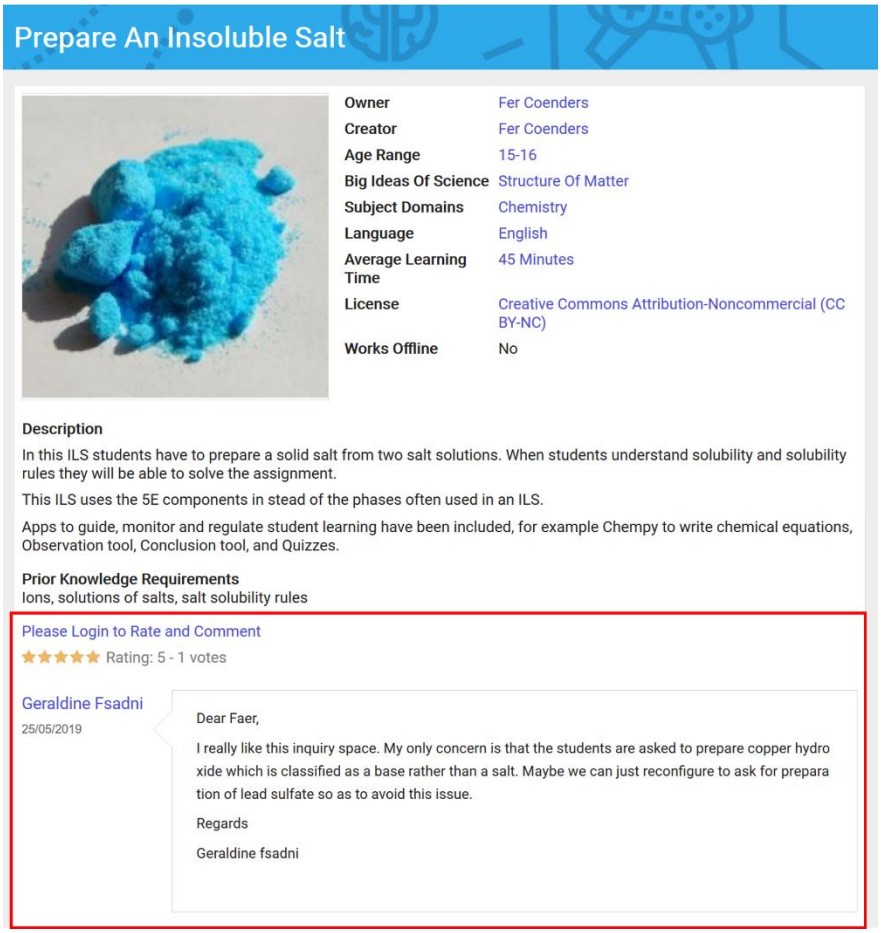


Figure 6: Rating and commenting function

On the list pages of labs and ILSs (https://www.golabz.eu/labs and https://www.golabz.eu/spaces), the resource rating is displayed under the name of the resource (see Figure 7 on the next page). The "sort" function on the right of the page now has an option "Top rated", allowing to display top rated resources on top of the list (see Figure 7 on the next page).

Besides the new "Top Rated" option, on the ILS list page there is an option "Example ILS first", allowing to display quality-approved Example ILSs on top the list. Furthermore, on the lab list page, there will be an option "Premium labs first", bringing commercial labs to the top of the list (as soon as premium labs become available).

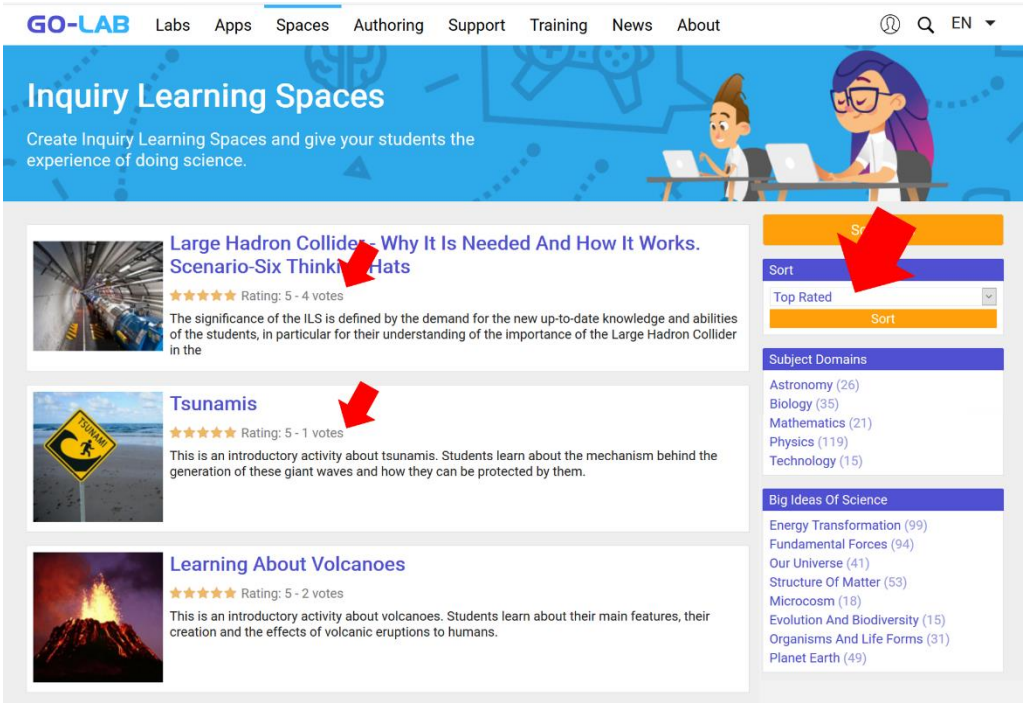


Figure 7: Rating in the list of ILSs

4.2 Recognition scheme

As reported in the Deliverable D2.7 (M24), the first badges (Publishers and Implementers) have been introduced in the second year of the project. The original plan was to have several additional badge categories, such as Co-creators (users who have co-created ILSs together with their colleagues), Experts (users having proven expert skills in ILS creation), and Ambassadors (the Next-Lab Ambassadors). However, we have identified several problems related to these badge categories:

1. Nearly all users have shared their ILSs with their colleagues or added project partners to their ILSs to receive pedagogical or technical support; thus, it is not possible to identify real co-creators in an automated way;
2. Assigning Co-creators and Implementers badges requires us looking into the usage data and making the status (“this user has created ILSs together with someone” or “this user has shared an ILSs with more than 10 standalone users”) publicly available as a badge, which contradicts our data management plan and can lead to GDPR-related issues;
3. The Expert and Ambassadors badges showed to involve high risk of exclusion of users. For example, the official Next-Lab Ambassadors have a great contribution to the dissemination of Go-Lab; however, there are many other teachers who actively disseminate Go-Lab among their colleagues; these teachers might feel excluded, if not receiving a badge. Same goes for the Experts: it is very difficult to identify expert users based on their participation in the project activities, since there are many proficient users in the different countries whom we might not know personally.

Considering the difficulties described above as well as the low users’ value of this feature, it was decided to keep only the Publishers badges (for users who have published at least one ILS in Golabz), since these can be assigned based on the publicly available platform’s data and communicate a concrete status, without the risk to exclude any categories of users.

5 Integration of premium labs

The integration of premium labs into the Go-Lab Ecosystem is a part of the sustainability plan of the Next-Lab project. The commercial premium labs will be offered to schools as a yearly subscription based on the number of students and will include online labs, such as advanced remote labs and 3D virtual labs (see Deliverable D5.5 for details). In this section, we describe the proof-of-concept implementation needed to validate the business model and collect users' feedback on the technical facilities. These technical facilities will be extended step-by-step along with the progress of the commercial activities.

5.1 Concept and architecture

The system architecture for the integration of premium resources into the Go-Lab Ecosystem consists of three main components:

1. Premium Resource Loader (PRL): a web application running on the Graasp platform, enabling users to enter their credentials and access premium content.
2. Premium Resource Gateway (PRG): a program located between Golabz platform and premium resource provider and handling the reservation of certain premium resources for the subscribed users.
3. Premium Resource Provider (PRP): the actual location of premium resources in the lab owner's repository, communicating with the PRG for the reservation of resources.

Figure 8 visualises the high-level architecture of the integration of premium resources and the main system components.

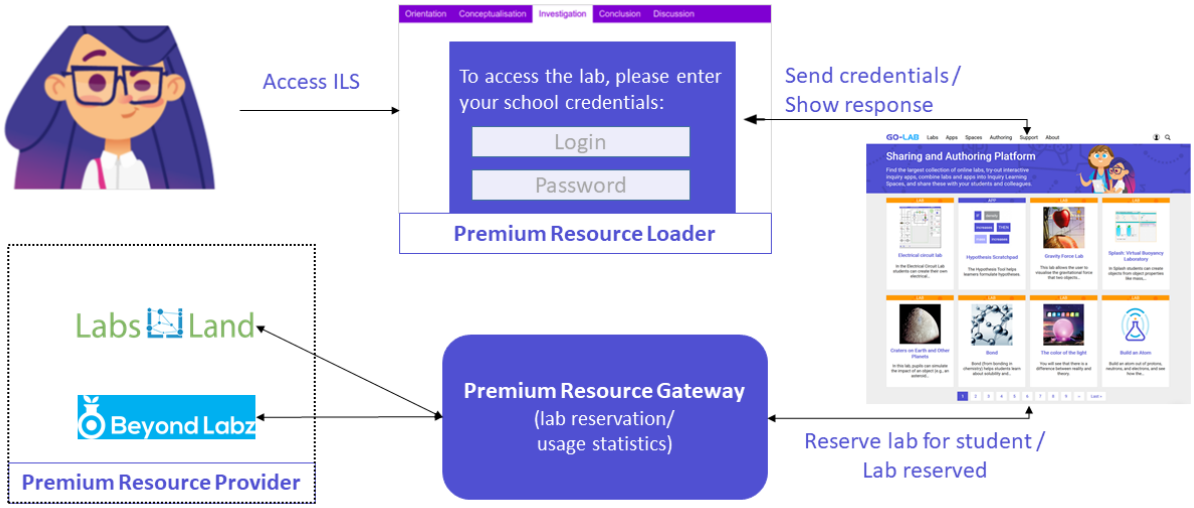


Figure 8: High-level architecture of the system

5.2 User management

In order to support premium lab subscription, we have introduced an extended user management system within Golabz. This system includes two types of accounts:

1. *Extended admin account*: the Golabz admin account now includes a new page allowing to manage subscriptions, including creation of school accounts, assigning school director and/or admin to the school account, defining start and expiration dates of the subscriptions (activating and deactivating subscriptions), and generating students' access credentials.

