Go-Lab

Global Online Science Labs for Inquiry Learning at School

Collaborative Project in European Union's Seventh Framework Programme

Grant Agreement no. 317601

Deliverable D5.6

Releases of the Go-Lab Portal and the App Composer - final

Editors: Yiwei Cao (IMC)
Adrian Holzer (EPFL)

Date: 31st October 2015

Dissemination Level: PU

Status Final

The Go-Lab Consortium

Beneficiary Number	Beneficiary name	Beneficiary short name	Country
1	University Twente	UT	The Netherlands
2	Ellinogermaniki Agogi Scholi Panagea Savva AE	EA	Greece
3	École Polytechnique Fédérale de Lausanne	EPFL	Switzerland
4	EUN Partnership AISBL	EUN	Belgium
5	IMC AG	IMC	Germany
6	Reseau Menon E.E.I.G.	MENON	Belgium
7	Universidad Nacional de Educación a Distancia	UNED	Spain
8	University of Leicester	ULEIC	United Kingdom
9	University of Cyprus	UCY	Cyprus
10	Universität Duisburg-Essen	UDE	Germany
11	Centre for Research and Technology Hellas	CERTH	Greece
12	Universidad de la Iglesia de Deusto	UDEUSTO	Spain
13	Fachhochschule Kärnten – Gemeinnützige Privatstiftung	CUAS	Austria
14	Tartu Ulikool	UTE	Estonia
15	European Organization for Nuclear Research	CERN	Switzerland
16	European Space Agency	ESA	France
17	University of South Wales	USW	United Kingdom
18	Institute of Accelerating Systems and Applications	IASA	Greece
19	Núcleo Interactivo de Astronomia	NUCLIO	Portugal
20	Cardiff University	CU	United Kingdom

Contributors

Name	Institution
Yiwei Cao, Nils Faltin	IMC
Adrian Holzer, Denis Gillet, María Jesús Rodríguez-Triana, Andrii Vozniuk, Aubry Cholleton, Alex Wild, Wissam Halimi	EPFL
Alexandros Trichos, Panagiotis Zervas	CERTH
Pablo Orduña	UDEUSTO
Lars Bollen, Ton de Jong	UT
Ellen Wassink-Kamp (internal reviewer)	UT
Manuel Castro (internal reviewer)	UNED

Legal Notices

The information in this document is subject to change without notice.

The Members of the Go-Lab Consortium make no warranty of any kind with regard to this document, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The Members of the Go-Lab Consortium shall not be held liable for errors contained herein or direct, indirect, special, incidental or consequential damages in connection with the furnishing, performance, or use of this material.

The information and views set out in this deliverable are those of the author(s) and do not necessarily reflect the official opinion of the European Union. Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for the use which may be made of the information contained therein.

Executive Summary

This deliverable presents the final releases of the Go-Lab Portal and the App Composer following the specifications presented in D5.2 and the initial releases presented in D5.4. In this deliverable we elaborate on the features that were added or modified since the releases of D5.4.

Since the initial releases were launched at the end of M24, many online labs, apps, and ILS have been added into the Portal. The Go-Lab Portal consisting of the Go-Lab Repository and the Go-Lab ILS Platform has been extended to support user communities and to integrate user generated content. The App Composer provides mechanisms to translate apps and include external applications in the ecosystem. All the three platforms are better connected and serve the Go-Lab user community together in a seamless way.

More important, the Go-Lab Portal and the App Composer are not just the final releases of a technical implementation, but a rich platform which orchestrates the work conducted by other Go-Lab clusters and their work packages. The final releases demonstrate the project-wide achievements of Go-Lab by M36. Especially, the labs and big ideas come from collaboration with WP2. The pedagogical suggestions of WP1 and community support requests of WP6 have been taken into consideration and implemented. The additions and improvements described in this D5.6 deliverable compare to the features and services offered by the platforms at the end of the second year (D5.4) result from participatory design and evaluation activities done in the Pilot B phase by WP3 and WP8, respectively, as well as from the feedback of the reviewers. The outcome of participatory design is fully detailed in D3.3 (M36).

This deliverable is tightly associated to the previous work delivered in WP5. The requirements were initially specified in D5.2 and implemented in the initial releases as described in D5.4. The structure of this deliverable is in line with the one of D5.4.

This deliverable corresponds to software releases. So, the actual outputs delivered are the final releases of the three following platforms: http://www.golabz.eu/, http://graasp.eu, and http://composer.golabz.eu/. Basic features can be tested without an account. For more advanced testing, an account should be created on http://graasp.eu to get then an access to all platforms. This document is just an accompanying summary explaining the new released features and services, as well as their elicitation process.

Table of Contents

EXECUTIVE SUMMARY 4

1 INTRODUCTION 7

2 THE GO-LAB REPOSITORY 10

2.1 NEW FEATURES AND CHANGES SINCE THE INITIAL RELEASE 10
2.2 FUNCTIONAL REQUIREMENTS AND THE RELEASE 11
2.2.1 Publishing labs 11
2.2.2 Creating ILS 13
2.2.3 Publishing ILS 14
2.2.4 Using ILS 16
2.2.5 Supporting apps 16
2.2.6 Searching labs, apps & ILS 17
2.2.7 User management 20
2.2.8 Social features 21
2.2.9 Tracking user activities 22
2.2.10 Recommendation 22
2.2.11 Getting support 23
2.2.12 Managing tutorials 24
2.3 NON-FUNCTIONAL REQUIREMENTS AND THE RELEASE 25
2.3.1 Interoperability 25
2.3.2 Ubiquitous access 25
2.3.3 Usability 25
2.3.4 Scalability 26
2.3.5 Internationalisation 26
2.3.6 Personalisation 27
2.4 RELEASE DEVELOPMENT MANAGEMENT 28

3 THE ILS PLATFORM 30

3.1 NEW FEATURES AND CHANGES SINCE THE INITIAL RELEASE 32
3.2 FUNCTIONAL REQUIREMENTS AND THE RELEASE 33
3.2.1 Creating ILS 33
3.2.2 Modifying ILS 33
3.2.3 Publishing ILS 34
3.2.4 Using ILS 34
3.2.5 Supporting apps 36
3.2.6 User management 37
3.2.7 Social features 37
3.2.8 Tracking user activities 38
3.3 NON-FUNCTIONAL REQUIREMENTS AND THE RELEASE 38
3.3.1 Ubiquitous access 38
3.3.2 Usability 38
3.3.3 Internationalisation 38

3.3.4 Scalability *38*

4 THE APP COMPOSER **39**

4.1 NEW FEATURES AND CHANGES SINCE THE INITIAL RELEASE 39
4.2 FUNCTIONAL REQUIREMENTS AND THE RELEASE 39
4.2.1 Adapting existing apps *39*
4.2.2 Creating and integrating apps *40*
4.2.3 4.2.3 Translating apps *42*
4.3 NON-FUNCTIONAL REQUIREMENTS AND THE RELEASE 47
4.3.1 Usability *47*
4.3.2 Scalability *47*
4.3.3 Internationalisation *48*

5 CONCLUSION **49**

6 REFERENCES **50**

1 Introduction

The final releases presented in this deliverable follow the initial releases of the Go-Lab Portal and the App Composer presented in D5.4. They follow the specifications elicited in D5.2. Similarly to D5.4, the main product of this deliverable is the developed software. The system requirements are adapted based on the feedback gathered on the initial releases. Changes are highlighted, i.e. this deliverable describes the software development related to the final releases of the Go-Lab Portal and the App Composer. More specifically, it focuses on the differences with the initial releases. Note that the main personalization features of the Go-Lab Portal were presented in D5.3 and D5.5 and will thus not be repeated here.

The release date: October 2015 (M36).

- Go-Lab Portal - Lab Repository (Golabz): http://www.golabz.eu/
- Go-Lab Portal - Inquiry Learning Space Platform (*Graasp*): http://graasp.eu
- Go-Lab App Composer: http://composer.golabz.eu/

At this development stage, the Go-Lab Portal and the App Composer are not just the final releases of a technical implementation, but stand for a rich platform which integrates the diverse work done by the other Go-Lab clusters and their work packages. They integrate pedagogical and community visions and recommendations. Since D5.4, numerous new resources have been added into the Portal, specifically labs, apps, or ILS. WP1 and WP2 are offering resources to produce and elaborate inquiry learning spaces and to discover online labs at a content level. There are 161 online labs and 159 ILS published in the Go-Lab Portal as of September 15, 2015. As depicted in Figure 1.1, the modifications from D5.4 to D5.6 are the results of participatory design (see D3.3) and evaluation done in the Pilot B phase by WP3, as well as feedback from the reviewers. WP4 has enriched the online lab infrastructure with a set of lab related services. WP6 contributed on the community level, which motivated many teachers to use the Go-Lab Portal.

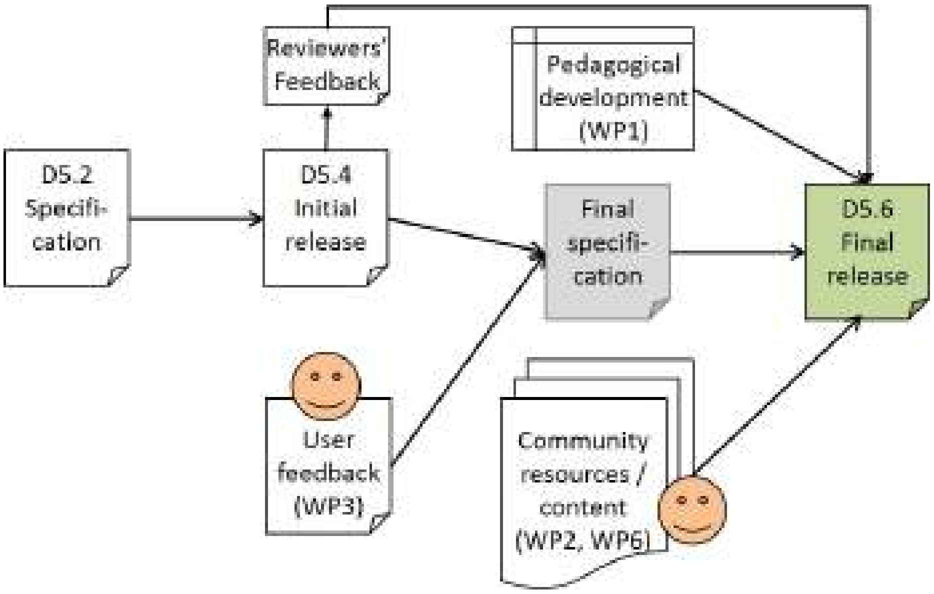


Figure 1.1. Various input and resources of Deliverable D5.6.

For consistency and continuity, this deliverable is structured as D5.4 (Initial releases). The final release of the Go-Lab Portal is described based on its two components, i.e., the Lab Repository (Chapter 2) and the ILS Platform (Chapter 3), respectively. After that, the final release of the App Composer is detailed in Chapter 4. Finally, Chapter 5 wraps up with a conclusion and a discussion regarding the next steps. For instance, the sustainable releases of the Go-Lab Portal and the associated end-user solutions will be delivered in D5.7 by M48. In each chapter, the new features and improvements added since the initial releases are listed for an overview and requirements are refined based on the initial releases. Moreover, the technical implementation are described together with screenshots.

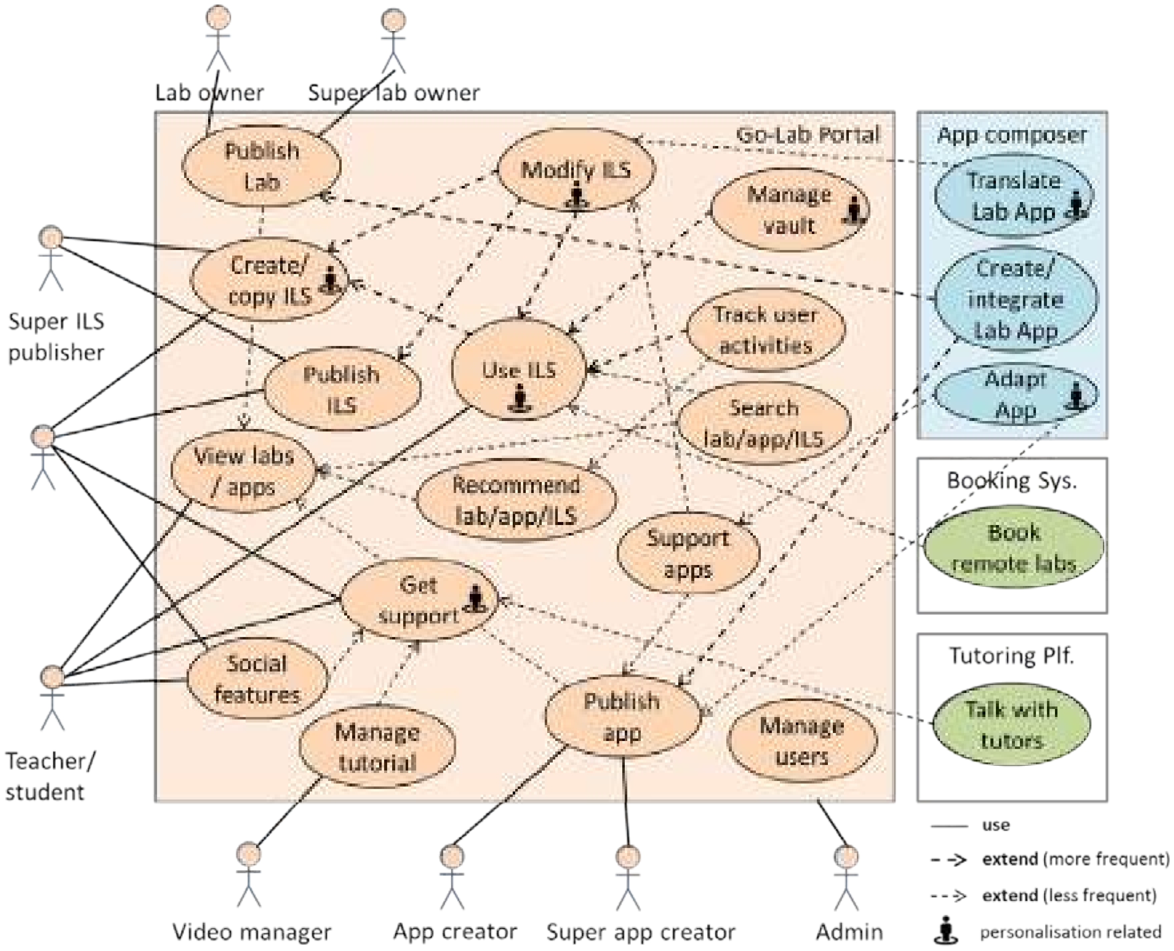


Figure 1.2. The use case diagram of the Go-Lab Portal and the App Composer.

The system requirements are in line with the previous specifications (D5.2) and the initial releases (D5.4). Since the technical development is conducted in an iterative way, more new features have been implemented and the existing features have been extended. In the portal, we refined the requirement of supporting lesson plans (learning scenarios) by providing dedicated ILS templates. Accordingly, the functional requirements are summarised as an oval in the use case diagram in Figure 1.2. The Go-Lab Portal consisting of the Go-Lab Repository and the Go-Lab ILS Platform is integrating improvements to involve user communities, while many stakeholders with respective access roles have been supported in these final releases. Besides teachers and students, lab owners, app creators, and ILS publishers play active roles in the portal. Meanwhile, the user communities are better supported, which leads to the new functional requirement: *Get support*. Some of the functional requirements also offer personalisation approaches of Go-Lab Portal as depicted in Figure 1.2. They are not the focus in D5.6, but more details on personalisation can be found in D5.5. The *Booking System* and *Tutoring Platform* are part of the add-on services of the Go-Lab Portal and are mainly reported in D4.8.

2 The Go-Lab Repository

The Go-Lab Repository is available at http://www.golabz.eu/ and its source code is available on a subversion repository[1]. We also call it *Golabz* for its briefness.

The statistics of the resources in the Go-Lab Portal as of September 15, 2015, is summarised below. Statistics can be found at http://www.golabz.eu/about-go-lab-portal. The number in the bracket followed by "+" shows the growth in comparison to the reported number in the initial releases D5.4 by M24. Both lab owners and ILS publishers have been supported after the initial release. There are overlapping between both numbers, since some ILS publishers could also be lab owners. And they have logged into Golabz with these roles, whereas it could happen that they have not published any labs or ILS.

- Labs: 161 labs (+ 113);
- Apps: 34 apps (+ 6), among them around 10 apps are exported from the ROLE Widget Store;
- ILS: 159 inquiry spaces (+ 151);
- Big ideas: 8, specified and fixed by WP2;
- Lab owners: up to 36 (+36);
- ILS publisher: up to 170 (+170).

In terms of terminologies and concepts, no big changes have been taken in the Go-Lab Repository since D5.4. They are in line with the section *2.1.2 Terms* in D5.4. Since the ILS Platform account is also used for the Go-Lab Repository, we also use the term *Graasp account* which is a unified single sign-on user account across the Go-Lab Portal.

2.1 New features and changes since the initial release

For a better overview, we list all the new features and changes since the initial release of the Go-Lab Repository in this section. They are ordered according to the requirements in line with D5.4 which are also depicted as use cases in Figure 1.2. More detailed information is given in Section 2.2.

Publishing labs

- To support lab owner to publish labs using the App Composer;
- Lab input form: extension of lab metadata fields and enhancement of user-friendliness with help information about each field;
- The deployment of the lab input form to lab owner replacing the Google Form of Lab Profiles;
- A lab owner kit for lab management.

Creating ILS

- Creation via the ILS Platform (no direct input in the repository any more).

Publishing ILS

- ILS input form: extension of ILS metadata fields and enhancement of user-friendliness with help information about each field;
- Automation of metadata input based on lab metadata;
- Performance improvement.

[1] http://svn.research.im-c.de/golab-labrepository/trunk/go-lab-repository

Using ILS

- New preview/copy workflow.

Supporting apps

- New specification of the app categories;
- Preview link of apps.

Searching labs, apps & ILS

- Various search approaches including filtering with faceted search and sorting;
- Listing labs & ILS by big ideas.

User management

- A refined user scheme with specified roles: (super) lab owner, (super) app creator, ILS publisher;
- Specific use cases (workflow) for lab owner, for teacher/student, for ILS publisher, for Go-Lab experts (video manager).

Social Features

- Support teachers to propose a lab to Go-Lab;
- Support page for community building (See Getting support and Managing tutorial).

Tracking user activities

- Tracking the usage of the buttons *Create an Inquiry Space* and *Copy this Inquiry Space* on lab and ILS page respectively.

Recommendation

- Recommender: extended with Elasticsearch (Gormley & Tong, 2015) for offering labs and apps recommendations based on the description of these items.

In addition, two new functional requirements have been added to the initial release in order to support the user communities in the repository.

Getting support. The Go-Lab Repository offers a landing page for all tutorials related to the portal. It offers community support with tutorial videos, faq, forum etc.

- A support landing page with various support;
- Tutorial content.

Managing tutorial. Accordingly, the tutorial needs to be managed by users who have the expertise and are granted with the access rights. They are specified as the user role of *video manager*.

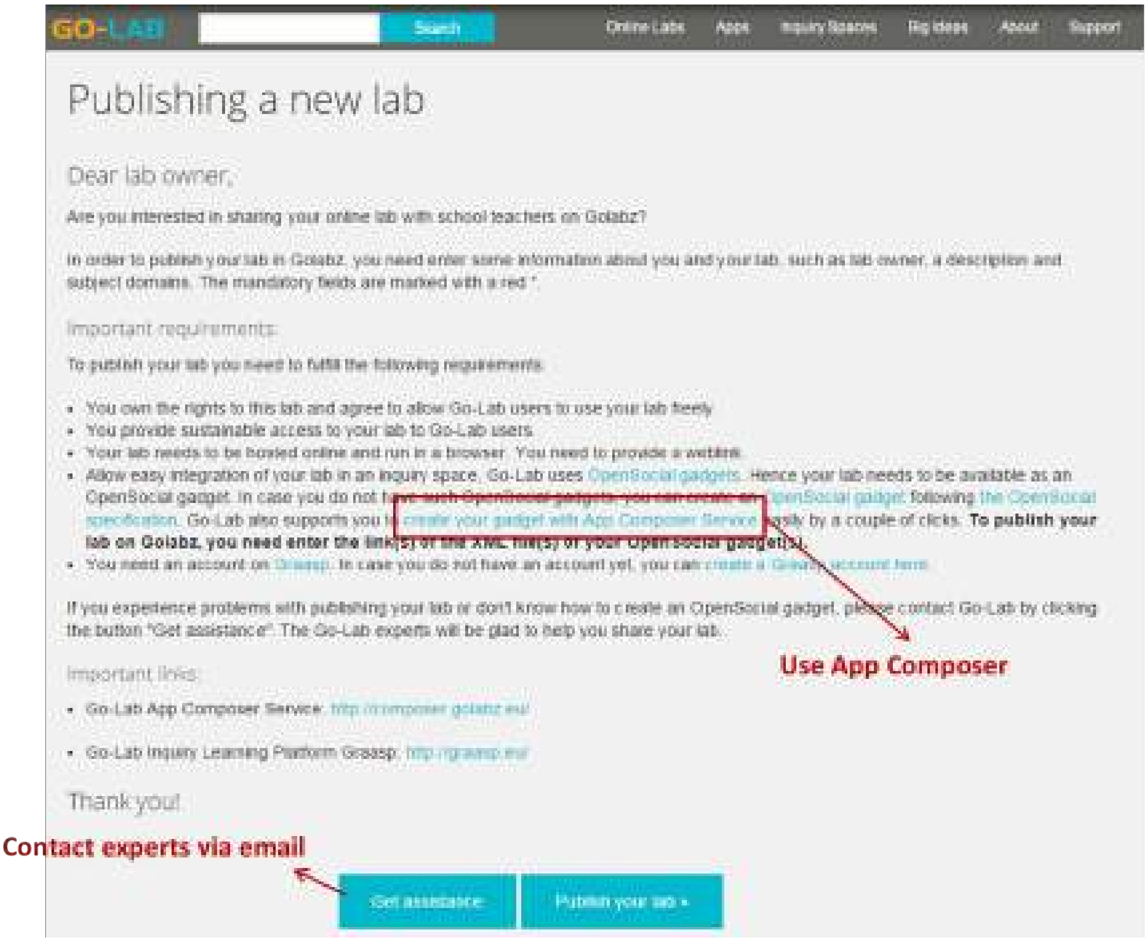
- Draggable view for video managers;
- Embedded video tutorials in each app, lab and ILS page;
- Personalized tutorials.

2.2 Functional requirements and the release

2.2.1 Publishing labs

As mentioned before, 161 labs and 36 lab owners have been published and more labs are expected to be published since the initial release. To ensure openness and sustainability of the Go-Lab Portal, lab owners have been able to publish their labs onto the Go-Lab Repository. Thus, any lab owner is able to publish his/her labs without the moderation or the control of the Go-Lab consortium. To this end the Go-Lab Repository has implemented a form to add online labs for lab owners. It works in this way:

1. Lab owners use their *Graasp* account to login.
2. They get the important information about how to publish their labs (Fig. 2-1).
3. They get the lab publishing form and fill in the metadata for their labs.



Publishing a new lab

Dear lab owner,

Are you interested in sharing your online lab with school teachers on Golabz?

In order to publish your lab in Golabz, you need enter some information about you and your lab, such as lab owner, a description and subject domains. The mandatory fields are marked with a red *.

Important requirements:

To publish your lab you need to fulfil the following requirements:

- You own the rights to this lab and agree to allow Go-Lab users to use your lab freely
- You provide sustainable access to your lab to Go-Lab users
- Your lab needs to be hosted online and run in a browser. You need to provide a weblink
- Allow easy integration of your lab in an inquiry space. Go-Lab uses OpenSocial gadgets. Hence your lab needs to be available as an OpenSocial gadget. In case you do not have such OpenSocial gadgets, you can create an OpenSocial gadget following the OpenSocial specification. Go-Lab also supports you to create your gadget with App Composer Service easily by a couple of clicks. **To publish your lab on Golabz, you need enter the link(s) of the XML file(s) of your OpenSocial gadget(s).**
- You need an account on Graasp. In case you do not have an account yet, you can create a Graasp account here.

If you experience problems with publishing your lab or don't know how to create an OpenSocial gadget, please contact Go-Lab by clicking the button "Get assistance". The Go-Lab experts will be glad to help you share your lab.

Important links:

- Go-Lab App Composer Service: http://composer.golabz.eu/
- Go-Lab Inquiry Learning Platform Graasp: http://graasp.eu/

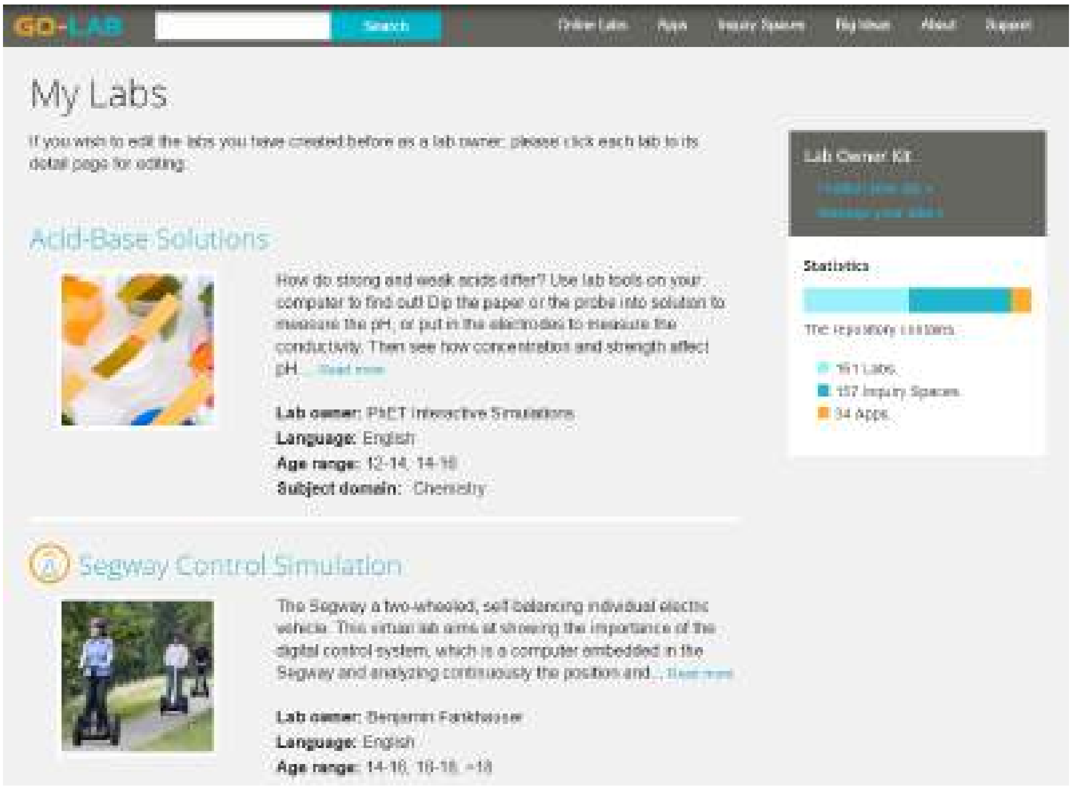
Thank you!

Figure 2.1. Screenshots of the information page for lab owners by publishing an online lab (http://www.golabz.eu/lab/publishrules).

The publishing rules depicted in Figure 2.1 also shows that lab owners get different kinds of support. Because the labs can only be used in an inquiry learning space with one or more than one valid gadgets, a prerequisite for online labs to be registered in the Go-Lab Repository is to create an OpenSocial gadget following the OpenSocial Standard. First, if a lab owner does not know how to create a gadget, he is suggested to use the Go-Lab App Composer (more information can be found in Chapter 4). Second, if the lab owner still have questions, he/she is encouraged to get Go-Lab consortium members' direct support by clicking the *Get assistance* button.

At the initial release phase, labs were all manually input by the Go-Lab consortium partners (EPFL, IMC, UNED, UDeusto, EA, and CERTH) based on the Lab Profiles. The Lab Profiles are a Google Form created within WP2 for lab owners to input lab metadata. The Google Form was a good solution at the early phase of the project, whereas it cannot be well maintained since more and more labs are being registered on the portal. As of the final use of this form, 94 lab profiles are registered, which means a huge input workload for the Go-Lab consortium. With the development of the final release, the Lab Profiles form has been completely closed[2] since March 2015. Various lab owners such as PhET and RemLabNet have since published their online labs directly in the repository successfully.

Accordingly, lab owners are supported to update their labs and publish new labs continuously. A lab owner kit is implemented for this purpose as illustrated in Figure 2.2. If a lab owner has logged in, the repository displays a block with the links of *publish your lab* and manage your labs at the sidebar. Each lab owner can access all labs he/she has published previously easily. By clicking each of one's labs, an edit tab is displayed for metadata editing and lab updating.



My Labs

If you wish to edit the labs you have created before as a lab owner, please click each lab to its detail page for editing.