2. *School account*: the school profile page enables the school director/admin to manage the account, including assignment of teachers to the school account and viewing and downloading students' access credentials assigned to the school. Both Golabz and school admins will receive an automated notification prior to the subscription expiration, so it can be prolonged or cancelled on time.

The school account involves three types of user roles:

(1) *Director/admin*, as described above.

(2) *Teachers*: existing teacher accounts can be assigned to the school account by the school director/admin, so there is no need for teachers to create a new account in addition to their free account. Once a teacher's account is assigned to the school account which has premium subscription, the premium resources in Golabz get unlocked for the teacher and can be used in Graasp for creating and sharing ILSs as usual.

(3) *Students*: in accordance with Go-Lab's policy of not collecting any personal students' data, there are no student accounts related to the premium subscription. Instead, Golabz admin will automatically generate anonymous access credentials for the given number of students, which will be available to the school director/admin in the school account. Students will receive those credentials from their teacher, e.g. in form of a student card, and use them to access premium resources within ILSs.

Figure 9 (below) presents an example of student access credential. Apart from the school name, all other information is generated automatically.

- *Username* acts as a nickname for the student and is not unique. User names are designed to be simple enough for young students and follow an "adjective + noun + integer (0-99)" rule. Furthermore, in order to provide more anonymity to school, usernames are only shared with the school administration; within the Go-Lab Ecosystem, only a universal unique identifier (e.g. e726c7c8842643123b5af01e…) is shared with the Premium Resource Gateway. The correspondence between the username and the unique identifier is only known by Golabz.
- *School name* is unique and is created by Golabz administrator. The actual school names are shared with the Premium Resource Gateway to collect usage statistics at the school level.
- *Login codes* are eight character long unique identifiers consisting of English alphabet letters and numbers (i.e. 0-9). They are designed in a way not to follow a specific pattern (e.g. EUCZ2559) and along with a secret code referring to a combination of school account and user-ID at the background. These codes are only known to Golabz and respective school admin and students.
- *Pass codes* are random four-character long numbers; they are not unique, assigned to the users randomly, and used along with the login code by the student as access credential.

When accessing a premium lab, the student is requested to enter the Login and Pass codes. The school name and nickname are used within the Premium Lab Loader to display a greeting message.

Figure 9: Example of a student access card

5.3 Premium resource access

5.3.1 Premium Resource Loader (PRL)

The PRL runs within ILSs in the student view (standalone view) of the Graasp platform. Whenever a user accesses an ILS that contains a premium resource, a simple login page is presented. It enables users to enter their credentials, including an 8-characters long “login code” and a 4-digit long “pass code”. Moreover, in order to speed up the access process, we made use of cookies to store users' pass code for a period of 30 minutes; therefore, if the student closes the ILS page and returns to it within that period, (s)he is only asked to enter the login code again. In addition, a user-friendly generated nickname is provided to each user. After having entered the login code, the user is presented with a greeting message showing the nickname and the school name.

Once the user enters the credentials, the required information about the user (i.e. the user's universal unique identifier, type, the school’s universal unique identifier and name) as well as about the premium resource and ILS is sent to the Golabz platform for further processing. Next, the manipulated data (to allow users’ anonymity) are sent to the Premium Resource Gateway. In case of successful response from the Gateway, the requested premium resource is displayed and ready for usage within the ILS. In case of failure, a message is displayed to the user (student) asking to consult the teacher for further assistance.

5.3.2 Premium Resource Gateway (PRG)

The PRG is a software component that acts as a gateway between Golabz and the Premium Resource Providers (PRPs). This way, Golabz has a single simple protocol with the PRG, and the PRG communicates with each of the PRPs using the protocols that the PRPs define, and supporting multiple protocols if required, without requiring changes in Golabz.

The concept is similar to the Smart Gateway used for communicating with each of the non-premium laboratory providers. However, the Smart Gateway typically interacts with providers which do not need any control on how many times or for how long the laboratories are used; which is not the case in the PRG. For this reason, the PRG is an isolated component that relies on a more robust protocol focused on managing binding transactions between both Golabz and the PRPs and keeping track of all the exchanges that occurred in a reliable way. The PRG also stores this information (without private user data) for potential audits or creation of reports for Golabz or the PRPs.

5.4 Usage scenarios

In order to give the above concepts a more practice-oriented form, below we present several high-level use cases describing the interaction between the users and the platform.

5.4.1 School director

Prerequisite: the school was informed by one of the Go-Lab Initiative partners or found information on the premium website about the premium lab subscription and decided to acquire it for the next school year. After having established the contact and agreed on the terms, the school has paid the subscription price for 100 students to the bank account of the Go-Lab Initiative[5].

1. Golabz admin creates a school account in Golabz and assigns the school director (and/or admin or any other representative named by the school) to that account.
2. Golabz admin generates 100 access credentials for the students (in an automated way), which are assigned to the school account.

[5] For Go-Lab Initiative, its partnerships, and payment procedures, see Deliverable D5.5 Section 4.

3. School director receives a notification about the school account creation together with the access data.
4. School director accesses the school account and assigns teachers of the own school to this account (the teachers have previously given the school director the nicknames/emails they use to access the Go-Lab Ecosystem).
5. School director downloads the list of students' access credentials. The access credentials are then distributed to the students by the teachers.
6. Teachers and students can start using premium resources.

End of the scenario: one month prior to the subscription expiration, both the school director and Golabz admin receive a notification reminding about the expiration. If the school wants to prolong the subscription for one more year, they pay for the subscription. If not, they cancel the subscription. Depending on the payment/cancellation status, Golabz admin keeps the subscription activated or deactivates it in the school account.

Note: to the renewal of the subscription, the school can inform Golabz admin about the changes in the number of students (e.g. total number of students, how many students have graduated, how many new students have come), so the number of available students' credentials can be adapted.

5.4.2 Teacher

Prerequisite: the school has acquired the subscription and the school director has assigned teachers to the school account.

1. Teacher accesses Golabz in order to find premium labs. She opens the lab list page (https://www.golabz.eu/labs) and activates "Premium labs first" sort option on the right of the page. Premium labs are displayed on top of the list.
2. Teacher opens one of the lab pages and clicks "Preview" button (available for all users) to view the lab. As the school has an active subscription, the "Create space" button is activated for this teacher as well.
3. Teacher clicks "Create space" button, edits the ILS and shares it with the students as usual.
4. Teacher can publish her ILS in Golabz. (In this case, a warning will be displayed on the ILS page, saying that the ILS contains premium content. The ILS can be copied and edited by other users as usual; however, the premium lab contained in the ILS will be available only for subscribed users).

End of the scenario: if the school has not prolonged the subscription, the "Create space" button on the premium lab pages will be blocked. There will be no consequences for private or published ILSs; however, the teacher or students won't be able to access the premium labs within those ILSs anymore. (If the teacher wants to continue using those ILSs, she can replace premium labs with free labs or ask the school to prolong the subscription).

5.4.3 Student

Prerequisite: the school has acquired the subscription and the students have received the access credentials (login and pass code) from their teachers.

1. Student receives the link to the ILS from the teacher and starts using it as usual.
2. In the Investigation phase, the student is requested to enter her login and pass code to access premium lab. After the student entered the credentials, the lab is unlocked and ready to be used; a personal greeting message is displayed.

3. If the student navigates between the phases of the ILS and comes back to the Investigation phase, she does not have to re-enter her credentials, as the lab remains active while the student is working with the ILS.
4. If the student closes the ILS and opens it within 30 minutes again, (s)he is only requested to enter her login.

End of the scenario: if the school has not prolonged the subscription, after entering the credentials a message will appear saying that the credentials are not correct, or the subscription has expired and asking the student to contact the teacher for further assistance.

5.5 Final remarks

The usage scenarios and technical aspects described above cover the proof-of-concept, basic implementation, which is needed to validate the business model and to collect users' feedback on the technical facilities, which will serve as a basis for the further development and fine-tuning of the system. When the business model becomes more mature and some first revenues are reached, the implementation of the following enhancements will be considered:

- Enhancement of the usage scenarios and usability of the system;
- Online payment system and automated subscription management;
- Reliability of the access control to avoid sharing credentials by the users.

For now, we have focused on the components and features which are essential for making premium labs available. This pilot implementation is done in collaboration with the remote lab provider LabsLand (https://labsland.com), whose labs will be integrated into the Go-Lab Ecosystem first (the launch is planned for the first quarter of 2020). Furthermore, we are discussing with the provider of 3D virtual labs Beyond Labz (https://www.beyondlabz.com), taking into account their requirements; the integration of their labs is planned for 2020. Finally, the Premium Labs Gateway will provide an LTI-interface, allowing an easy integration of any LTI-compatible resources and repositories of resources, so we can approach other online labs providers in the future.