Acid-Base Solutions

How do strong and weak acids differ? Use lab tools on your computer to find out! Dip the paper or the probe into solution to measure the pH, or put in the electrodes to measure the conductivity. Then see how concentration and strength affect pH. ... Read more

Lab owner: PhET Interactive Simulations
Language: English
Age range: 12-14, 14-16
Subject domain: Chemistry

The repository contains

- 161 Labs
- 157 Inquiry Spaces
- 34 Apps

Segway Control Simulation

The Segway a two-wheeled, self-balancing individual electric vehicle. This virtual lab aims at showing the importance of the digital control system, which is a computer embedded in the Segway and analyzing continuously the position and... Read more

Lab owner: Benjamin Fankhauser
Language: English
Age range: 14-16, 16-18, +18

Figure 2.2. Screenshots of *My Labs* page for lab owners with the lab owner kit.

Please note that the *My Labs* page identify the lab owner as a Go-Lab user who has published this lab online. Thus, it could be different to the information displayed in the metadata field *Lab owner*.

2.2.2 Creating ILS

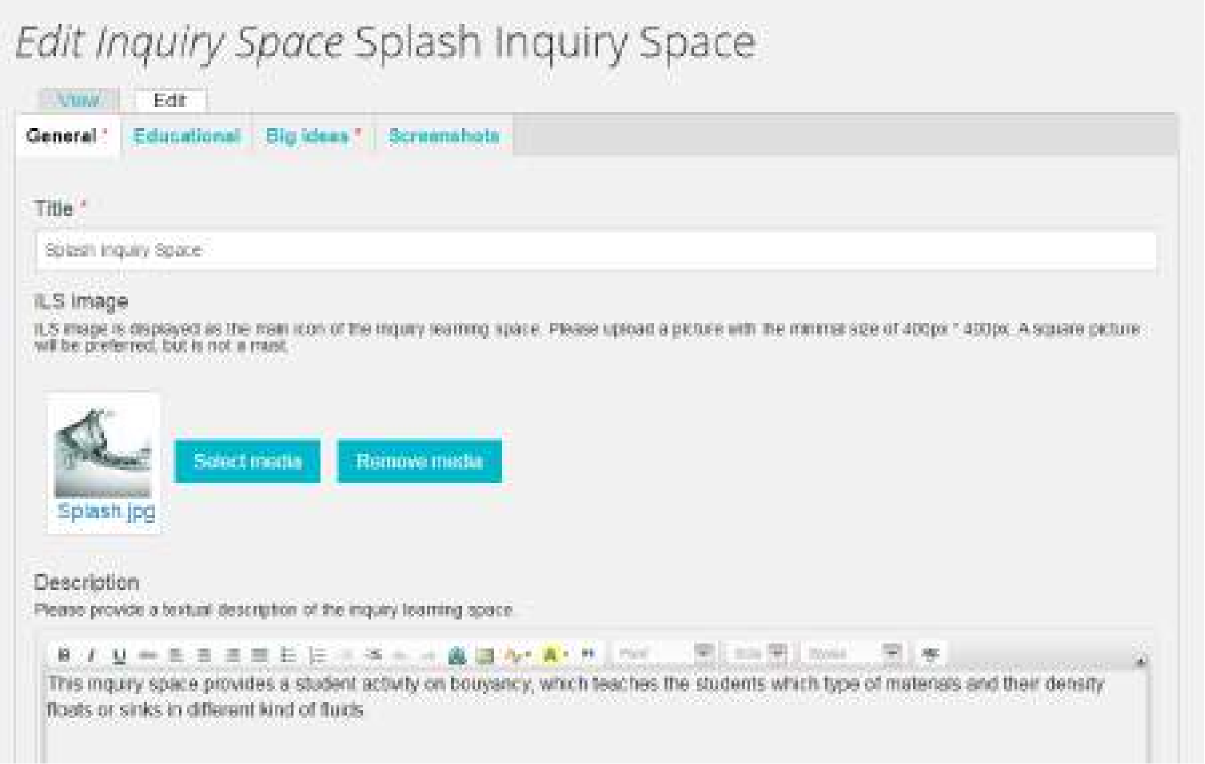
An ILS can be created by users with a *Graasp* account. From the ILS Platform (*Graasp*), a user can create an empty ILS (see D5.4). From the Go-Lab Repository there are two options on how to create an ILS. One can create an ILS starting from an online lab by clicking the "Create an inquiry space" button on the detail page of a lab. This will create an ILS in *Graasp* with the online lab integrated in the *Investigation* phase. The other option is to pick a published ILS on the Go-Lab Repository and click the "Copy this Inquiry Space" button on an inquiry space detail page. This will create an exact copy of the published ILS with you as owner and without any user data of the original published ILS. Once an ILS is created in the ILS Platform, the user can edit and modify text and content as described in Chapter 3. Thus, the completion of ILS creation only takes place in the ILS Platform. The Go-Lab Repository only triggers the creation of an ILS which need further processed in the ILS Platform.

[2] The previous Lab Profile form´: http://goo.gl/forms/101ZrBErv0

2.2.3 Publishing ILS

ILS creators (mainly teachers and lab owners) can publicly publish their finished ILS on the Go-Lab Repository to foster reuse via the ILS input form (see Figure 2.3). Such a published ILS can be seen as an Open Educational Resource (OER). Essentially, the published ILS is a bundle of all resources included in the ILS and its structure. This bundle is compressed as a ZIP file and its resources are structured internally in directories based on the phases (*Graasp* spaces) of the ILS and include extra metadata on resource order, access rights and organisation. Upon creation of such a bundle, the privacy sensitive information is excluded (e.g. the members of the space and the student data stored in the Vault). From a published ILS, a new exact copy (except the space members and privacy sensitive data) of the ILS can be recreated on the ILS Platform (*Graasp*).

The metadata of the existing online lab in this ILS is taken automatically in the ILS metadata input form including subject domains and difficulty levels etc. The metadata fields are also organised in the tabs *General*, *Educational*, *Big ideas*, and *Screenshots* in the similar as the lab metadata organisation. Furthermore, users could edit the existing metadata, add new metadata, esp. add an icon for the ILS and add screenshots for preview.



Edit Inquiry Space Splash Inquiry Space

Title *

Splash Inquiry Space

ILS image

ILS image is displayed as the main icon of the inquiry learning space. Please upload a picture with the minimal size of 400px * 400px. A square picture will be preferred, but is not a must.

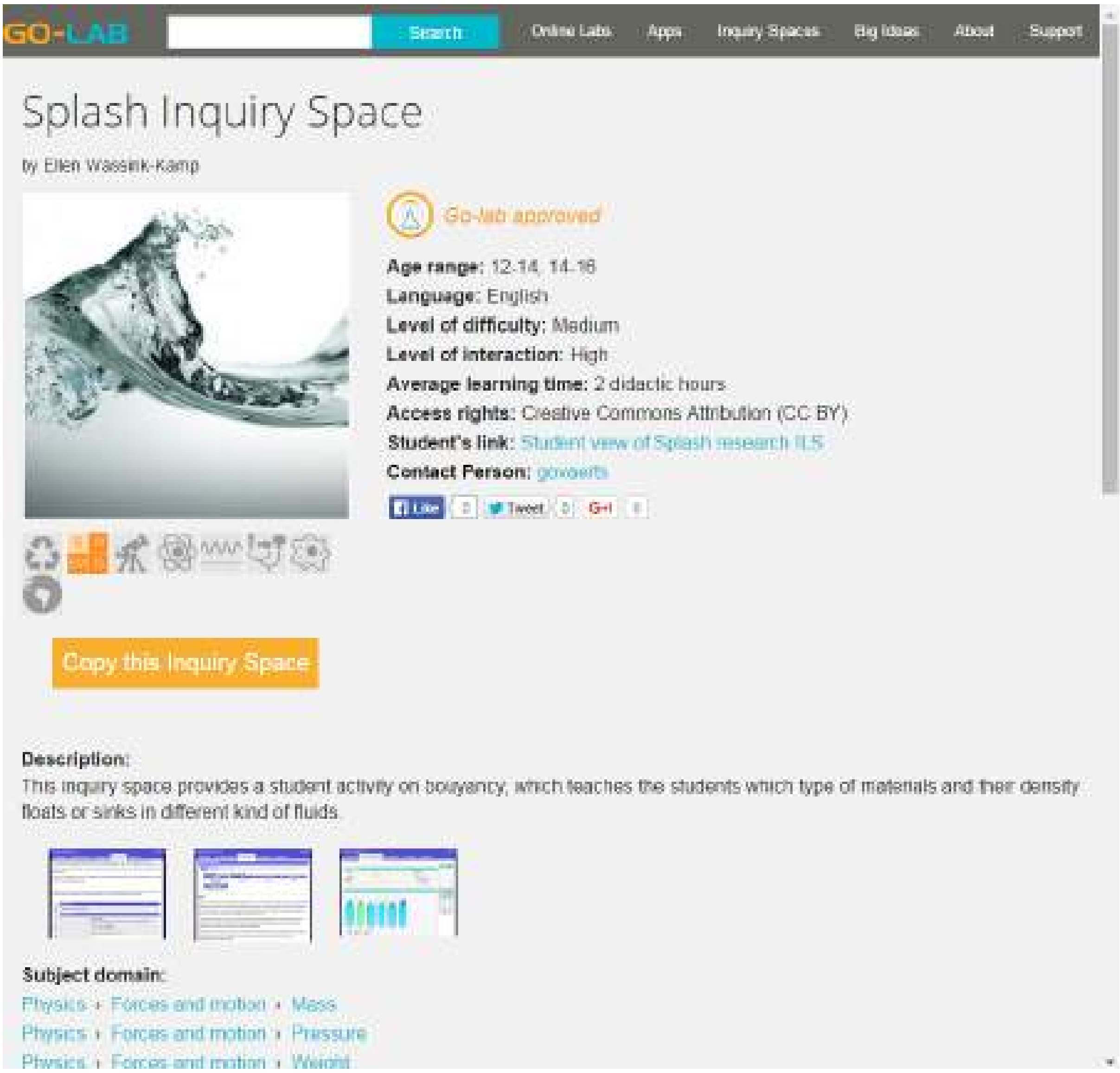
Description

Please provide a textual description of the inquiry learning space.

This inquiry space provides a student activity on bouyancy, which teaches the students which type of materials and their density floats or sinks in different kind of fluids

Figure 2.3. Screenshots of *My Labs* page for lab owners with the lab owner kit.

Accordingly, the view of this ILS is displayed in Figure 2.4. In compared to the initial release, the metadata fields are extended with Average learning time, Access rights and contact person etc.



Splash Inquiry Space

by Ellen Wassink-Kamp

Age range: 12-14, 14-16
Language: English
Level of difficulty: Medium
Level of interaction: High
Average learning time: 2 didactic hours
Access rights: Creative Commons Attribution (CC BY)
Student's link: Student view of Splash research ILS
Contact Person: gowaerts

Description:
This inquiry space provides a student activity on bouyancy, which teaches the students which type of materials and their density floats or sinks in different kind of fluids.

Subject domain:
Physics › Forces and motion › Mass
Physics › Forces and motion › Pressure
Physics › Forces and motion › Weight

Figure 2.4. Screenshots of ILS with extended metadata fields.

Once the ILS is published, the teacher can adapt his original ILS and the published ILS will not be affected. Thanks to the zipped bundle, the published version is a snapshot. However, after a teacher has applied changes to his original ILS, she can re-publish the ILS and decide whether she wants to update the already published ILS or publish it as a new ILS on the Go-Lab Repository.

Since the single-sign-on login method and the ILS import/export are conducted seamless between the repository and the ILS Platform with a large volume of data, stability and performance has become a key issue which has demanded much development workload for this final release. More details will be discussed in Section 2.3.

2.2.4 Using ILS

In the repository, users can explore the catalogue of ILS and have a look of the ILS by clicking the “Student’s link”. An ILS can only be used when a copy is made in *Graasp*. More information of the new features about how to use ILS will be given in the next chapter.

The new feature in the repository is being developed based on the feedback from WP3. Core teachers group and many other teachers sometimes don’t want to copy the ILS by clicking the button *Copy this Inquiry Space* on the ILS page. They just want to take a look at the ILS by clicking the *student’s link,* while they started to use this preview ILS by mistake. In order to avoid this unclarity, a new preview/copy workflow has been designed as depicted in the mockup in Figure 2.5. Users will have access to two buttons on the ILS page: 1) Preview and 2) Copy and use. If *Preview* is clicked, a warning message will be displayed in *Graasp* to remind users of the preview status. If *Copy and use* is clicked, the user is taken to Graasp (via authentication).

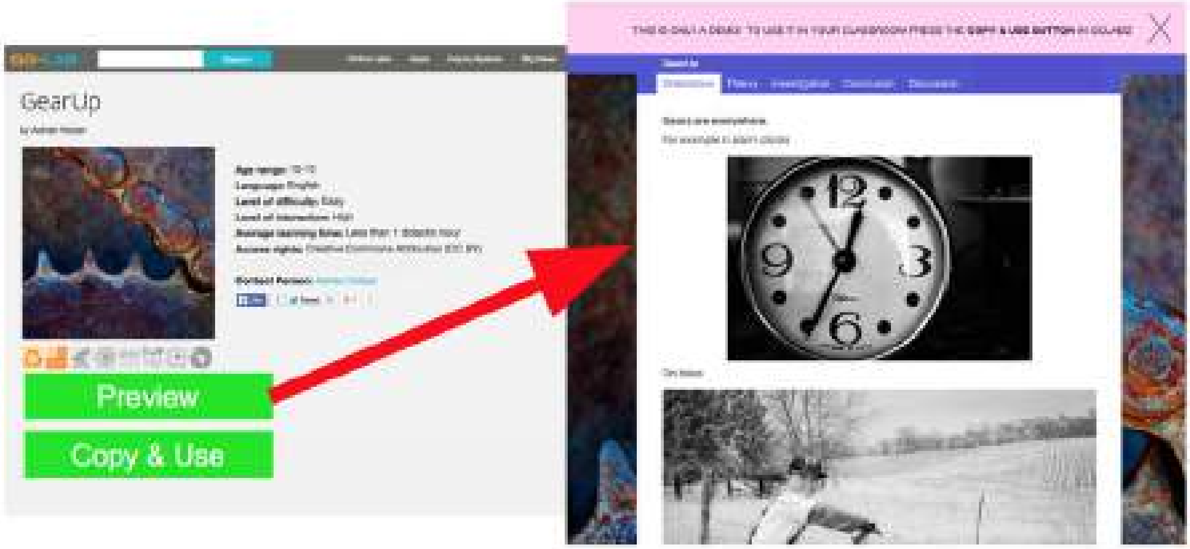


Figure 2.5. Mockups of preview/copy ILS workflow.