6 Premium website and megamenu

After the migration of Golabz to Drupal 8, at the beginning of Year 2, the Next-Lab project website (https://nextlab.golabz.eu) was implemented in alignment with the new design of the platform. This website provides an overview of the project's mission and goals, the project consortium and the Go-Lab Initiative. Furthermore, it gives access to the publications and deliverables from both Next-Lab and Go-Lab projects.

In the third project year, we decided to extend the infrastructure and to implement a new premium website (https://premium.golabz.eu) for the following purposes:

(1) Present the commercial offers of the Go-Lab Initiative, e.g. premium online lab subscription, paid teacher training, pedagogical consultancy, etc.

(2) Present the Go-Lab Initiative itself, while addressing the different target groups (schools and teachers, Ministries of Education and TTIs, online lab providers, etc.) and explaining what kind of cooperation we can offer to them.

(3) Provide sustainable access to the information, which should be available after the project time. For example, each project of the Go-Lab Initiative receives a dedicated page (e.g. Go-Lab, Next-Lab, GO-GA, some other current and past projects related to Go-Lab). Also, the deliverables and publications from these projects (at least Go-Lab and Next-Lab) will be stored in one place and won't have to be migrated each time we start a new project. So, in the future, all new projects will be added to this area of the premium website and stay there beyond their lifetime.

Thus, the new premium website will replace the current Next-Lab project website, whose weblink will be redirected to the corresponding area of the premium website shortly after the project end.

6.1 Navigation through the megamenu

The megamenu introduced on the Go-Lab Sharing Platform extends the two areas of the main menu: "About" and "Premium". Most of the pages accessible through the megamenu are hosted on the new premium website (https://premium.golabz.eu). Some items of the megamenu (especially those under the "Keep in touch" section) lead to the pages on the Support page ("Go-Lab in your country", "National Training Institutes") or to the community registration forms in Graasp.

The "About" part of the megamenu is divided into three sections:

(1) Who we are: here, we present the Go-Lab Initiative and related projects. A promo video of the Go-Lab Initiative is available.

(2) What we offer: here, the Go-Lab Ecosystem is introduced. Dedicated pages provide information for schools and teachers, Ministries of Education and Teacher Training Institutions, as well as for the online lab providers. A video demonstrating the Go-Lab Ecosystem is accessible from the megamenu.

(3) Keep in touch: this section gives access to the list of contacts (NECs and Ambassadors) in the different countries as well as to the list of TTIs, who are partners of Next-Lab. Access to European and African Go-Lab online communities is given. Furthermore, there is a possibility to download Go-Lab marketing materials as well as to contact us using a contact form.

Figure 10 (on the next page) demonstrates the "About" part of the megamenu.

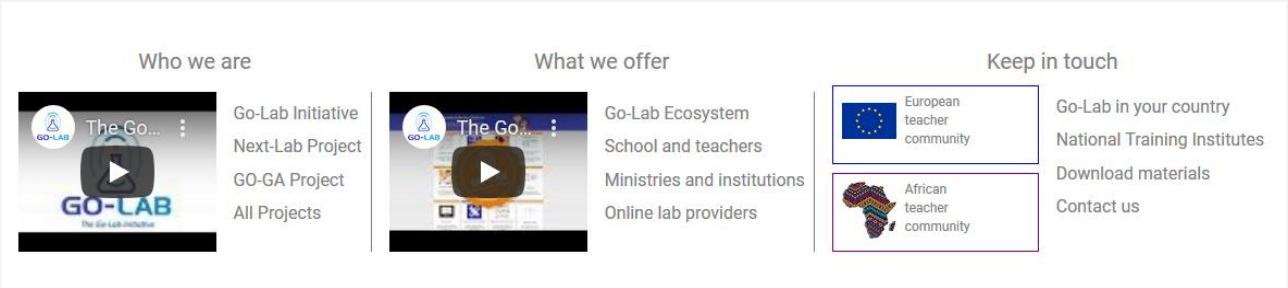


Figure 10: Megamenu: "About" menu item

The "Premium" part of the megamenu is divided into three sections as well[6]:

(1) Tools: here, premium online labs and premium apps are presented.

(2) Consultancy: this area presents pedagogical and technical consultancy.

(3) Services: teacher training and school membership are the focus of this section.

The megamenu is implemented in two versions: desktop and mobile ones. Thus, also the smartphone and tablet users can easily navigate through the platform. Figure 11 presents the mobile view of the "About" and "Premium" megamenu areas.

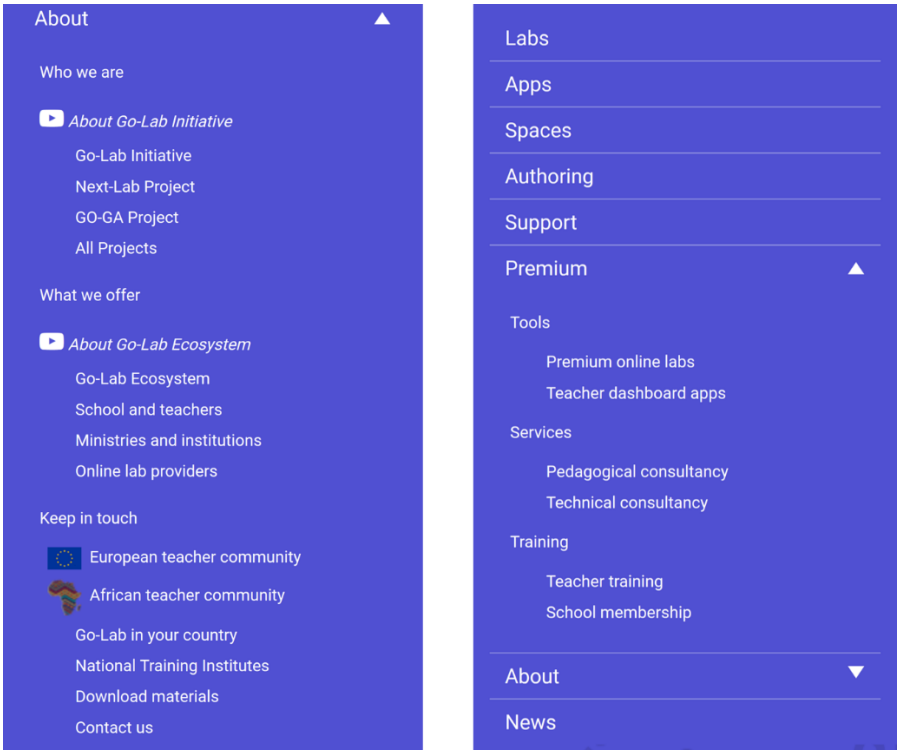


Figure 11: Mobile view of the megamenu: "About" (on the left) and "Premium" (on the right)

6.2 Go-Lab premium website

The structure of the premium website (https://premium.golabz.eu) is reflected in the structure of the megamenu presented above. Whereas the "About" part presents the Go-Lab Initiative, the Go-Lab Ecosystem, and the benefits for the different target groups, the "Premium" part focuses on concrete commercial offers. In order to make the website more appealing, several types of pages with dynamic elements have been implemented:

[6] For the description of the commercial tools and services and related business models, please see D5.5 "Report on sustainability activities and results – final version" (M36).

- *Page with scrolling statistics*: this page type is applied to the Go-Lab Initiative page (https://premium.golabz.eu/about/go-lab-initiative). Under the text presenting the Initiative, the main statistics are shown (e.g. number of teachers trained by Go-Lab, number of teachers using Graasp, number of students benefiting from using ILSs etc.). When the user opens the page, the figures scroll from zero to the target number giving the page a more dynamic view. Figure 12 (on the left) presents the Go-Lab Initiative page.
- *Page with flip card icons*: this page type is applied to the Go-Lab Ecosystem page (https://premium.golabz.eu/about/go-lab-ecosystem). Instead of presenting the users with a long description of the platform, we've decided to structure the content using the flip card icons. The icons are grouped under three titles: "The Go-Lab Ecosystem supports…", "The Go-Lab Ecosystem offers…" and "We work closely with…". Under each title, the main content is presented on three icons, which flip when the user places the cursor over them (or clicks when on mobile). Figure 12 (on the right) presents the Go-Lab Ecosystem page.

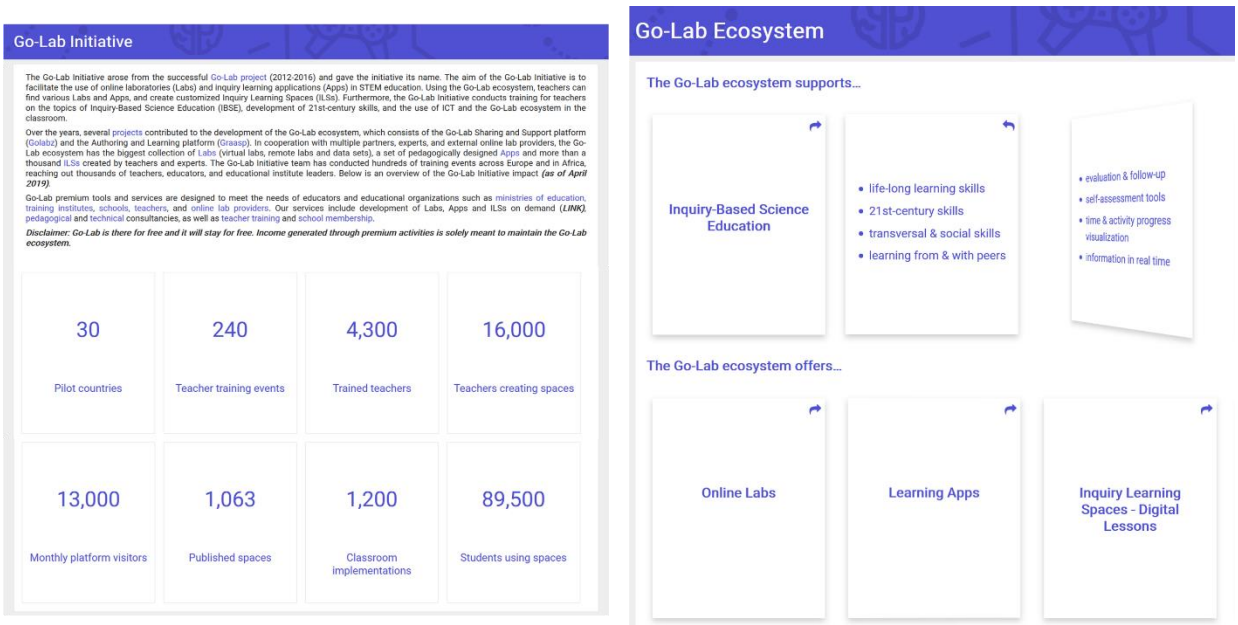


Figure 12: Go-Lab Initiative page (on the left) and Go-Lab Ecosystem page (on the right)