2.2.5 Supporting apps

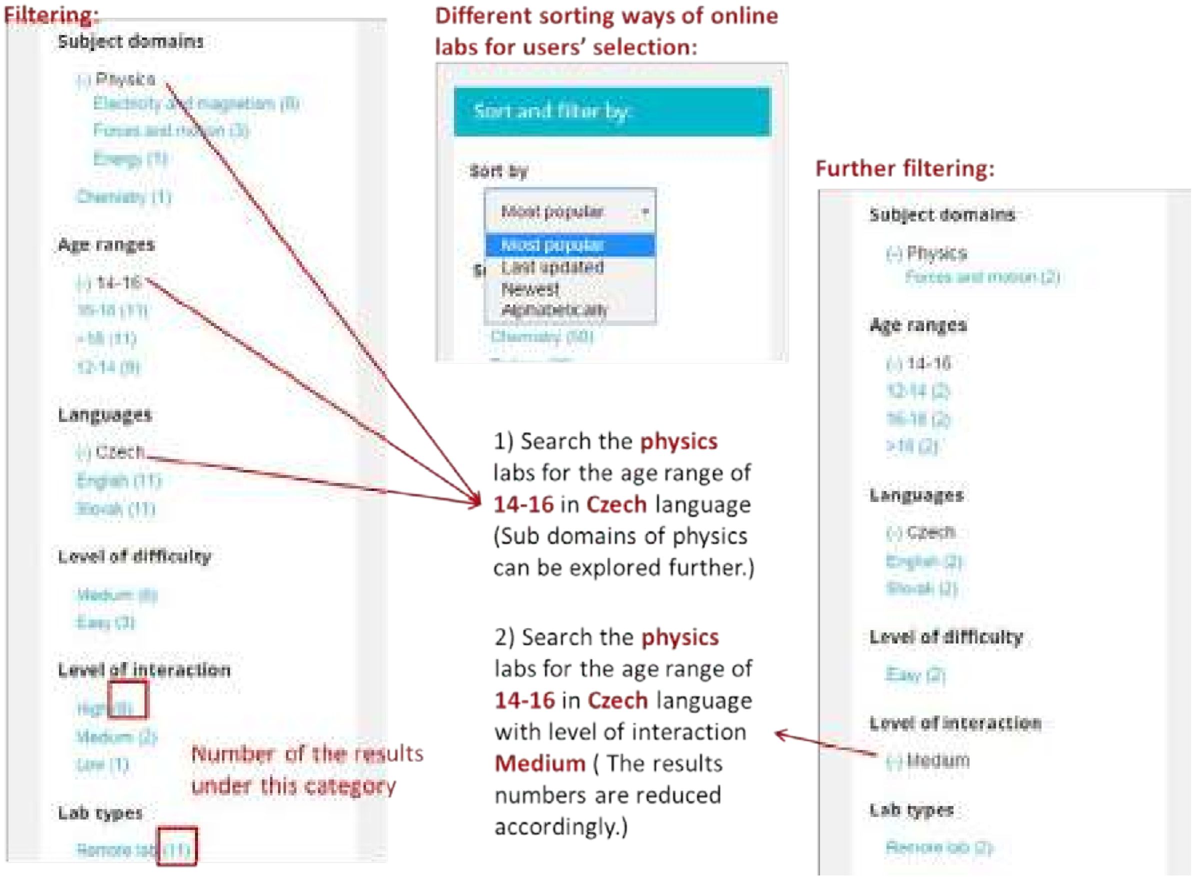
Based on feedback from users after the initial releases, six new app categories are specified clearly based on the work done by WP1. It help users find the proper supporting apps in the Go-Lab Repository. One app can be assigned to different app categories.

- Go-Lab inquiry apps are specific apps supporting inquiry learning methods, e.g. Hypothesis Scratchpad.
- General apps are those for various file management and processing, e.g. Check Spelling and File Drop.
- Collaboration apps enables cooperation among users, e.g. Wiki App.
- Math related support apps pertain to the mathematics domain, e.g. Function Plotter and Calculator.
- Learning analytics apps delivers user statistics about learning, e.g. Action Statistics
- Domain specific apps are specific tools for certain domains except mathematics, e.g. Periodic Table.

In addition, a *Preview link* is added to improve the display of App preview. App creators can input an additional url instead of the gadget source code location. This solved the issue in the initial release. Some apps were not be able to be previewed properly, if the apps needed user data and can only be used in certain ILS, e.g. the learning analytics apps.

2.2.6 Searching labs, apps & ILS

One can search for online labs, ILS and apps on the Lab Repository via a general keyword-based search and via filtering in the listing pages. Through participatory design activities (see D2.2), we have surveyed the importance of the metadata fields for online labs. These results have been used to optimize the user interface of the Lab Repository, by reordering the search filters and reordering the presentation of the metadata fields on the detail pages of online labs. Users could also sort labs, apps & ILS according to the popularity, update time, creation time, and title alphabetically. Figure 2.6 displays the screenshots of sort online labs in the middle. The rest in Figure 2.6 gives an example of search for physics labs with different criteria step by step. It works the same for apps and ILS except different metadata fields accordingly.



Filtering:

Different sorting ways of online labs for users' selection:

Further filtering:

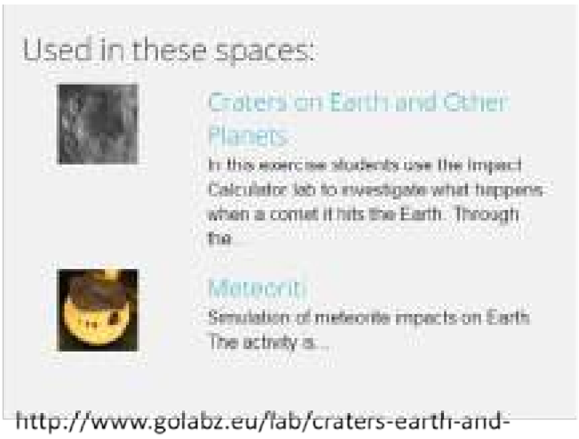
1) Search the **physics** labs for the age range of **14-16** in **Czech** language (Sub domains of physics can be explored further.)

2) Search the **physics** labs for the age range of **14-16** in **Czech** language with level of interaction **Medium** (The results numbers are reduced accordingly.)

Number of the results under this category

Figure 2.6. Sort and filter sidebar on the listing page of online labs.

The Go-Lab Repository also provides more interconnection between the available resources. For instance, the online labs and apps show which published ILS are using this online lab or app on the lab and app page respectively, as depicted in Figure 2.7.



Used in these spaces:

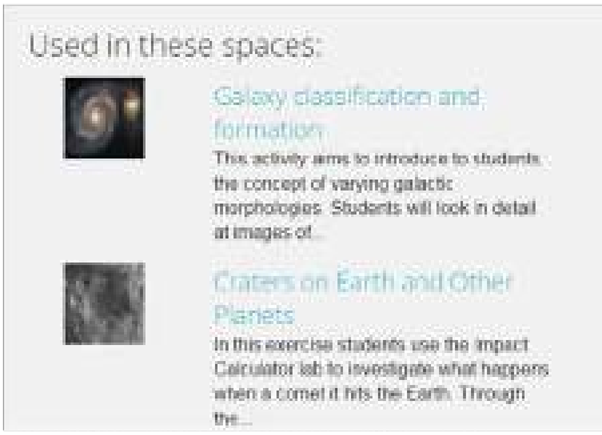
Craters on Earth and Other Planets

In this exercise students use the Impact Calculator lab to investigate what happens when a comet it hits the Earth. Through the...

Meteorit

Simulation of meteorite impacts on Earth. The activity is...

http://www.golabz.eu/lab/craters-earth-and-other-planets



Used in these spaces:

Galaxy classification and formation

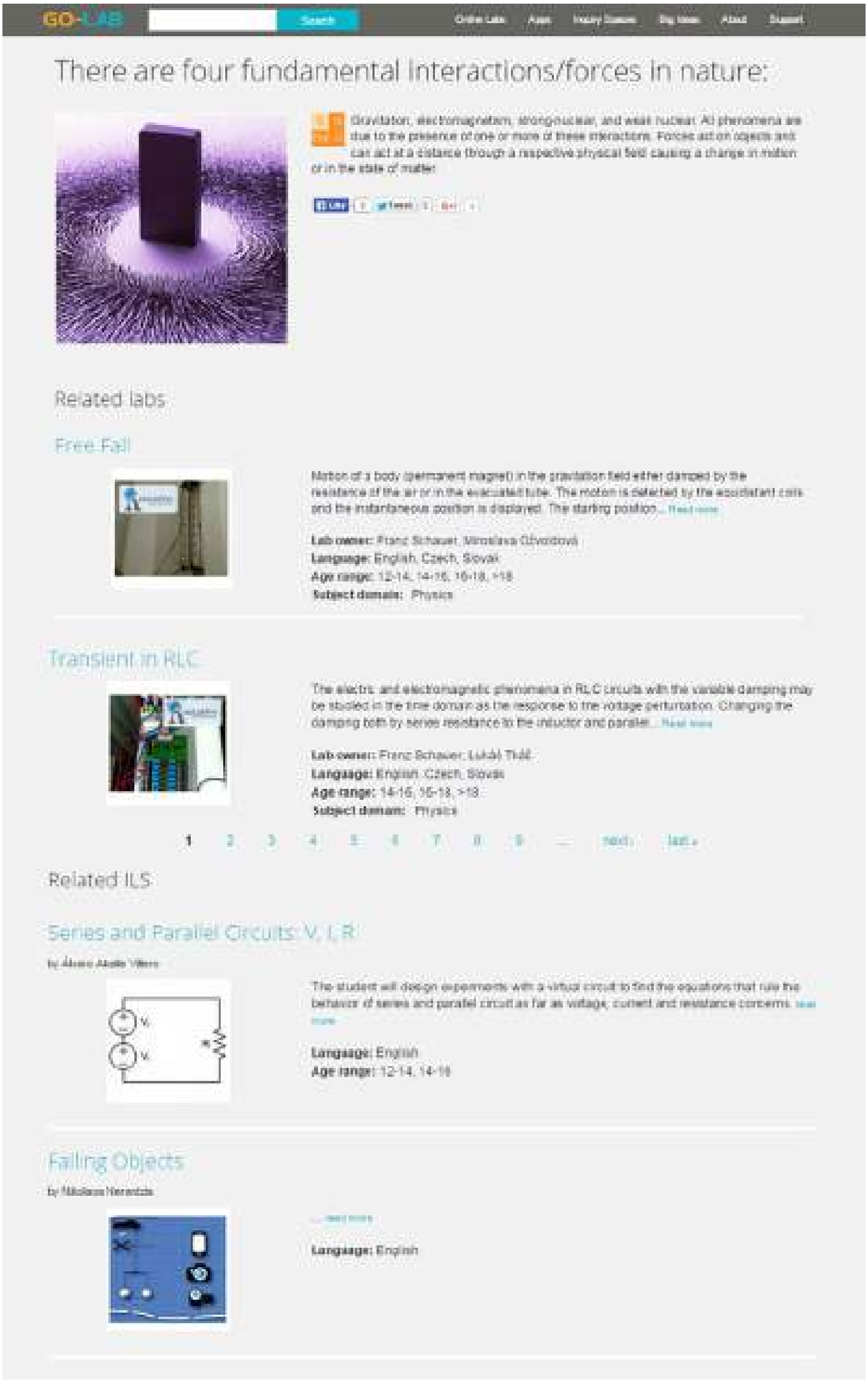
This activity aims to introduce to students the concept of varying galactic morphologies. Students will look in detail at images of...

Craters on Earth and Other Planets

In this exercise students use the Impact Calculator lab to investigate what happens when a comet it hits the Earth. Through the...

http://www.golabz.eu/app/hypothesis-tool

Figure 2.7. ILS uses the lab Craters on Earth and Other Planets (left) and the app Hypothesis Scratchpad (right).



There are four fundamental interactions/forces in nature:

Gravitation, electromagnetism, strong nuclear, and weak nuclear. All phenomena are due to the presence of one or more of these interactions. Forces act on objects and can act at a distance through a respective physical field causing a change in motion or in the state of matter.

Related labs

Free Fall

Motion of a body (permanent magnet) in the gravitation field either damped by the resistance of the air or in the evacuated tube. The motion is detected by the equidistant coils and the instantaneous position is displayed. The starting position... Read more

Lab owner: Franz Schauer, Miroslava Ožvoldová
Language: English, Czech, Slovak
Age range: 12-14, 14-16, 16-18, >18
Subject domain: Physics

Transient in RLC

The electric and electromagnetic phenomena in RLC circuits with the variable damping may be studied in the time domain as the response to the voltage perturbation. Changing the damping both by series resistance to the inductor and parallel... Read more

Lab owner: Franz Schauer, Lukáš Tkáč
Language: English, Czech, Slovak
Age range: 14-16, 16-18, >18
Subject domain: Physics

Related ILS

Series and Parallel Circuits: V, I, R

by Álvaro Akollo Villero

The student will design experiments with a virtual circuit to find the equations that rule the behavior of series and parallel circuit as far as voltage, current and resistance concerns. read more

Language: English
Age range: 12-14, 14-16

Falling Objects

by Nikolaos Nerantzis

... read more

Language: English

Figure 2.8. Big ideas to sort related labs and ILS (http://www.golabz.eu/big-ideas/there-are-four-fundamental-interactionsforces-nature).

Additionally, big ideas of science have been added to the Go-Lab Repository, as listed at http://www.golabz.eu/big-ideas. The big ideas are selected by WP2 (see the deliverable D2.1) combining theoretical research (Harlen 2010) and teachers' feedback. Each big idea has an icon and the description. The icon is used on each lab and ILS page as well, so that teachers know which big ideas this lab or ILS is devoted to. Through these Big Ideas, teachers can navigate in a different dimension through the labs and ILS as illustrated in Figure 2.8.

To summarize, The Go-Lab Repository offers various approaches to searching labs, apps & ILS as below:

- Keyword search in the search field on the top menu bar on each page
- Search labs, apps & ILS by sorting them from the *Sort by* list
- Search labs, apps & ILS by filtering with metadata
- Explore the big ideas page to see all related labs and ILS
- Search for ILS which uses certain labs and apps

Furthermore, the search features will be further improved according to users' feedback, which will be described in D5.7.

2.2.7 User management

With the *Graasp* user account, users are created in the Go-Lab Repository after they create or copy an Inquiry Space by clicking the buttons. This is supported by the OAuth2 service of the ILS Platform (cf. Chapter 3).