- *Page with clickable slider*: pages with clickable slider present organisations, e.g. partner lab providers on the "For online lab providers" page and partner Ministries and TTIs on the "For Ministries and Institutions" page (e.g. https://premium.golabz.eu/about/online-lab-providers). Each icon presents the name and logo of the organisation. If clicking on the icon, the user is forwarded to the website of the organisation, which opens in a new browser tab. Figure 13 (on the left) presents the "For online lab providers" page.
- *Page with clickable icons*: some pages provide a static list of clickable icons under the text, leading to the subpages of the premium website. These are the "All projects" page leading to the dedicated project page, "For Schools and Teachers" page leading to the showcases (teachers sharing their impressions about their experience with Go-Lab) as well as the "Teacher Training" and "School Membership" pages leading to the pages presenting the offers by country in their local languages (e.g. https://premium.golabz.eu/training/teacher-training). Figure 13 (on the right) presents the "All projects" page.
- *Page with image slider*: this page type is applied to the pages presenting premium online labs and apps. Under a text description, sliding screenshots demonstrate the available tools. The screenshots can be opened in an overlay by click. (Note: by the time of writing of this Deliverable the feature is not launched yet).

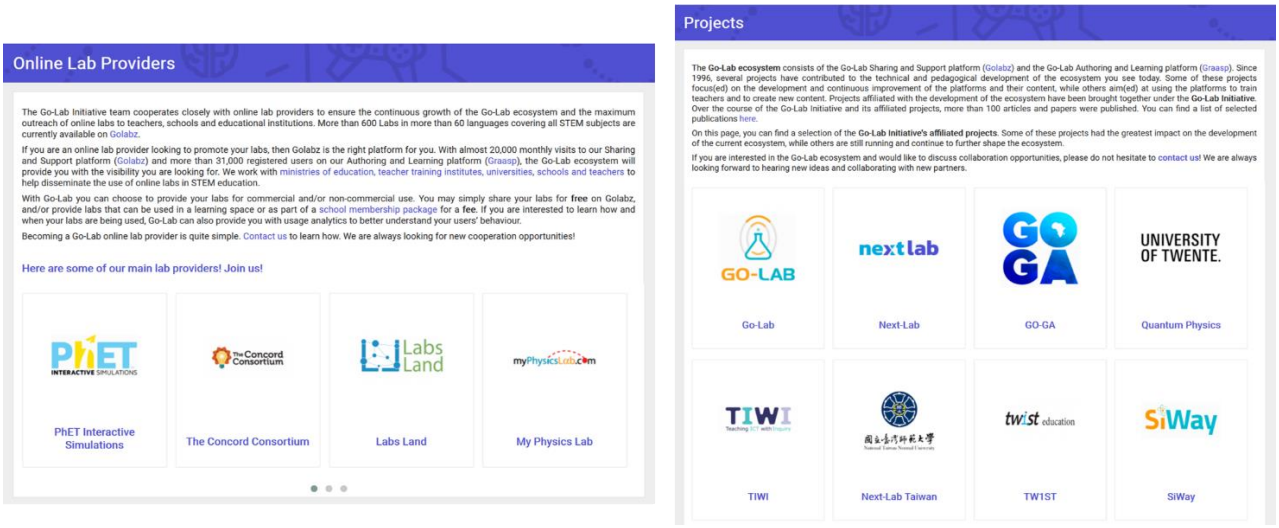


Figure 13: Online Lab Providers page (on the left) and Projects page (on the right)

As described above, pages with clickable icons lead to subpages presenting more specific information to the different topics. These are:

- *Project pages*: each project page contains a text description of a project in which the Go-Lab Ecosystem has been developed, further developed, or used in a school context. Under the text description, a clickable slider presenting the consortium partners (and leading to the partner's website, when clicked) is located. On the right of the page, main project information is summarized, such as project name, duration, funding body and programme, project coordinator, etc. (Example: https://premium.golabz.eu/projects/next-lab).
- *Showcase pages*: these pages present interviews with teachers, testimonials written by teachers, as well as teachers' videos, in which their talk about their experience with Go-Lab. Publishing these showcases on the website aims to give a more personal feeling to the school heads and teachers visiting the website (Examples: https://premium.golabz.eu/showcase/my-go-lab-experience-philippe-kobel and https://premium.golabz.eu/showcase/go-lab-ambassador-preeti-gahlawat).

The premium website has responsive design and can be used on desktop as well as on mobile devices. The content of the website will be updated and extended, where necessary, in accordance with the progress of the sustainability activities after the project end.

7 Reliability, scalability, security

Taking into account the increasing number of the Go-Lab Ecosystem's users and in the view of the Next-Lab project's end, the following measures were taken to make the Golabz platform more reliable, secure, and scalable, so it does not require a lot of maintenance after the project end.

1. *Drupal upgrade*: The Golabz' content management framework, Drupal, was upgraded to its latest stable version 8.6.17, including an update of the majority of the custom and third-party modules. Moreover, the deprecated code and services were replaced in the system. The system upgrade and code maintenance have resulted in the removal of possible security leaks, made the platform work in a more reliable manner, and made the possibility of any feature upgrades or migration to a newer version of Drupal easier and faster.
2. *Scalability*: In terms of scalability, the Golabz platform and its related services were efficiently distributed across several servers, including (1) the production version of Golabz, accessible to the outside world, (2) the development version of Golabz and (3) the newly introduced server, hosting premium resource gateway, migrated app composer and smart gateway.
3. *Reliability*: In terms of reliability, a weekly backup of all databases and important files, as well as a monthly snapshot of all Golabz-related servers were setup. These measures were introduced to avoid loss of any data and keeping server downtime to a minimum in case of any possible issues in the future.
4. *Security*: All Golabz-related websites are secured with HTTPS. We obtained free SSL/TLS certificates from Let's Encrypt[7] Certificate Authority. Using HTTPS protects any data transmitted between the server and browser during a users' session as well as in scope of communication between Golabz, Graasp, Smart Gateway, and App composer.
5. *Maintenance*: the two crucial components the Smart Gateway (enabling the embedding of online labs in an ILSs and harvesting metadata from large online labs repositories to update these metadata in Golabz) and the App Composer (mainly responsible for the proper functioning of the apps in an ILS as well as for their translations) were migrated from UDEUSTO to IMC. The components have been installed on a dedicated server; the IMC's staff has been trained in handling the components, so the maintenance after the project end is assured.

The updates and restructuring described above contributed also to the improved performance of the platform, which now works faster even by poor internet connection, which is relevant for both European and African (GO-GA project) users.

[7] Let's Encrypt: https://letsencrypt.org/

8 Summary

In the second and third years of the Next-Lab project, the Go-Lab Sharing platform has been further developed and fine-tuned in order to (1) assure the reliability and scalability of the platform as a whole as well as smooth functioning of its basic processes and components, (2) provide features supporting the sustainability efforts of the project, as well as (3) improve the usability of the platform in accordance with the users' feedback.

In particular, the following processes and functionalities have been *improved*:

(1) The authentication, lab and ILS publishing, as well as content reviewing processes;

(2) The content search, sort, and recommendation functions.

Furthermore, several *new features* have been implemented:

1. The ILS updating process;
2. The ILS authorship tracking and history;
3. The rating and commenting function;
4. The Premium website and megamenu;
5. The integration of premium online labs, including implementation of the Premium Resource Gateway and Premium Resource Loader.

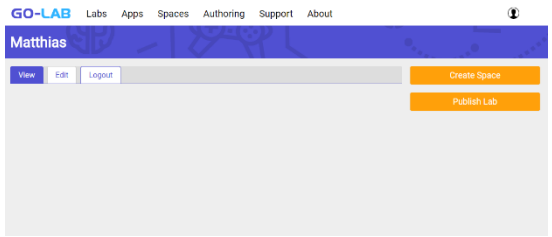
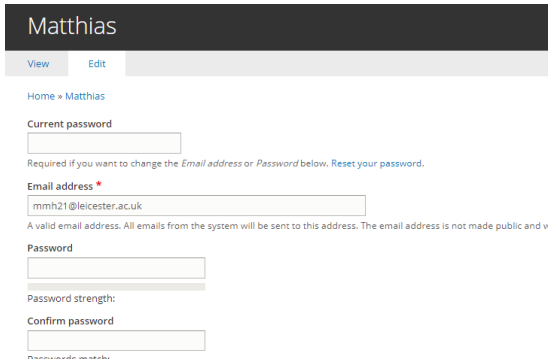
The Smart Gateway and App Composer have been migrated to IMC's servers to be hosted and maintained after the project end. The HTTPS protocol has been introduced in order to allow secure communication between the different system components. Several changes and upgrades have been made on the server side, in order to assure platforms' scalability and performance accommodating higher number of users and bigger data volumes.