Table 2.1
Go-Lab user roles and access rights

Roles/ permissions	Target content	Create/ modify/ delete own content	Create/ modify all content	Delete all content	Evaluate content/ give badge
Anonymous (teacher/student)	All	no	no	no	no
Lab owner	Lab	yes	no	no	no
Super lab owner		yes	yes	no	yes
App creator	App	yes	no	no	no
Super app creator		yes	yes	no	yes
ILS publisher	ILS	yes	no	no	no
Super ILS publisher		yes	yes	no	yes
Video manager	Video	yes	yes	no	yes
Admin	All	yes	yes	yes	yes

In the repository, different user roles as depicted in the use case diagram (Figure 1.2) have been specified with different access rights. Table 2.1 shows the restricted access rights for the users with different roles. All can view the content and search for certain content in the repository, which is not listed additionally. They are configured in Drupal user management system and can be extended easily. This user role scheme is able to enable a large number of users to input their own content on the one hand. The recent data input status shows that teachers and lab owners have been well motivated to contribute to the Go-Lab Repository. On the other hand, it also enables the quality control by super roles of labs, apps, and ILS. They are the Go-Lab experts in WP1 and WP2 who know the quality of labs and ILS well and who may also be the app developers. They are able to correct the content added by teachers (the usual ILS publishers) and lab owners and they are granted the right to assign the badge Go-Lab approved to different resources.

An example of this user generated online labs with quality control is illustrated in Figure 2.9. The Go-lab experts have less input workload of publishing online labs or ILS, since many lab owners know their own labs well with the related metadata and are also willing to input the metadata by themselves. Meanwhile, the experts are able to check the quality and evaluate the labs with assigning some badges e.g. the *Go-Lab Approved* badge. Individual users also have the email address listed, so that Go-Lab experts could send an email to ILS publisher to give suggestions to improve their content easily. This has become a routine task for the Go-Lab consortium to content the ILS publishers.

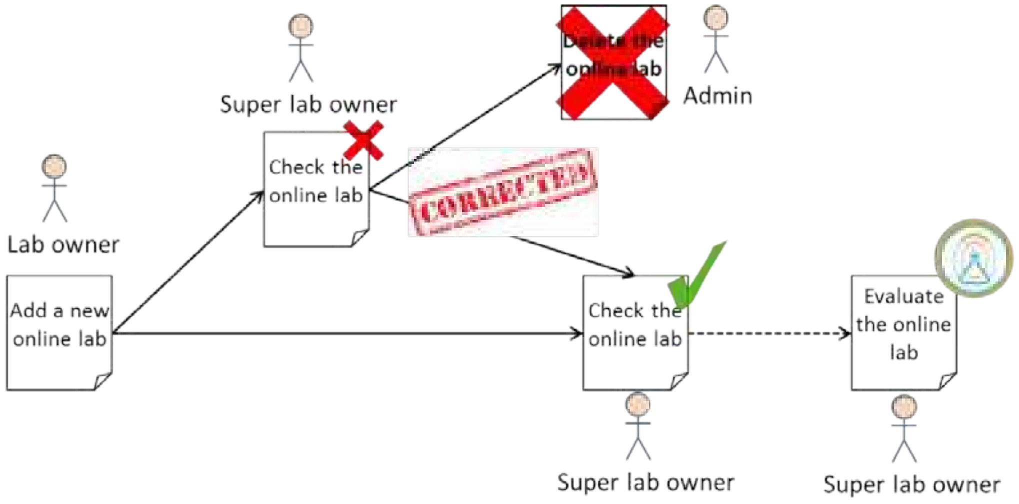


Figure 2.9. How is an online lab published in the repository.

The rapid increase both in the numbers of the registered lab owners and ILS publishers show the practical usefulness of the user management approaches in the repository. The increase of online labs and ILS numbers is even a better proof of the user model.

2.2.8 Social features

Disqus (https://disqus.com/) has been embedded to enable spam-free comments and rating on the detail pages on the Go-Lab Repository. The Lab, apps, ILS, and big ideas pages also integrate social media buttons for fast sharing of detail pages.

Based on feedback from the participatory design in WP3 and workshops organized by WP2, a form to input proposed lab is demanded by teachers. Teachers may have found an interesting lab on the Internet which has not been published in *Golabz*. They could propose this lab in the repository by clicking the button *Propose a lab* as depicted in Figure 2.10. Super lab owners will further progress this request and contact the lab owners to publish the lab after certain quality control measures.

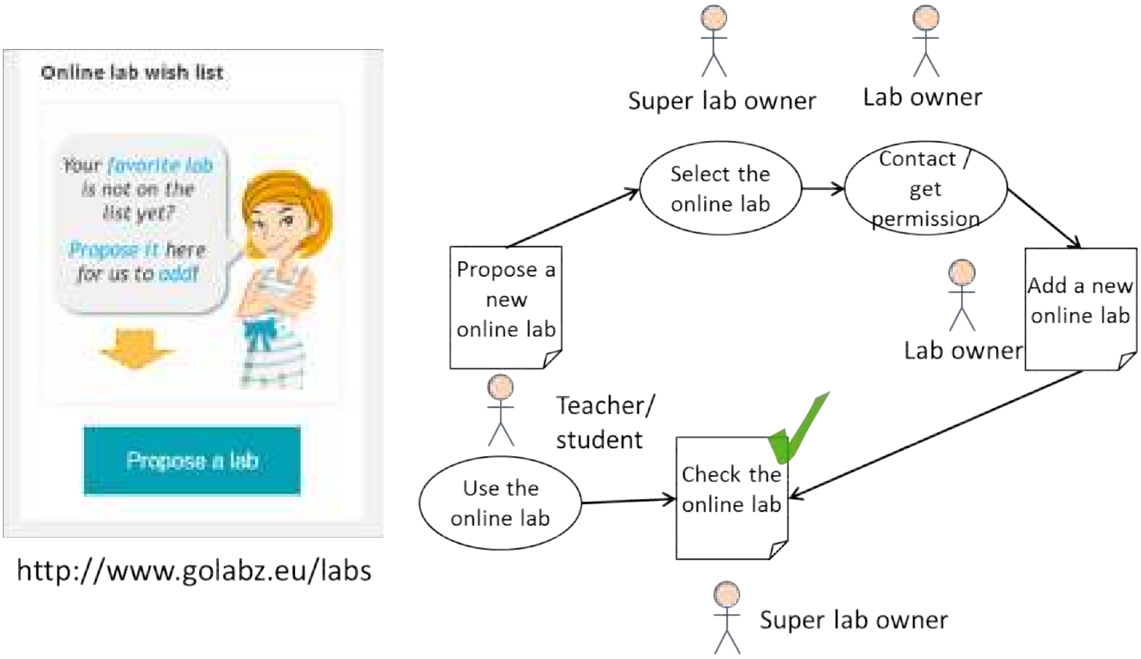


Figure 2.10. Anonymous users could propose a lab for the Go-Lab Repository.

Additionally, the Go-Lab Repository will become more social by adding the tutors of the Tutoring Platform (see D4.8) that are available for help sessions on the lab, app or ILS. A web service has been established to display online labs in the tutoring platform. If sufficient tutors select the labs in which they are specialized, this piece of information will be listed in the repository as well. More details will be described in D5.7.

In the final release, the user community support page has been designed and implemented, which will be described as two new requirements *Getting support* and *Managing videos* at the end of this section.

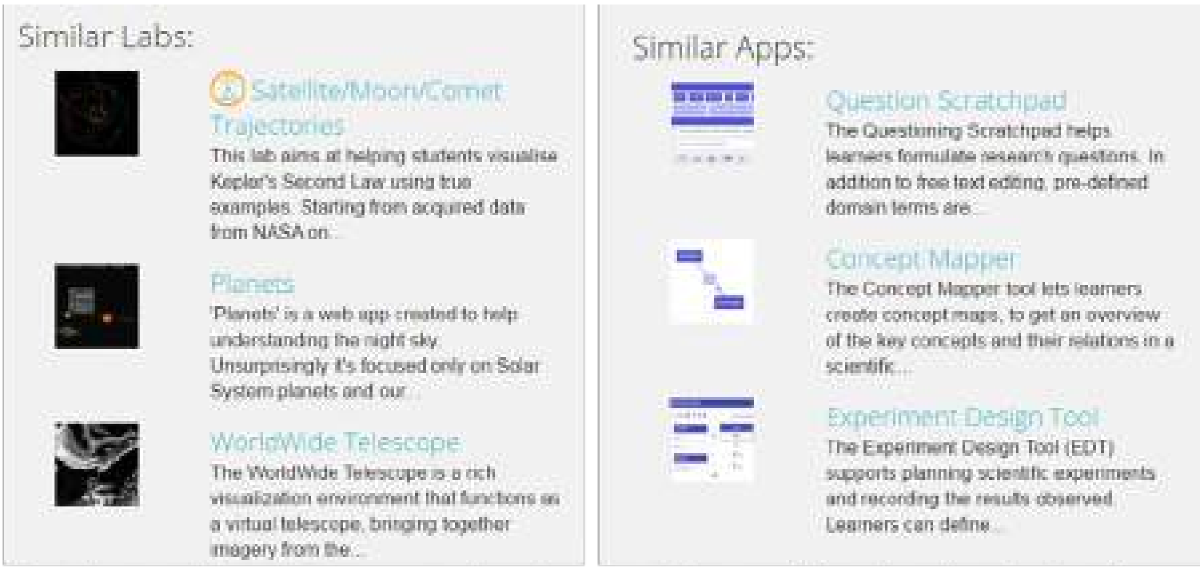
2.2.9 Tracking user activities

The most tracking user activities take place in the ILS Platform. Tracking the Go-Lab Repository is also enhanced with Piwik, Google Analytics, and Drupal web statistics module to get metrics on visits by teachers and lab owners in order to assess the dissemination of the project and to highlight the most frequently accessed or exploited resources. In detail, two events are specified in Google Analytics to track the clicks of the buttons *Create an Inquiry Space* and *Copy this Inquiry Space* on lab and ILS page respectively.

In addition, the Go-Lab Portal also integrates the results from the final releases of the Learning Analytics, scaffolding services. Their research work in Work Package 4 has launched an app only for lab owners and app creators. The user access data of individual labs and apps are visualised. More detail is found in the deliverable D4.8.

2.2.10 Recommendation

A simple recommender system to recommend related resources has been implemented on the Lab Repository. For instance, for a lab the related labs could be shown as depicted in Figure 2.11. This recommender system has been implemented as a standalone service so that other platforms or apps can make use of it, e.g. the ILS Platform or a recommender widget.



Similar Labs:

Satellite/Moon/Comet Trajectories

This lab aims at helping students visualise Kepler's Second Law using true examples. Starting from acquired data from NASA on...

Planets

'Planets' is a web app created to help understanding the night sky. Unsurprisingly it's focused only on Solar System planets and our...

WorldWide Telescope

The WorldWide Telescope is a rich visualization environment that functions as a virtual telescope, bringing together imagery from the...

Similar Apps:

Question Scratchpad

The Questioning Scratchpad helps learners formulate research questions. In addition to free text editing, pre-defined domain terms are...

Concept Mapper

The Concept Mapper tool lets learners create concept maps, to get an overview of the key concepts and their relations in a scientific...

Experiment Design Tool

The Experiment Design Tool (EDT) supports planning scientific experiments and recording the results observed. Learners can define...

http://www.golabz.eu/lab/craters-earth-and-other-planets

http://www.golabz.eu/app/hypothesis-tool

Figure 2.11. The recommended labs for Craters on Earth and Other Planets (left) and the recommended apps for Hypothesis Scratchpad (right).

The recommender system uses ElasticSearch (Gormley & Tong, 2015), a distributed search index. This technology allows us to conduct advanced text analysis and text-based search on the metadata available in the Lab Repository. Apart from the metadata, we also employ the anonymous interaction data collected by Piwik, e.g. page views. Using a separate search index from the database of the Go-Lab Repository means that this index needs to be synchronised when data is added or edited on the Go-Lab Repository. This synchronisation is handled by a Drupal module. More details about this recommender system can be found in D4.8.

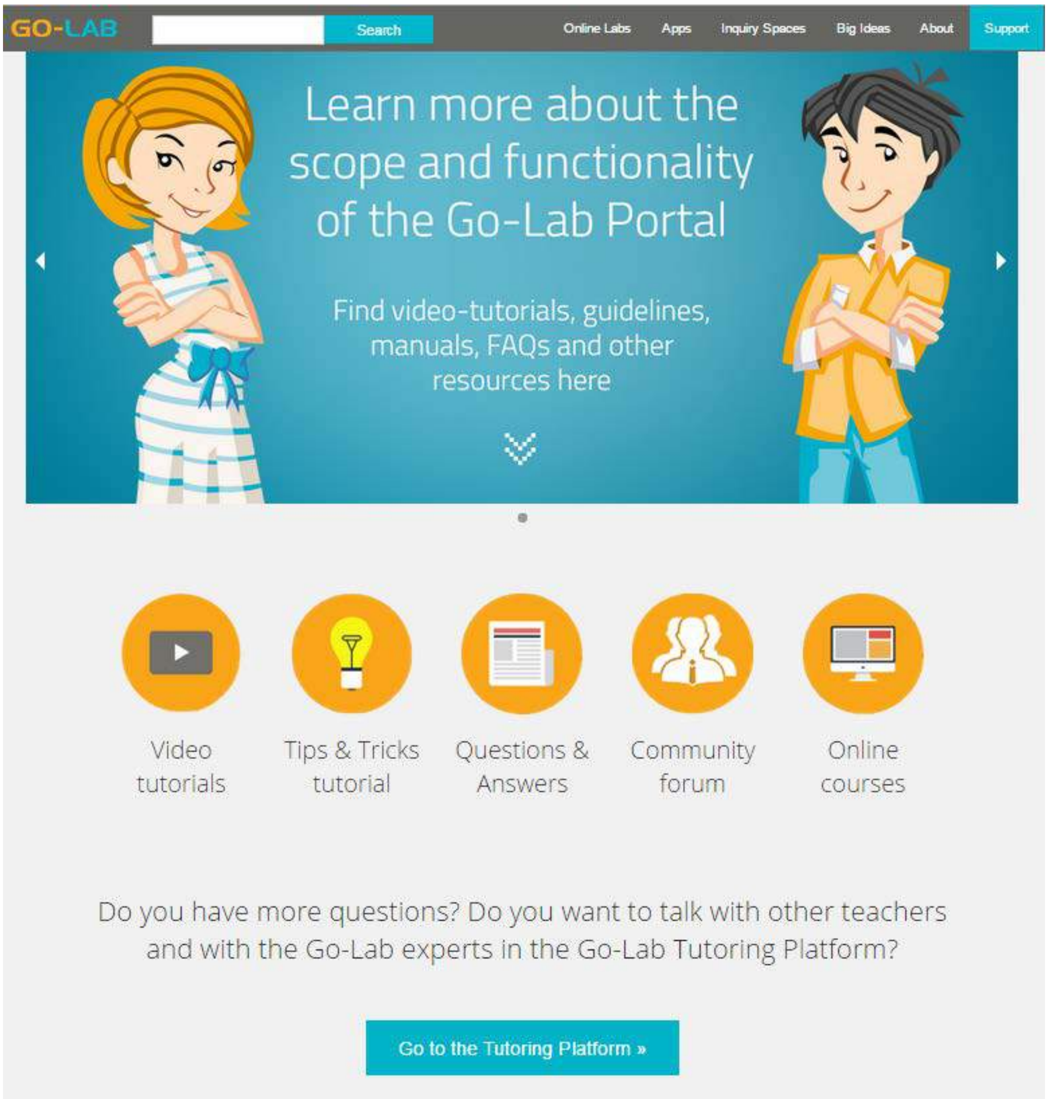
2.2.11 Getting support

As an extension to the requirements social features, this new feature aims to support and build user communities. This requirement is specified after plenty of feedback coming from the Go-Lab community cluster, esp. from WP3, WP6, and WP7. Although the usability of the Portal is mostly rated as easy-to-use and the community cluster has offered much online or offline community support to users, teachers still wish to get support directly from the portal, such as Question and Answer or forum.

To that end, a support landing page is realised in the repository offering links to various community building approaches (Figure 2.12). After several discussions with the community cluster and feedback from teachers, five types of support have been offered:

- Video tutorials are videos of different length and how-to topics about the portal;
- Tips & tricks tutorial are manuals hosted on the project website (contributed by WP1);
- Questions & answers lists frequently asked questions hosted on the project website;
- Community forum links to the forum in the tutoring platform (supported by WP6);
- Online courses links to Go-Lab MOOCs (see WP9).

They could be further extended on demand. Besides this framework, the support content is essential. All Go-Lab partners especially the technical cluster team and WP1 have been preparing videos and manuals. The tutoring platform as the main community building platform is also promoted with a big button. Teachers are encouraged to access the support content and further to go to the tutoring platform to share their experiences together with other teachers and the tutors. The tutoring platform is described in D4.8.



Learn more about the scope and functionality of the Go-Lab Portal

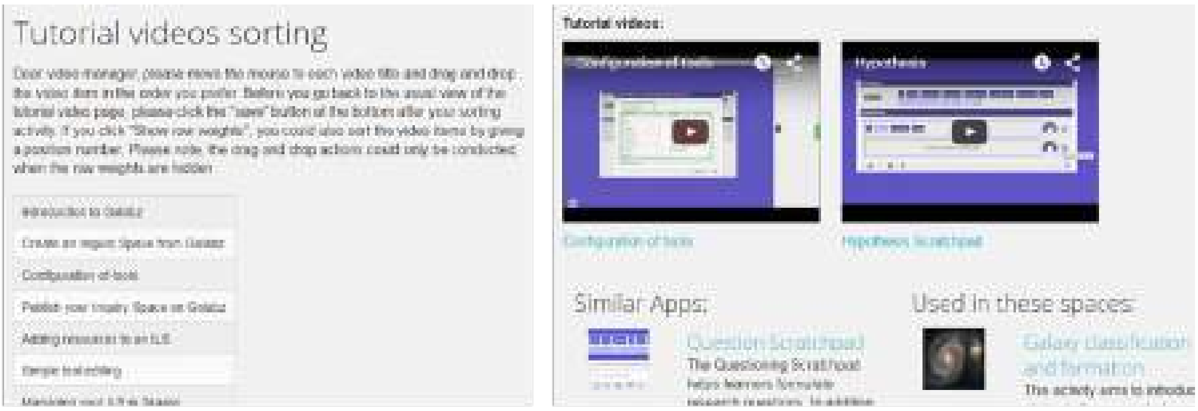
Find video-tutorials, guidelines, manuals, FAQs and other resources here

Do you have more questions? Do you want to talk with other teachers and with the Go-Lab experts in the Go-Lab Tutoring Platform?

Figure 2.12. The landing page of users support for community building.

2.2.12 Managing tutorials

Since the support content is more essential. Additional user roles need be specified to manage the content. Because the video tutorials have been hosted in the repository and a content type of tutorial has been integrated, the role Video manager has been created. Only users with the video manager role can add videos, edit the metadata such as which lab/app/ILS is related, and sort the videos in the certain sequence. The repository enables drag & drop actions for the video managers to sort the videos easily (Figure 2.13 left). With the related lab/app/ILS metadata, the videos have been listed on the single lab/app/ILS page, so that users can find the tutorial videos beside the resources they are using easily. Figure 2.13 (right) shows that two related tutorial videos are connected on the Hypothesis Scratchpad app page.



Tutorial videos sorting

Dear video manager, please move the mouse to each video title and drag and drop the video item in the order you prefer. Before you go back to the usual view of the tutorial video page, please click the "save" button at the bottom after your sorting activity. If you click "Show row weights", you could also sort the video items by giving a position number. Please note, the drag and drop actions could only be conducted when the row weights are hidden.

- Introduction to Golabz
- Create an Inquiry Space from Golabz
- Configuration of tools
- Publish your Inquiry Space on Golabz
- Adding resources to an ILS
- Simple text editing
- [illegible]

http://www.golabz.eu/videos/sort

Tutorial videos:

Configuration of tools

Hypothesis Scratchpad

Similar Apps:

Question Scratchpad

The Questioning Scratchpad helps learners formulate research questions. In addition

Used in these spaces:

Galaxy classification and formation

This activity aims to introduc

http://www.golabz.eu/app/hypothesis-tool

Figure 2.13. The video sorting page (left) and listing related videos on the app page (right).

2.3 Non-functional requirements and the release

Apart from the aforementioned functional requirements and their implementation, non-functional requirements have been covered in the final release as well. They are finalized based on the specification (D5.2) and the initial release (D5.4) and are reflected by implementation of the functional features. For the sake of consistency, we focus on the non-functional requirements with the release of the Go-Lab Repository in this chapter, while the ILS Platform will be described separately in Chapter 3.

2.3.1 Interoperability

In D5.2, three levels of interoperability are specified: lab interoperability, metadata interoperability, and interface interoperability. The latter has been further specified as ubiquitous access in D5.4. For Lab and metadata interoperability, online labs from diverse lab owners can be easily integrated through the App Composer and the consistent lab input interface in the repository. Till now, online labs from external lab owners like PhET Interactive Simulations, East Tennessee State University, CREATE lab (at NYU), and RemLabNet etc. have been listed in the repository. The interoperability is reflected not only by the simple displaying, but integration in the Smart Gateway (WP4), use of the App Composer, and usage/integration in teachers' generated inquiry spaces.

Metadata interoperability is realised between metadata for online labs and for ILS. As mentioned in the Publishing ILS section before, ILS takes the metadata of online labs as the first step. Moreover, the metadata interoperability also supports easy display of ILS resources for external partners. For example, ViSHub has created a Go-Lab category to list Go-Lab ILS at http://vishub.org/categories/214.

2.3.2 Ubiquitous access

In order to be used in a wide range of settings and without the need to install additional software, the Go-Lab technology is based on web standards, such as HTML and Javascript.

Therefore the technology can be accessed from any modern browser. The Go-Lab Repository employs the responsive design of the Zurb Foundation framework. Hence, it is adapted to the screen size of the Web browsers and fits both usual Web browsers and smartphones.

2.3.3 Usability

The usability of the Go-Lab Portal including the repository is monitored in the participatory design activities with WP3 and the large scale pilots conducted by WP7. The feedback are considered to improve the portal. For better clarity, terms displayed on the Go-Lab Repository have been often improved based on user feedback. Many functional features are implemented with a starting point of improved usability. For example, the feature of new demo/edit workflow in Using ILS section comes from the usability consideration.

2.3.4 Scalability

Aiming at 1000 schools in Go-Lab, performance of the repository could be influenced by the continuous growth of the content amount and user numbers. Network status could also influence the scalability. Some approaches focus on the improving scalability of the repository. Drupal system log files are used to monitor the usage and performance of the repository. The request time is to deal with large data exchange between the repository and the ILS Platform. The recommender uses ElasticSearch server instead of the Drupal embedded server to fit the scalability.

2.3.5 Internationalisation

In the repository (as of September 15, 2015), 161 labs have the versions in 34 languages in total according to lab metadata. Among them, 159 labs have the English version and English is the dominating language. In the other two labs which don’t have the English version: one is in Greek[3], and the other is in Spanish[4]. Almost all metadata of the labs are given in English, except the Greek one with Greek title and lab description. Considering the sustainability of the repository, it would be hard to maintain if all labs with their metadata are required to be translated into different languages. Subject domains alone have over 600 terms in English.

On the contrary, ILSs often have metadata in their specific language. Among all the 159 ILSs, English is still the most-in-use language with 71 ILSs, followed by 28 Portuguese and 17 Greek ILS. The rest of the ILSs are disseminated in 10 other languages including Spanish, Estonian, and Dutch. Through the language selection list on the sidebar, users can find all ILSs in a certain language easily.

Hence, from the technical aspect, it is feasible to switch the labels to different languages. From the content maintenance aspect, it is hard to keep all content being translated accordingly, since the repository has over 350 individual lab/app/ILS pages and the number is growing rapidly. Since it is impossible to translate the content including teacher generated ILSs and lab owner generated labs, all content is better to be kept as one with the useful language filter. It is not helpful and the repository will not look professional if only labels are translated in different European languages. This issue will be further investigated for the deliverable D5.7 (Releases of a sustainable version of the Go-Lab Portal and the associated end-user solutions).

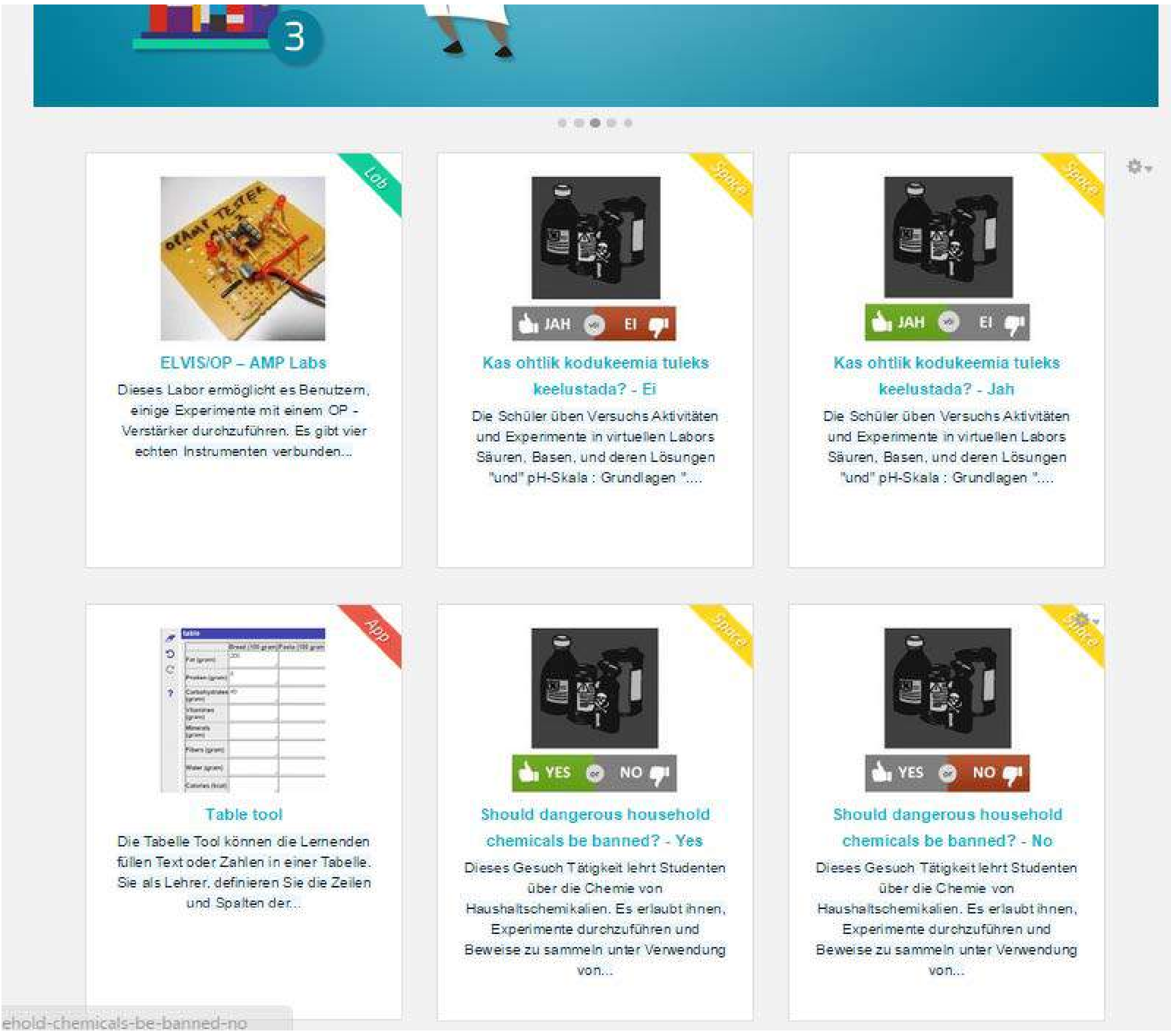
Although translation of the Go-Lab Portal is at this point not planned due to the aforementioned issues, we have found a free third-party service for the Chrome Web browser, called Language Immersion[5]. Users need to download and install the add-on service into their Chrome browser and can select the target language. Accordingly, the Web site is translated. Figure 2.15 shows *Golabz* in German. Although some parts are not translated as wished, e.g. the title of labs/ILS, it is helpful for teachers who are not good in English and want to read the content in their mother tongue. From the sustainability aspect,

[3] The lab in Greek: http://www.golabz.eu/lab/%CF%83%CE%B5%CE%B9%CF%83%CE%BC%CE%BF%CE%AF-%CF%83%CF%84%CE%B7%CE%BD-%CE%B5%CE%BB%CE%BB%CE%AC%CE%B4%CE%B1

[4] The lab in Spanish: http://www.golabz.eu/lab/friction-lab

[5] http://www.useallfive.com/work/language-immersion/

this requires low content maintenance workload for the Go-Lab consortium. Further test will be reported in D5.7.



ELVIS/OP – AMP Labs

Dieses Labor ermöglicht es Benutzern, einige Experimente mit einem OP - Verstärker durchzuführen. Es gibt vier echten Instrumenten verbunden...

Kas ohtlik kodukeemia tuleks keelustada? - Ei

Die Schüler üben Versuchs Aktivitäten und Experimente in virtuellen Labors Säuren, Basen, und deren Lösungen "und" pH-Skala : Grundlagen "....

Kas ohtlik kodukeemia tuleks keelustada? - Jah

Die Schüler üben Versuchs Aktivitäten und Experimente in virtuellen Labors Säuren, Basen, und deren Lösungen "und" pH-Skala : Grundlagen "....

Table tool

Die Tabelle Tool können die Lernenden füllen Text oder Zahlen in einer Tabelle. Sie als Lehrer, definieren Sie die Zeilen und Spalten der...