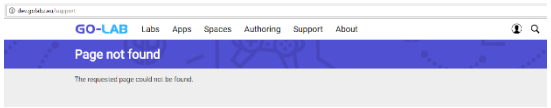
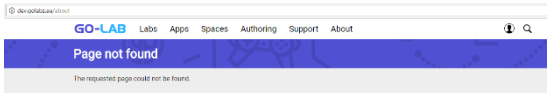
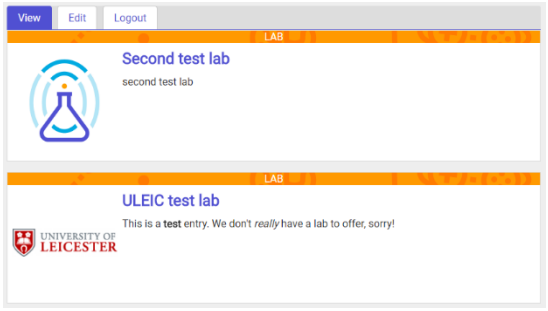
Teachers' feedback collected during the Summer School in July 2019 confirms that the usability of the Golabz platform has improved: *"This shows that the current search facilities allowed teachers to find apps and labs they are looking for, even without knowing their name (…)"*[8]. Some improvement suggestions were related to adding more labs, especially for teaching math, and including support content into the general search on Golabz. Generally, the platform was perceived positively and even novice teachers had no major problems handling it.

[8] Report on Usability and User Experience Evaluation of the Go-Lab Ecosystem with Novice and Advanced Users, 09.09.2019, ULEIC.

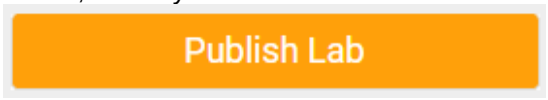
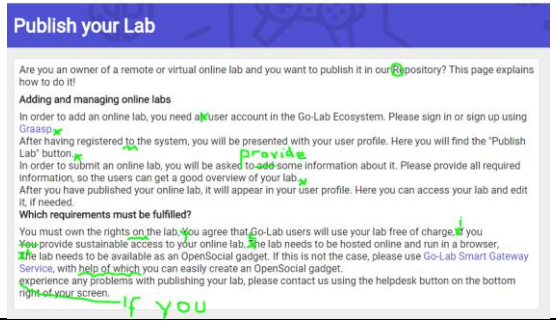
ANNEX A: Commented list of requirements based on D4.3 Annex FF "Detailed Findings from the Analytical Walkthrough Performed for the New Go-Lab Sharing Platform (LEIC-06092017)"

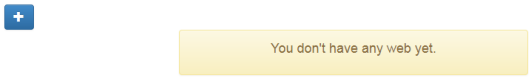
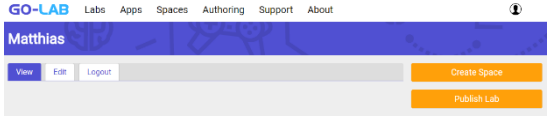
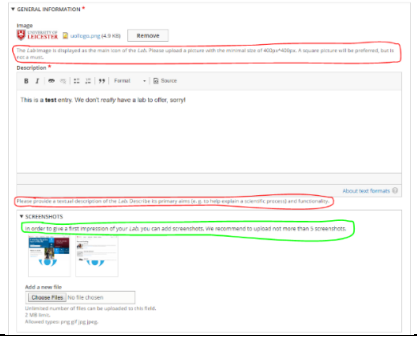
1. General

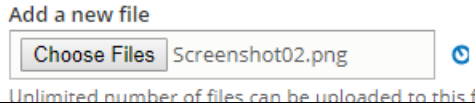
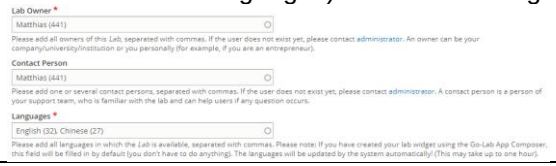
	Usability Observation	Recommended Modification	Import-ance	Comment/ Solution	Status
1	The "View" area of the user profile is empty (even after uploading a picture). 	Show user information in "View" tab or remove it. NB: The next day a list of the published labs was displayed there. Still it would be nice to also present some profile information.	**M**	The tabs have been renamed, one new tab has been added: My content, Edit content, Edit profile, Logout. The View area (My content) now displays content, where the user has "creator" or "contact person" role. The profile information is available under "Edit profile" tab.	Done
2	If the end-user clicks on the "Edit" tab, the edit functionality is not displayed underneath, instead a completely different interface is presented. 	Show edit functionality in the page with the "Edit" tab. Make sure design is consistent.	**M**	The tabs have been renamed, one new tab has been added: My content, Edit content, Edit profile, Logout. The new "Edit content" tab leads to the page presenting content, which the user can edit. The "Edit profile" (previously "Edit") tab allows editing the user profile.	Done

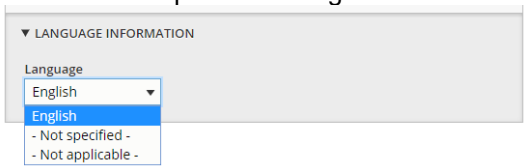
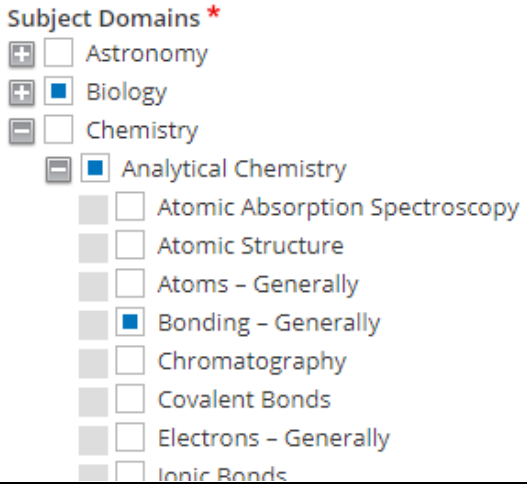
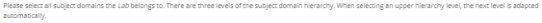
	Usability Observation	Recommended Modification	Import-ance	Comment/ Solution	Status
3	When clicking on a screenshot it opens in the same tab. 	Screenshot should be displayed in an overlay on top of the lab information or at least in a new tab, so that the end-user does not lose the lab, when closing the screenshot tab.	**H**	The screenshots are now displayed in an overlay on top of the lab/app/ILS information.	Done
4	Support page cannot be found. 	Add “Support” page.	**H**	-	Fixed
5	About page cannot be found. 	Add “About” page.	**H**	-	Fixed
6	Based on the presented information the end-user might expect to “edit” the list of his or her LABs and might be confused to see his or her profile details instead. 	Display profile information above the list of LABs. Provide access to edit LABs information from the Edit profile page.	**M**	The tabs have been renamed, one new tab has been added: My content, Edit content, Edit profile, Logout. The new “Edit content” tab leads to the page presenting content, which the user can edit. The “Edit profile” (previously “Edit”) tab allows editing the user profile.	Done

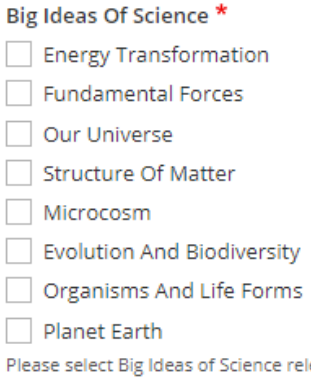
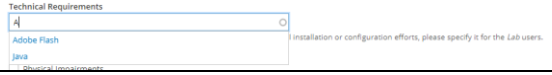
2. Lab editor experience

	Usability Observation	Recommended Modification	Import-ance	Comment/ Solution	Status
7	Interface element to publish lab looks like a button, but only the text is interactive.  This is inconsistent to other interface elements (e.g. “Sort” button) and thus unexpected for the end-user.	Make the interface element work like a button (whole coloured area can be clicked).	**M**	The whole button is now clickable.	Done
8	The button that looks like it offers the functionality to actually publish your Lab only leads to a page describing the publishing process (http://dev.golabz.eu/labs/publish).	Change the misleading label of the button, e.g. to “How to publish your lab.”	**M**	The button renamed in “How to publish your lab”	Done
9	The “Publish your Lab” page (http://dev.golabz.eu/labs/publish) has a misleading heading.	Should be “How to publish your Lab” instead	**M**	The page renamed in “How to publish your lab”	Done
10	The “Publish your Lab” page (http://dev.golabz.eu/labs/publish) has several typos and the layout could be improved (e.g. space above the second heading). 	Fix the typos on this page and check if some of the descriptions could be improved.	**H**	The text has been checked and improved.	Done
11	On the “Publish your Lab” page the textual description of how to get help / contact us could be improved.	Add a picture of said button to the text.	**L**	Adding a picture would worsen the design of the page; it would look like a real button mid of the text.	Discarded

	Usability Observation	Recommended Modification	Import-ance	Comment/ Solution	Status
12	When following the “Go-Lab Smart Gateway Service” link, the end-user reaches a page which might be confusing for them, e.g. what is a “web”. Manage webs 	Improve wording, e.g. call it a “lab” maybe?	**H**	The page has been renamed in “Manage resources” (as one can manage not only labs through that page)	Done
13	Not sure if every Lab editor will be an “admin” or if that is a specificity of our testing role, but not all should be admins. 	Make sure that not all Lab editors get admin permissions.	**H**	Only project partners have admin rights in Smart Gateway	Done
14	Profile page can not necessarily be identified as being the profile page. 	Add “(My) Profile” in front of the user name in the header. Show profile information in “View” area.	**L**	The tabs have been renamed, one new tab has been added: My content, Edit content, Edit profile, Logout. Adding “(My) Profile” in front of the user name in the header is somewhat complicated. Given the low priority, we’ve discarded it.	Improved
15	Having the description of the entry underneath the interface element to specify it, could be confusing or missed by the end-user. (Green highlighting in the screenshot = good, red highlighting = could be improved) 	Put the description between the title and interface element to provide information.	**H**	This is a standard Drupal form. Making changes in it is theoretically possible but is very complicated and requires a huge time effort.	Discarded