Should dangerous household chemicals be banned? - Yes

Dieses Gesuch Tätigkeit lehrt Studenten über die Chemie von Haushaltschemikalien. Es erlaubt ihnen, Experimente durchzuführen und Beweise zu sammeln unter Verwendung von...

Should dangerous household chemicals be banned? - No

Dieses Gesuch Tätigkeit lehrt Studenten über die Chemie von Haushaltschemikalien. Es erlaubt ihnen, Experimente durchzuführen und Beweise zu sammeln unter Verwendung von...

Figure 2.14. The homepage is partly translated in German.

2.3.6 Personalisation

Personalisation has been mainly reported in D5.5, which is handled in the ILS Platform. Few personalisation issues are related to the repository, because the main purpose of the repository is to offer users access to all labs, apps, and ILS. Usage of the resources takes place in the ILS Platform. In the repository, each copy of an inquiry space offers the teacher a personal space in the ILS Platform. This action could also be applied for a tutorial in the repository. Each user could use the pre-created Go-Lab tutorial to create one's own tutorial in the ILS Platform. Although this Go-Lab tutorial consists of the most important video tutorials and other manuals, each user may still like to add some resources based on their own experiences. Hence, each user could have a personalised tutorial easily just by a few clicks, as illustrated in Figure 2.15. Another click button could be used, since the tutorial is not an inquiry space. But the idea also shows the scalability of the Go-Lab Portal: all learning resources can be efficiently organised in a systematic way at teachers' disposal.

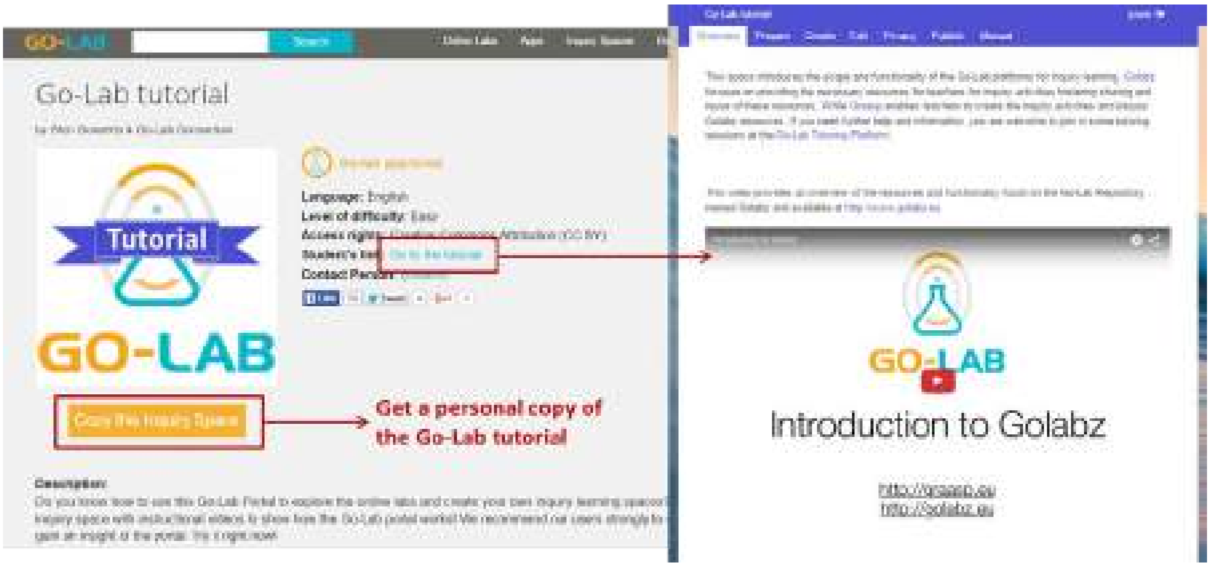


Figure 2.15. A special space Go-Lab tutorial for users' personalisation.

2.4 Release development management

In order to manage the development efficiently and collaboratively, we apply the Scrum project management process. All implementation tasks of the *Golabz* platform is registered first in the "Backlog" in Trello, a free web-based project management application. We have set up a Trello board for the Go-Lab Repository at the following address: https://trello.com/b/mUcTx8Fs/go-lab-repository. Then we set priority for different tasks in Backlog and move them to the column "Next", further in "In Progress". After the implementation is done, the task is moved to "Approved & Feedback" to collect user evaluation results. Finally, they are released in the production server at different time period. Figure 2.16 shows two release dates: End of July 2015 and End of Oct. 2015. The old ones have be archived for a better overview.

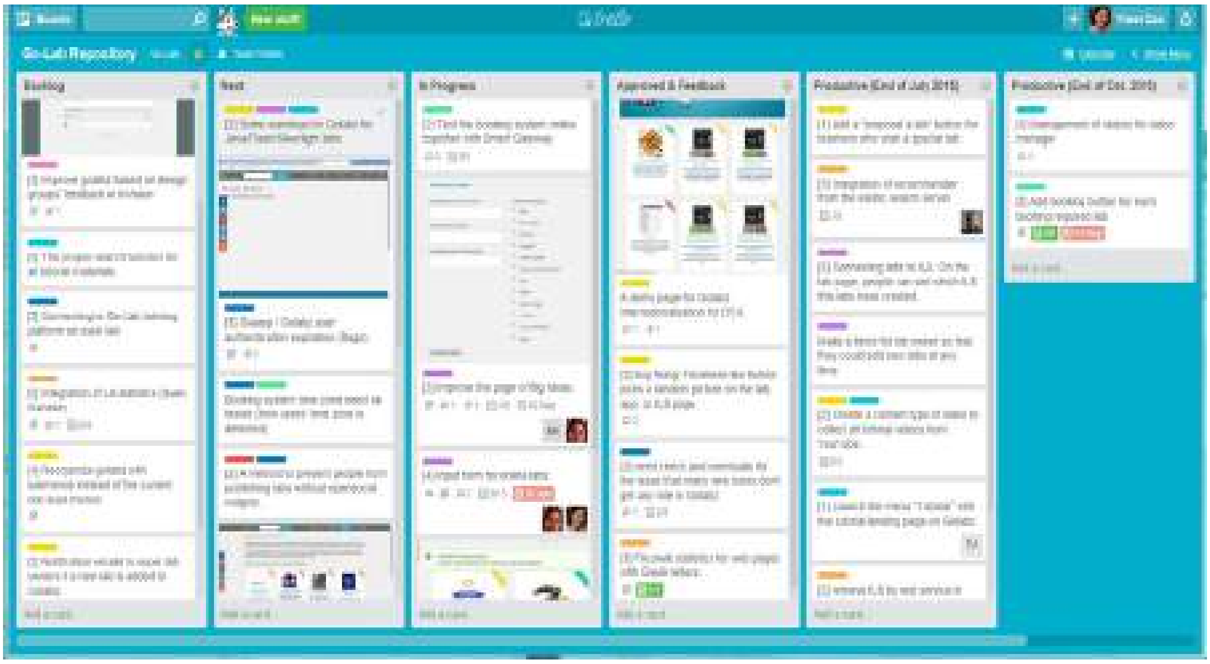


Figure 2.16. The Go-Lab Repository Trello board for development management.

We have also kept a release plan for The Go-Lab Repository in Google Docs for documentation. We mostly use the Trello board. The benefits of using Trello are multifold. First of all, it offers a transparent view for all partners who are involved in requirement specifications. Second, other partners could see the progress of the development and give feedback. Third, it fits the iterative design paradigm of the Go-Lab Project well. Old task cards could still be iteratively registered in the backlog.

3 The ILS Platform

The ILS Platform is accessible at http://graasp.eu. We also call it *Graasp* for its briefness. As we can see in Figure 3.1, if we compare the 2293 users already registered by September 1st, 2014 and the values by the end of August 2015 (4754 accounts), we can observe a clear increase in the number of users. Among these 2412 new accounts, 76% joined the platform by registering their emails, 15% used their Google account and the remaining 9% the Facebook account.

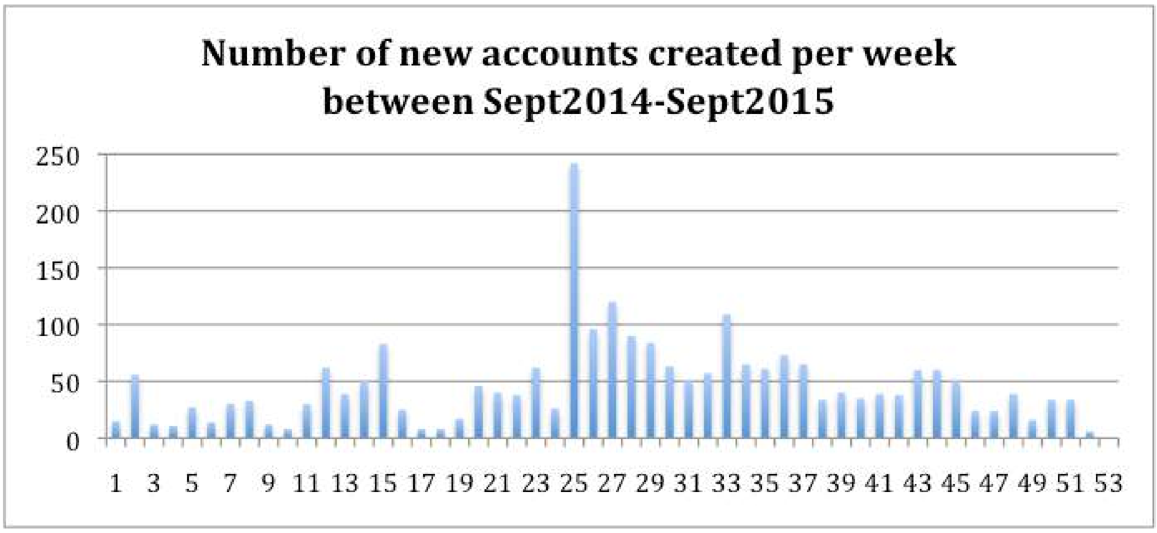


Figure 3.1. Evolution of accounts created Sep. 2014 - Aug. 2015 (as of Aug. 29, 2015).

By September 1st 2014 the number of ILS in the platform was 919, while the number reached by August 29th 2015 was 4371. Thus, 3452 ILSs have been created during this year and 2459 belong to new *Graasp* users. Figure 3.2 shows the number of ILS created by such users per week.

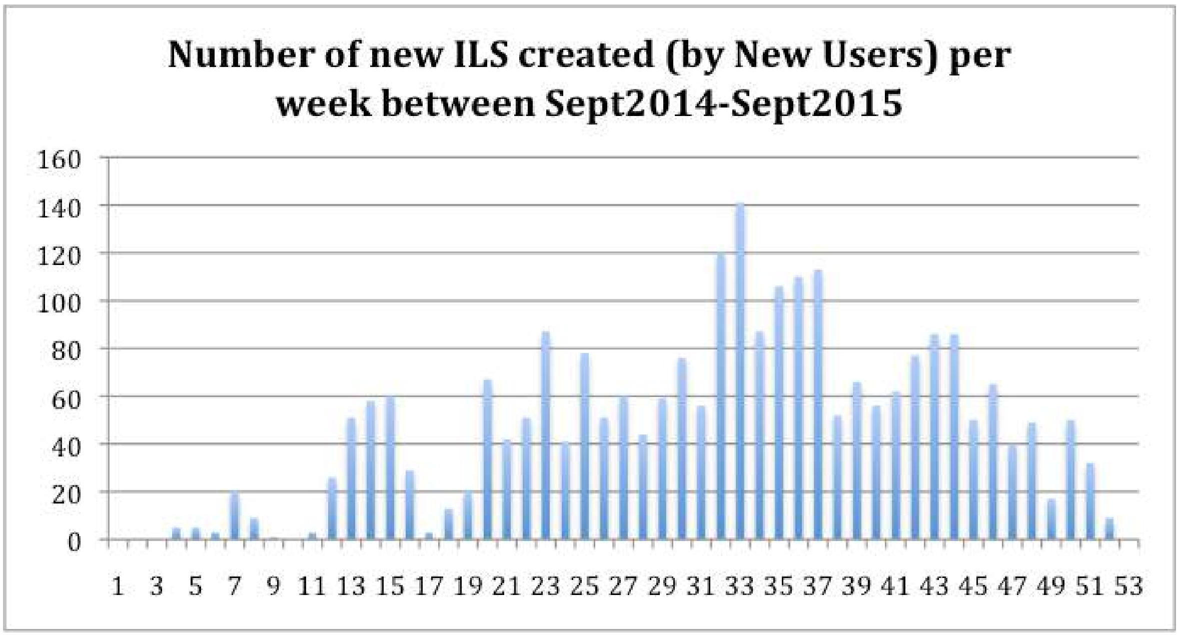


Figure 3.2. Evolution of ILS created Sep. 2014 - Aug. 2015 (as of Aug. 29, 2015).

Table 3.1 shows the proportion of ILSs per language created by all *Graasp* Users. It is noteworthy that ILSs are created in English by default and then the teachers can change it to the desired language. However, the users often provide the ILS description and content in the corresponding language but they do not modify the ILS language configuration.

Table 3.1
Total number of ILSs available in the platform classified by the language settings

Language	Number of ILSs	%
en	2045	83.16%
es	82	3.33%
fr	66	2.68%
it	56	2.28%
pt	56	2.28%
el	30	1.22%
de	25	1.02%
ru	21	0.85%
et	15	0.61%
nl	14	0.57%
ca	13	0.53%
fi	10	0.41%
eu	9	0.37%
tr	6	0.24%
ro	2	0.08%
pl	3	0.12%
sv	2	0.08%
hu	1	0.04%
bg	1	0.04%
sr	1	0.04%
uk	1	0.04%
cs	0	0.00%
no	0	0.00%

3.1 New features and changes since the initial release

For a better overview, we list all the new features and changes since the initial release of the ILS Platform (*Graasp*) in this section. They are ordered according to the requirements in line with D5.4 which are also depicted as use cases in Figure 1.2. More detailed information is given in Section 3.2.

The detailed elicitation process for these new or improved features is detailed in D3.3. One should however underline that the Technical Cluster, WP3 and WP1 had regular meeting to compile the list of features to be added, to discuss their technical feasibility, to assess the resources available for implementation, to discuss their design through mockups or prototypes, and to prioritize them. The list below is the result of this continuous collaboration process.

Creating ILS

- Templates for scenario use when creating an ILS.

Modifying ILS

- Hidden/unhidden feature for any item (a hidden item is not shown in the standalone view).
- Now it is possible to drag-and-drop an archive containing Javascript code with the associated file hierarchy and to execute it directly in a space.

Publishing ILS

- The publishing of ILS in Golabz has been improved.