	Usability Observation	Recommended Modification	Import-ance	Comment/ Solution	Status
16	The loading spinner when uploading a screenshot is “cut off” on the right hand side. 	Show the complete loading spinner.	**L**	Discarded due to low priority.	Discarded
17	The buttons to “Edit” and “Remove” screenshots shown on MouseOver over the screenshot preview seem out of place and are partly cut off. 	Replace buttons with smaller interface elements.	**L**	The buttons have been made smaller and ordered in a way they are visible completely.	Done
18	The numbers added in brackets behind information retrieved from the system (e.g. user names and languages) can be confusing. 	Display these information without the numbers or explain the meaning of these numbers.	**M**	This is a standard Drupal form. Making changes in it is theoretically possible but is very complicated and requires a huge time effort.	Discarded
19	There seem to be some English language issues and grammar mistakes in the forms descriptions.	Address them.	**H**	The texts have been checked and corrected.	Done
20	It is not clear for what the “Language information” is specified.	Give a description of the Language information.	**H**	This field is only visible for IMC admins, not for teachers.	No action needed

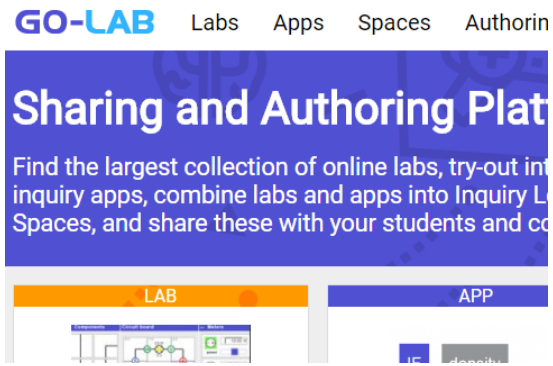
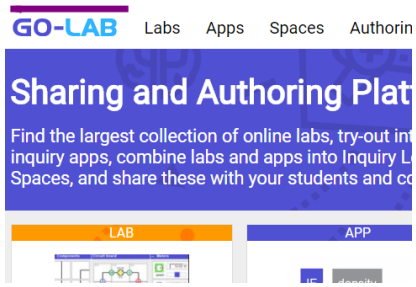
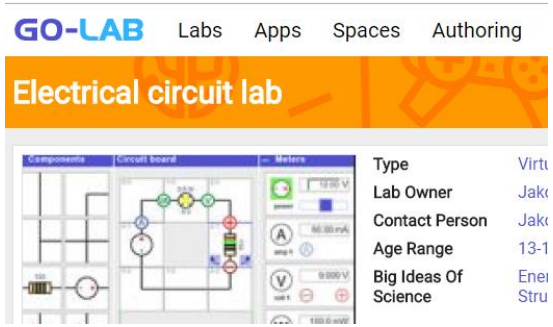
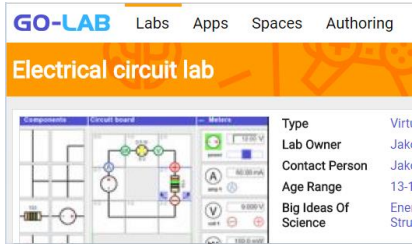
	Usability Observation	Recommended Modification	Import-ance	Comment/ Solution	Status
21	The only real option in the Language information dropdown is “English”. 	Check if this is the intended behaviour for this dropdown.	**H**	This field is only visible for IMC admins, not for teachers. The behaviour of the field is correct (now it also has French and Swahili for GO-GA).	No action needed
22	For “Subject Domains” the end-user can select a lower-level domain without also selecting the according higher-level domains. 	Automatically select all according higher-level domains, when a lower-level domain is chosen.	**H**	When a lower-level domain is chosen, according higher-level domains are selected automatically.	Done
23	From the description of the “Subject Domains” entry it is unclear, what is “adapted” and how. 	Describe this in more detail / in a way that is understandable for the user.	**H**	The description has been revised.	Done

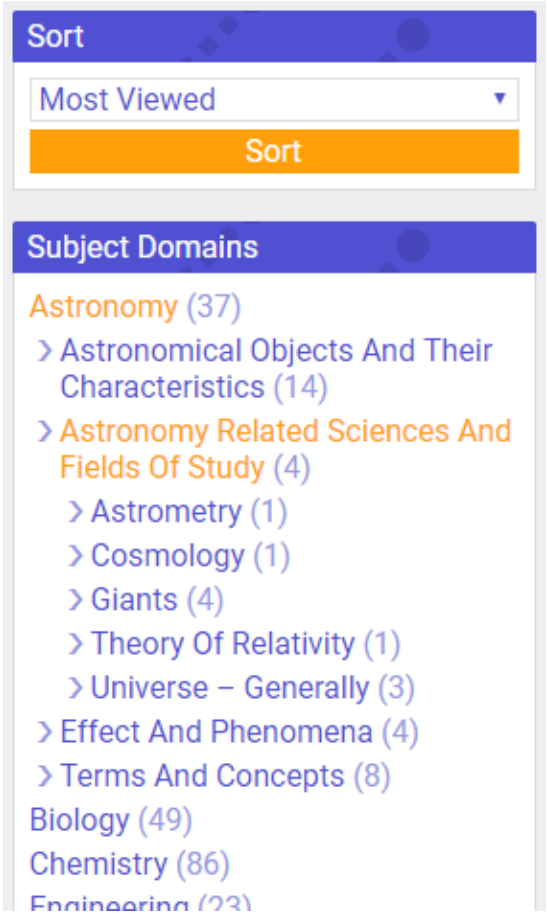
	Usability Observation	Recommended Modification	Import-ance	Comment/ Solution	Status
24	End-users not familiar with the Big Ideas Of Science might not know which ones to choose for their lab. 	Link from the names of the Big Ideas to their description in the portal.	**H**	A link to the descriptions of all Big Ideas has been added in the sentence “Please select Big Ideas of Science relevant for this lab”.	Done
25	Some of the description texts do not describe the entry, but give requirements instead. 	Make sure that there is a real description with more information regarding each entry.	**H**	Some texts are a part of the original Drupal forms. Additional texts have been revised/added to provide a well understandable description.	Done
26	If Adobe Flash and Java are the only two possible entries for “Technical Requirements”, they should not be entered in a text box. 	Provide checkboxes instead. These could be supported by icons of Adobe Flash and Java.	**M**	Technical requirements are now presented as tick boxes.	Done

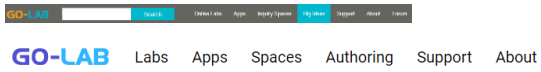
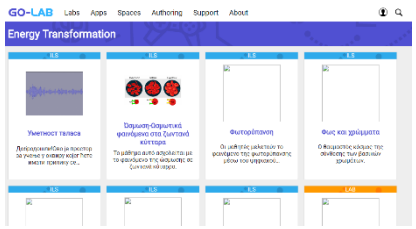
	Usability Observation	Recommended Modification	Import-ance	Comment/ Solution	Status
27	Row weight for “Embed Link” is confusing and seems to be unnecessary. 	Remove this functionality.	**L**	Functionality is removed.	Done
28	Error message on top of the Create lab page does not help to find the issue in the page. 	Area that contains the issue should be automatically expanded or at least its heading should be highlighted.	**H**	Implemented.	Done
29	The label of the “Save” button could be misleading (e.g. save for later). 	Use “Publish” as the label instead.	**L**	“Publish” is also misleading, since the content doesn’t get published immediately (only admins and reviewers can publish the content). It was a decision of the GA to call the button “Save”. After the content is saved, the user receives an e-mail notification explaining that the content will be reviewed and published within 24 hours.	Discarded
30	The red bar shown when viewing the lab looks like there is an error and the red does not fit the colour scheme of the rest of the page. 	Remove the red colouring.	**L**	Standard Drupal function showing that the content is unpublished.	Discarded

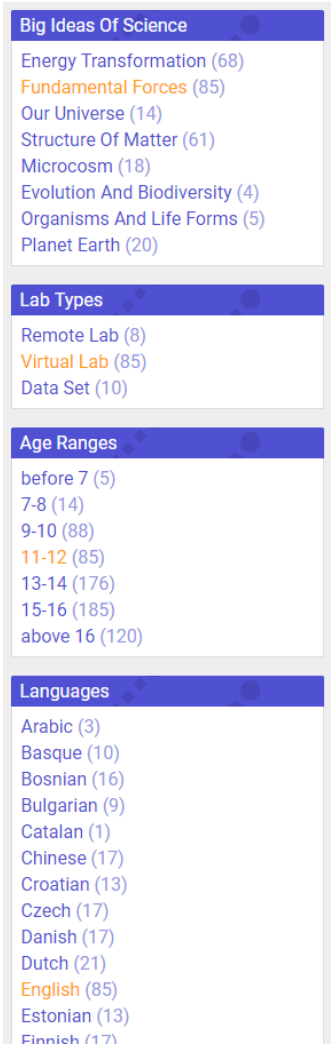
	Usability Observation	Recommended Modification	Import-ance	Comment/ Solution	Status
31	After saving a lab and going back to “Edit” it, the interface is sending mixed messages of it “has been created” and is “Not published”. 	Change “not published” to “published” once the lab has been published. Maybe change it to “unsaved changes” to indicate changes that have not been saved yet.	**H**	These are standard Drupal messages related to the form. Changing them is very complicated and requires a huge time effort.	Discarded
32	As a Lab editor I would like to see an overview of all my labs, to be able to access, edit, … them from there.	Show a list of “My Labs” in the View area of the end-user profile. NB: Such a list was shown the next day, thus it might just need some time. The portal should inform the Lab editor about the details somewhere (e.g. the instructions page).	**H**	The tabs have been renamed, one new tab has been added: My content, Edit content, Edit profile, Logout. The View area (My content) now displays content, where the user has “creator” or “contact person” role. The new “Edit content” tab leads to the page presenting content, which the user can edit. After the content is saved, the user receives an e-mail notification explaining that the content will be reviewed and published within 24 hours.	Done
33	Published labs do not appear in the list on the website.	Might be because it is only a testing version of the portal. In case the labs have to be “approved” by somebody, before they appear on the portal, this should be communicated to the end-user. NB: They were shown in the list the next day, thus it might just need some time. Again, inform the Lab editor about the details somewhere (e.g. the instructions page).	**H**	After the content is saved, the user receives an e-mail notification explaining that the content will be reviewed and published within 24 hours.	Done

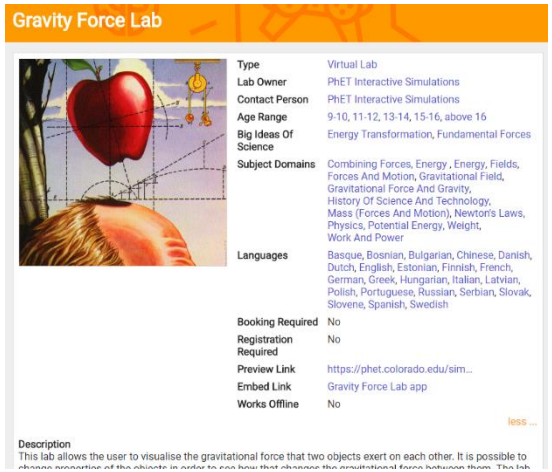
3. ILS editor experience

	Usability Observation	Recommended Modification	Import-ance	Comment/Solution	Status
1	On the start page the current location is not indicated in the menu. This is inconsistent with the behaviour for Labs, Apps, and Spaces menu entries. 	Add coloured bar over the Go-Lab logo when on the start page. 	**M**	From the design point of view, this is not very helpful: a dark or light blue bar would look like a part of the logo; an orange bar would be “too much”.	Discarded
2	On the details pages for labs, apps, and ILSs the visual clue on the location in the menu is no longer shown. 	Continue indicating the current location when going from the overview to details pages. 	**M**	Bug fixed.	Fixed

	Usability Observation	Recommended Modification	Import-ance	Comment/Solution	Status
3	Some filters are applied automatically onClick, Sort requires a button to be pressed, this is inconsistent. 	Apply the sorting “OnSelectionChanged” of the Dropdown list and remove the button.	**L**	The effort to reimplement the sort function is relatively high. Discarded due to low priority.	Discarded

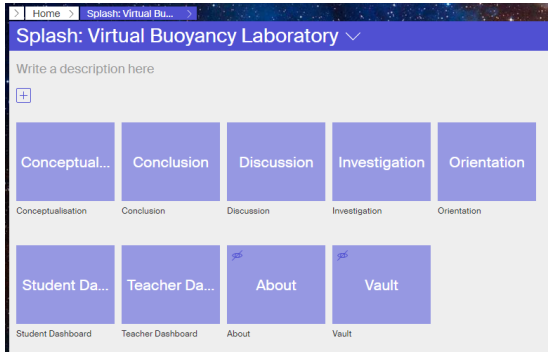
	Usability Observation	Recommended Modification	Import-ance	Comment/Solution	Status
4	The Big Ideas are missing from the menu and their explanation seems to be no longer on the portal?  	When clicking on one of the Big Ideas in the lab/app/ILS description, not only a list of artefacts assigned to this big idea should be shown, but also an explanation, for teachers that are not familiar with the Big Ideas of Science.  	**H**	The description of the Big Idea is now displayed between the header and the content in the search results.	Done
5	When looking at the details page of a lab and going back to the list using the “Labs” entry in the menu (instead of the back button of the browser), the selected filter options are lost.	If possible the filtering should be stored in a way that automatically applies them after looking at the details of one of the labs found. If the filtering should stay present when switching from labs to apps or ILS should be discussed.	**H**	This is how the filters are supposed to behave.	No action needed

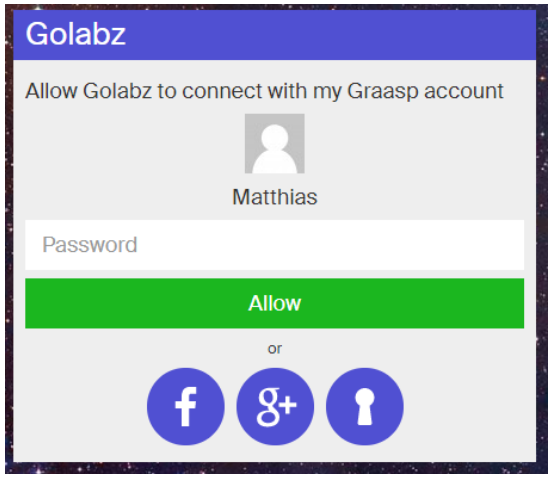
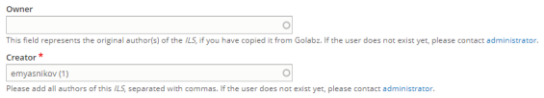
6	The filter options on the right hand side (especially for language) take up a lot of space, although only one can ever be selected at the same time. 	To save space, a dropdown list could be used, at least for the language, as it is done for Sort. For all other options (besides Subject Domains, which have sub- and subsub-domains) this could be considered as well, although they do not require as much space and the preview of what other options and home many elements would be available could be helpful there.	**L**	The language filter is now limited to the length of the content list and has a scrollbar.	Done

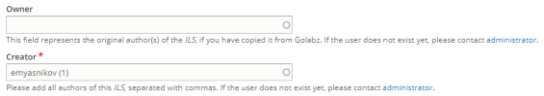
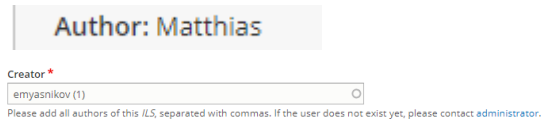
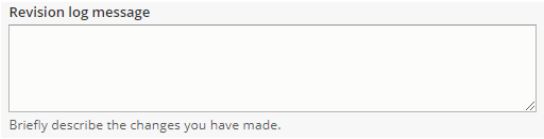
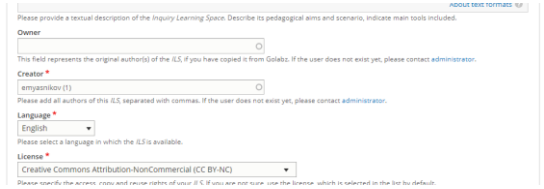
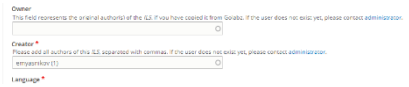
	Usability Observation	Recommended Modification	Import-ance	Comment/Solution	Status
7	The detailed information could be presented less wordy and more appealing. 	For example Big Ideas of Science could be represented by icons, like on the old portal, and the languages could be represented by flags. The are ranges could be presented in a similar way as the Big Ideas, with the age ranges being all displayed, with some being “active” and the others “inactive”. Icons could also be used for Type, Booking required and Registration required. On one hand that would make the presentation more unified and less wordy, on the other hand it could support the users in more quickly gathering the information. 	**M**	Displaying icons presenting different types of information would overload the design. The Big Ideas icons were excluded in the new design on purpose, as they were found less informative (by the users) in the previous version of the platform.	Discarded

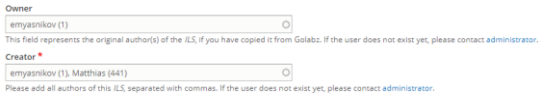
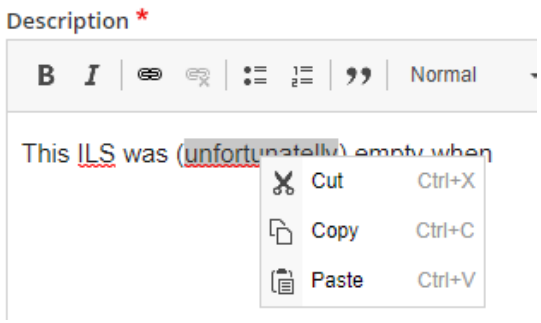
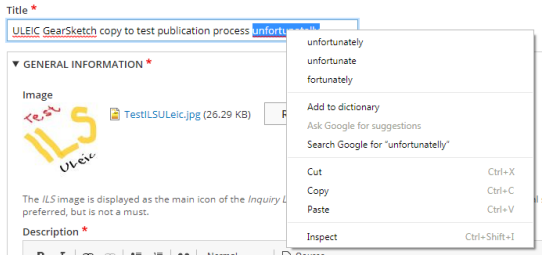
	Usability Observation	Recommended Modification	Import-ance	Comment/Solution	Status
8	The amount and type of information present on the details pages is not consistent. Compare: http://dev.golabz.eu/lab/13c-nuclear-magnetic-resonance-spectroscopy http://dev.golabz.eu/lab/gravity-force-lab and http://dev.golabz.eu/lab/balloons-and-static-electricity which show information from Type to Registration Required, Subject Domains, and Big Ideas of Science respectively.	The "less…" information should not depend on the size of the information. Instead the most important information should always presented here, no matter the size and additional information hidden behind "more …". Suggested information and ordering: less: - Preview Link (duplicated info to "Preview" button) - Age Range - Subject Domains - Big Ideas of Science - Type - Booking required - Registration required more: - Works Offline - Languages - Embed Link - Contact Person - Lab Owner	**M**	The "more/less…" information depends on the size of the information on purpose: some important information which has to presented on top (for example, subject domains) can be really huge and wound destroy the design of the page, if not collapsed. If we change this function, each page will look differently. "Contact person" and "Lab owner" are considered as important information (as we give credits to providers who share their tools with schools for free), so it should be displayed on top, although it's maybe less relevant for the users.	Discarded
9	"Preview" and "Create Space" interaction elements look like buttons, but only the words are interactive. 	Make those interaction elements behave like buttons.	**M**	Now the whole button is clickable.	Done

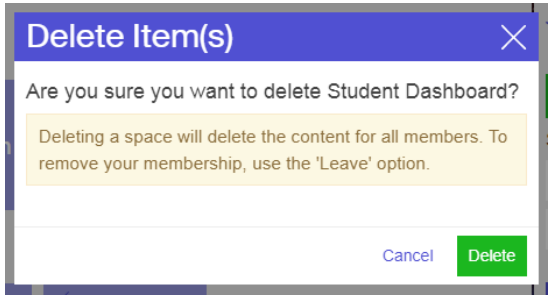
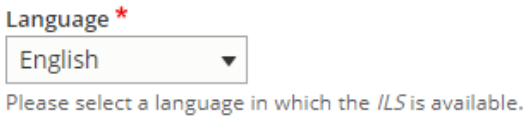
	Usability Observation	Recommended Modification	Import-ance	Comment/Solution	Status
10	It is not clear which fields are covered by the search? If the description should be covered it seems to not work correctly as a search for “HTML5” does not return the “Uniform Circular Motion” lab, which has HTML5 in its description text. “abridged” returns “Sexual Selection in Guppies (HTML5)” LAB, where “Java” does not.	Provide help and support and make sure that search functionality is working correctly.	**H**	The search function has been improved.	Done
11	There seems to be an issue with the rendering of lists in the Lab description (the numbering is displayed outside the content area). 	Make sure lists are rendered inside the area.	**L**	Bug fixed.	Fixed

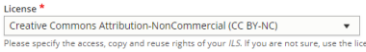
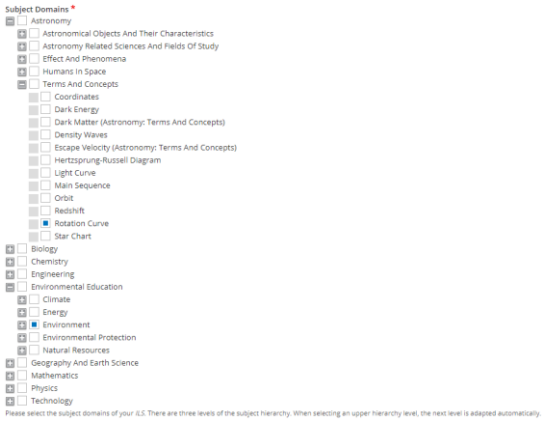
	Usability Observation	Recommended Modification	Import-ance	Comment/Solution	Status
12	The phases in ILS previews seem to be ordered alphabetically instead of in inquiry order (might be related to 13), e.g.: http://dev.graasp.eu/ils/59a821c01b3c64c7f46cebee/?lang=en http://dev.graasp.eu/ils/59a820dd1b3c64c7f46cebeb/?lang=en http://dev.graasp.eu/ils/59ad73fb1b3c64c7f46cebf8/?lang=en	Show the ILS phases in the order given by the teacher creating the ILS.	**H**	Problem on Graasp side.	Fixed
13	When creating an ILS from a lab, the phases are in alphabetical order, not inquiry cycle order. 	Put the phases in inquiry cycle order.	**M**	Problem on Graasp side.	Fixed

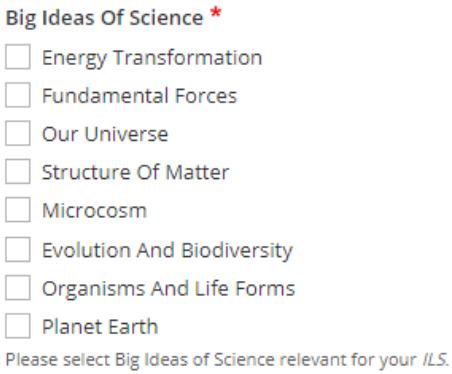
	Usability Observation	Recommended Modification	Import-ance	Comment/Solution	Status
14	Permission allowing Golabz to connect with Graasp account is not remembered after the first time it was granted. 	If possible, require giving this permission only once and remember it for the future (e.g. when duplicating other spaces).	**M**	The user can choose to save the login data in the browser, so (s)he doesn't have to enter them every time. The active login ("allow") should be there for security reasons.	No action needed
15	The publishing form tab shows the drupal icon as Favicon. 	Apply Next-Lab branding instead. 	**L**	-	Done
16	The original author of a duplicated ILS appears in the "Creator" not in the "Owner" text box, as indicated by the description. 	Pre-fill correct text field with original author.	**M**	After the ILS-owner history has been implemented, we have disabled and hidden the "owner" field. Now there is only "Creator" field which is populated automatically from Graasp.	Done

	Usability Observation	Recommended Modification	Import-ance	Comment/Solution	Status
17	Unclear who is the owner and creator of an ILS: Should the description of “Owner” and “Creator” be the other way around? Should the “Owner” be repeated as first entry in the “Creator” text field? 	From the terms I would have guessed “creator” is the original author of an ILS, who created it, and “owner” is the person who adapted it and thus “owns” the current version.	**H**	After the ILS-owner history has been implemented, we have disabled and hidden the “owner” field. Now there is only “Creator” field which is populated automatically from Graasp.	Done
18	Name of author(s) have to be manually entered in the “Creator” text field. 	“Creator” text field should be pre-filled with the information from Graasp or at least with the name of the person publishing the ILS.	**L**	The “Creator” field which is populated automatically from Graasp, including all users who have the “owner” role in Graasp.	Done
19	Wording might not be understandable for teachers, e.g. do they know what a revision log message is and why it is needed or would be useful? Where is it shown? 	Make sure this information is needed and if it is, explain it more detailed.	**L**	This field is only visible for the IMC admins, not for teachers.	No action needed
20	Description of what to enter should be between label and input interface element, not below interface element to specify the information. 	First provide all the information necessary or helpful for the task, then the means to perform it. 	**H**	This is a standard Drupal form. Making changes in it is theoretically possible but is very complicated and requires a huge time effort.	Discarded

	Usability Observation	Recommended Modification	Import-ance	Comment/Solution	Status
21	The numbers added in brackets behind information retrieved from the system (e.g. user names and languages) can be confusing. 	Display these information without the numbers or explain the meaning of these numbers.	**M**	This is a standard Drupal form. Making changes in it is theoretically possible but is very complicated and requires a huge time effort.	Discarded
22	The custom context menu in the “Description” text area prevents useful functionality usually accessible through the browsers context menu (e.g. spell check).  Which is possible, for example in the “Title” input field. 	As the options in the custom context menu are also available in the browser’s default context menu, the benefit of the custom context menu is not clear and it could therefore be removed.	**H**	The custom context menu of Drupal has been removed.	Done

	Usability Observation	Recommended Modification	Import-ance	Comment/Solution	Status
23	The warning message when deleting a phase from the ILS sounds odd for deleting a phase. 	Warning messages for phases and Graasp spaces should be customized and different from each other.	**M**	Forwarded to EPFL.	-
24	Opposite to the live system, deleting a space on the dev.Graasp does not give a confirmation message and does not automatically refresh the view, no longer showing the deleted phase. 	Not sure why this functionality is not working as expected and as on the live server, but should be the same.	**H**	This works correctly on the live platform. Sometimes, there can be deviations between live and dev platforms.	No action needed
25	Pre-filled “Language” seems to be English as default, even when submitting an ILS that was specified as being German in Graasp. 	This information should be automatically taken from Graasp, to speed up the process.	**L**	This field is only visible for IMC admins, not for teachers. The behaviour of the field is correct.	No action needed

	Usability Observation	Recommended Modification	Import-ance	Comment/Solution	Status
26	Teachers might not know what the different “License” options available mean. 	Add a link to a page describing the different options (either on the portal or external).	**H**	Two links have been added: to a page describing Open Source licences and to a page describing Creative Commons licences.	Done
27	The hint “… use the license, which is selected in the list by default.” does not help if the user has changed it (accidentally). 	Either specify the license to select in the description or add “(default)” to the entry in the dropdown list.	**H**	“Default” identifier has been added to the name of the licence in the list.	Done
28	For “Subject Domains” the end-user can select a lower-level domain without also selecting the according higher-level domains. 	Automatically select all according higher-level domains, when a lower-level domain is chosen.	**H**	When a lower-level domain is chosen, all according higher-level domains are selected automatically.	Done
29	From the description of the “Subject Domains” entry it is unclear, what is “adapted” and how. 	Describe this in more detail / in a way that is understandable for the user.	**H**	The description has been revised.	Done

	Usability Observation	Recommended Modification	Import-ance	Comment/Solution	Status
30	End-users not familiar with the Big Ideas Of Science might not know which ones to choose for their ILS. 	Link from the names of the Big Ideas to their description in the portal.	**H**	A link to the descriptions of all Big Ideas has been added in the sentence “Please select Big Ideas of Science relevant for this lab”.	Done
31	The label of the “Save” button could be misleading (e.g. save for later). 	Use “Publish” as the label instead.	**L**	“Publish” is also misleading, since the content doesn’t get published immediately (only admins and reviewers can publish the content). It was a decision of the GA to call the button “Save”. After the content is saved, the user receives an e-mail notification explaining that the content will be reviewed and published within 24 hours.	Discarded
32	The red bar shown when viewing the lab looks like there is an error and the red does not fit the colour scheme of the rest of the page. 	Remove the red colouring. If it is indicating, that this resource is not yet published / available on the portal, make that clear to the user.	**L**	Standard Drupal function showing that the content is unpublished.	Discarded