Using ILS

- Three standalone modes (anonymous, nickname, nickname and password).
- An ILS can be copied in another space.
- An ILS can be moved into another space.
- Now, ILS can be set as private without blocking the display of the standalone view.
- The personal spaces are now displayed in three tabs.
- A new popup menu has been added in the title bar of the spaces to allow contextual actions.

Supporting apps

- Providing means to store students resources into the Vault.
- Storing app configurations in the app’s metadata.
- Forwarding action log information to the Learning Analytics framework.
- Giving access to more information within the apps.

User management

- Standalone users (students) have been implemented and are shown in the Graasp member list. These users are attached to a given ILS and are created when students log in the standalone view.
- Now, the users are listed by role in the member list.

Social features

- The comments in *Graasp* allow @ mentions.

Tracking user activity

- Templates for scenario use when creating an ILS.

3.2 Functional requirements and the release

3.2.1 Creating ILS

An ILS can be created by users with a Graasp account.

The ILS Platform now supports the creation of differentiated ILS depending on the chosen learning scenario (e.g. Jigsaw, Find the mistake, Six changing hats, etc). When pressing create ILS, users can select the appropriate scenario from a drop down list and a new template ILS will be generated. The drop down menu is populated by any ILS created in a special Scenario space (illustrated below). When a user selects a scenario the system simply makes a copy of the ILS.

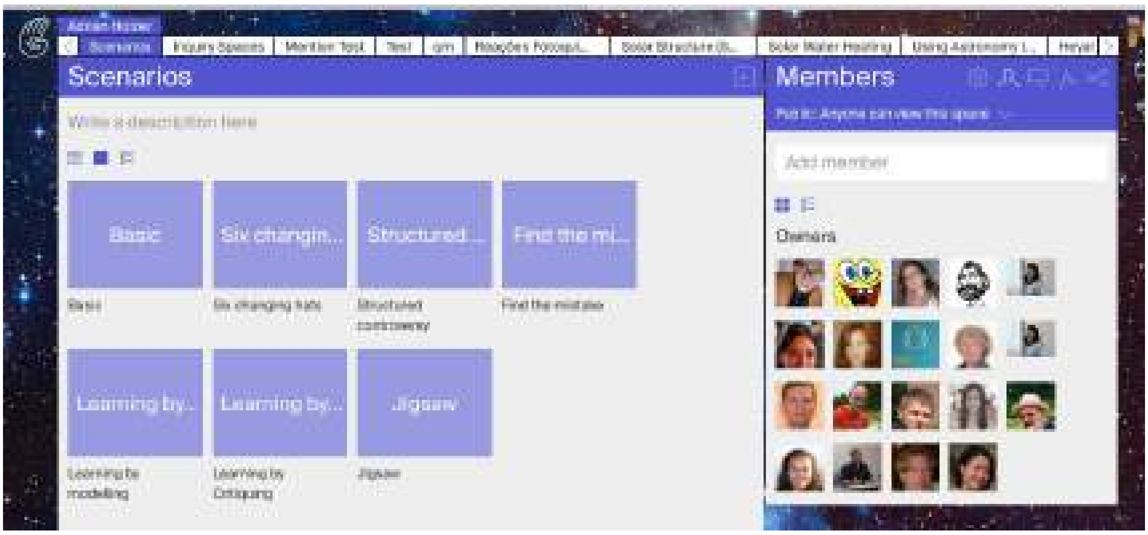
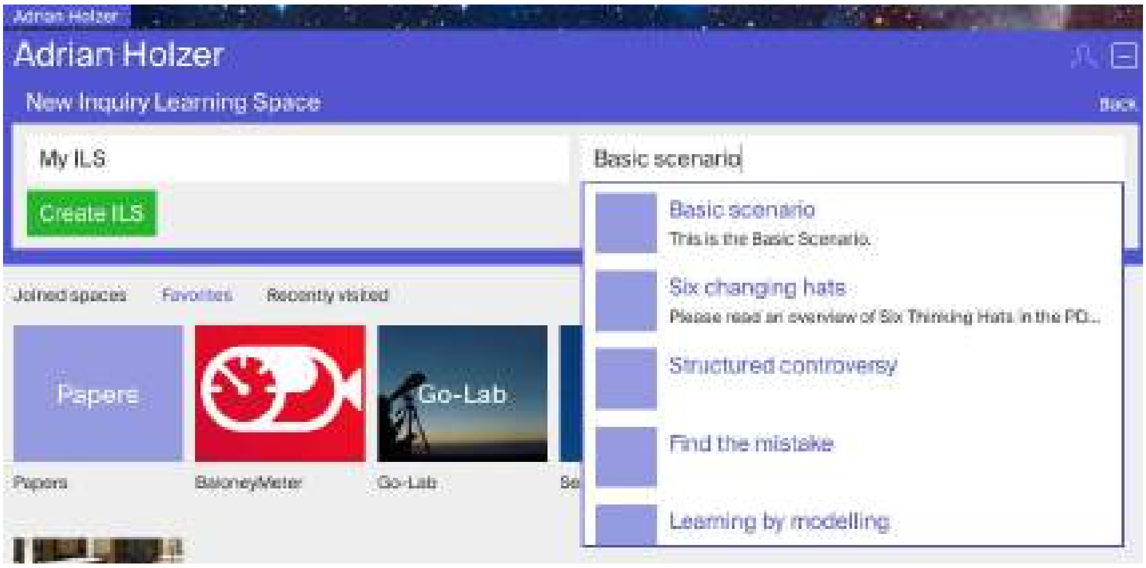


Figure 3.3. Templates available for the creation of ILS.



My ILS

Basic scenario

Basic scenario
This is the Basic Scenario.

Six changing hats
Please read an overview of Six Thinking Hats in the PD...

Structured controversy

Find the mistake

Learning by modelling

Figure 3.4. Menu provided for the creation of ILSs based on existing templates.

3.2.2 Modifying ILS

In Graasp, an ILS can be modified and personalized by the teacher.

Most personalisation features have been described in D5.5 and thus are not repeated here. The main new feature in this deliverable is support for teacher notes through invisible items. Indeed items in an ILS can be set to invisible and thus will not be shown in the standalone view. This allows teachers to add notes and answer sheets directly in the ILS. This feature also allows them to show certain parts of the ILS and not others.

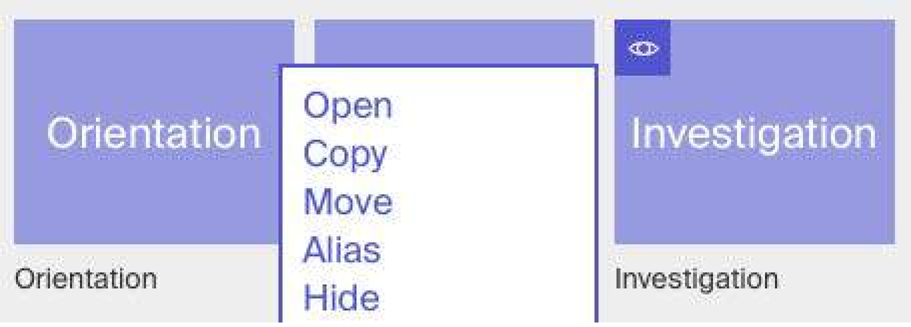


Figure 3.5. Configuration of the item visibility (hidden/visible). Here the Investigation phase is hidden.

Aggregation of external resources. Furthermore, it is now possible to drag-and-drop the content of an archive containing Javascript code (as example) with the associated file hierarchy and to execute it directly in a space (this enables the integration of EasyJavascript Simulations as described in Chapter 4). From a technical point of view, this has been enabled by adding support for relative file paths in *Graasp*. The hide/unhide feature enables to hide the relative folders (sub-spaces) and files which should not be displayed in the standalone view.

3.2.3 Publishing ILS

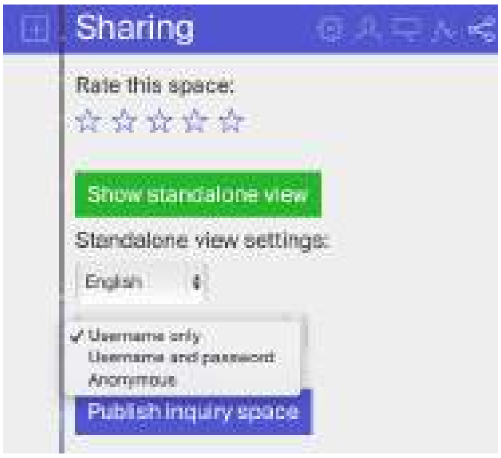
ILS creators (mainly teachers and lab owners) can publicly publish their finished ILS on the Lab Repository to foster reuse.

Since D5.4, the publish feature was finalized and when an ILS is published it is now copied and stored in the profile of the *Golabz Master* user. The Golabz Master user provides a simple way to store ILSs in their original format and allows the administrators of the account to possibly remove undesirable content.

3.2.4 Using ILS

Three login schemes are offered for the standalone view

There are now three modes for using ILS with students, an anonymous mode, a nickname mode and a password mode. The nickname mode was presented in D5.4 and allows students to enter an ILS by simply providing a nickname. Following discussions with teachers, we also included a password mode which prevents fellow classmates to peek in each other's work and requires a password as well as a nickname to sign in. Note that at this stage passwords cannot be retrieved as this would imply students to enter email addresses as well as nickname upon sign up. We will evaluate the need for this feature in upcoming pilots. Finally, in the anonymous mode students enter an ILS like they would any web page, without any need for credentials. Note that this mode limits the possibility for students to save information.



Rate this space:

☆ ☆ ☆ ☆ ☆

Standalone view settings:

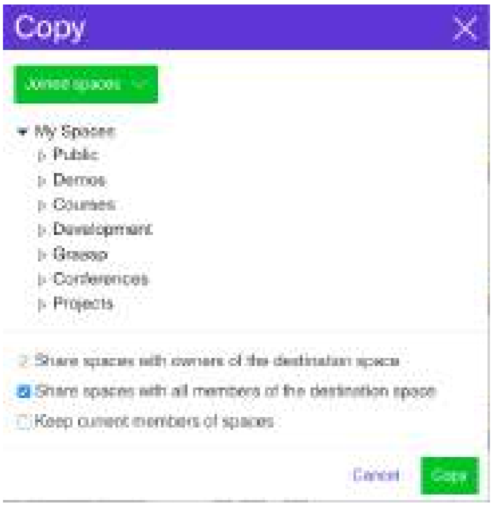
English

✓ Username only
Username and password
Anonymous

Figure 3.7. ILS sharing modes (username, username and password, or anonymous).

It is now possible to copy ILSs.

This feature is used to consolidate the import and export of ILSs with the Go-Lab Repository (see 3.2.3), to enable the archiving of an ILS and its content (especially the vault) when a class is completed, or to start with a fresh copy when using the same ILS with another class. As best practice, Go-Lab encourages teachers to do so in order to ease the supervision of the student activities and the evaluation of the learning outcomes. Destination and members can be selected when copying as shown in Figure 3.8.



- My Spaces
  - Public
  - Demos
  - Courses
  - Development
  - Graasp
  - Conferences
  - Projects

☐ Share spaces with owners of the destination space
☑ Share spaces with all members of the destination space
☐ Keep current members of spaces

Figure 3.8. Dialog displayed when copying an ILS.

An ILS can be moved into another space.

This enables teachers to better organize their resources. Moving ILS located at the top level will be enabled in the sustainable version at M48.

An ILS can be set to private.

Now, ILS can be set to private without blocking the display of the standalone view. This complete the privacy protection scheme designed for Go-Lab. From a technical point of view, this has been enabled by using the new space visibility feature (instead of privacy) to define what is displayed or not in the standalone view.

Personal spaces are more easily accessible.

The personal spaces are now displayed in three tabs instead of a popup menu in the user profiles to provide a better overview of the available categories. The tabs are “Joined spaces”, “Favorites”, and “Recently visited”, as shown in Fig. 3-9.

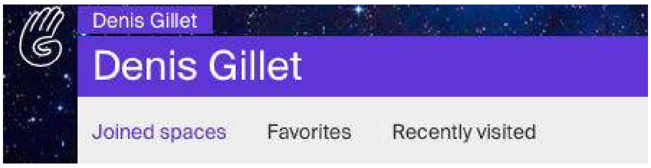


Figure 3.9. User profile tabs for personal spaces.

Contextual actions are enabled.

A new popup menu (Fig. 3.10) as been added in the title bar of the spaces to allow contextual actions. This enables the selection and the execution of contextual actions without requiring users to move one level up in the hierarchy (where in some cases users have no access).

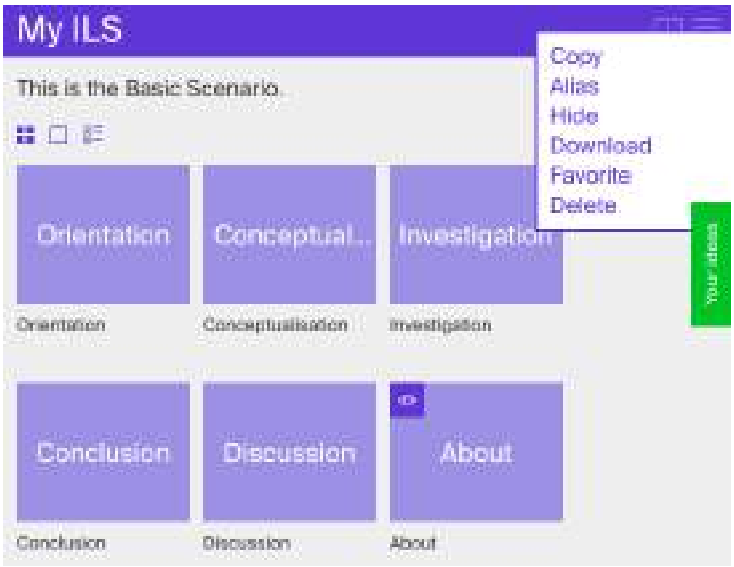


Figure 3.10. Contextual popup menu (top right corner).

3.2.5 Supporting apps

The interplay between embedded apps and the ILS have been improved.

The latest information about how apps are supported in the ILS Platform is described in D5.5, Section 3. In particular, the ILS Platform is supporting apps by

- Providing means to store students resources into the Vault.
- Storing app configurations in the app’s metadata, so that apps can be copied without losing their specific configurations.
- Providing features for forwarding action log information to the Learning Analytics framework.
- Giving access to information about the user, the ILS structure and the app context, which is then used as metadata information within the apps.

These features are accessible to the apps through the ILS library, which is described in more detail in D5.5.

3.2.6 User management

A major new feature is the addition of Standalone Users. So far, teachers did not know who accessed a particular standalone view. Now users who log in the standalone view (either with password or with nickname alone) get displayed in *Graasp* in the Members tab, as shown below. Furthermore, teachers can click on the name of users, unless it is password protected, and see the standalone view of the respective user. This feature allows teachers to see the learning outcomes of students directly.

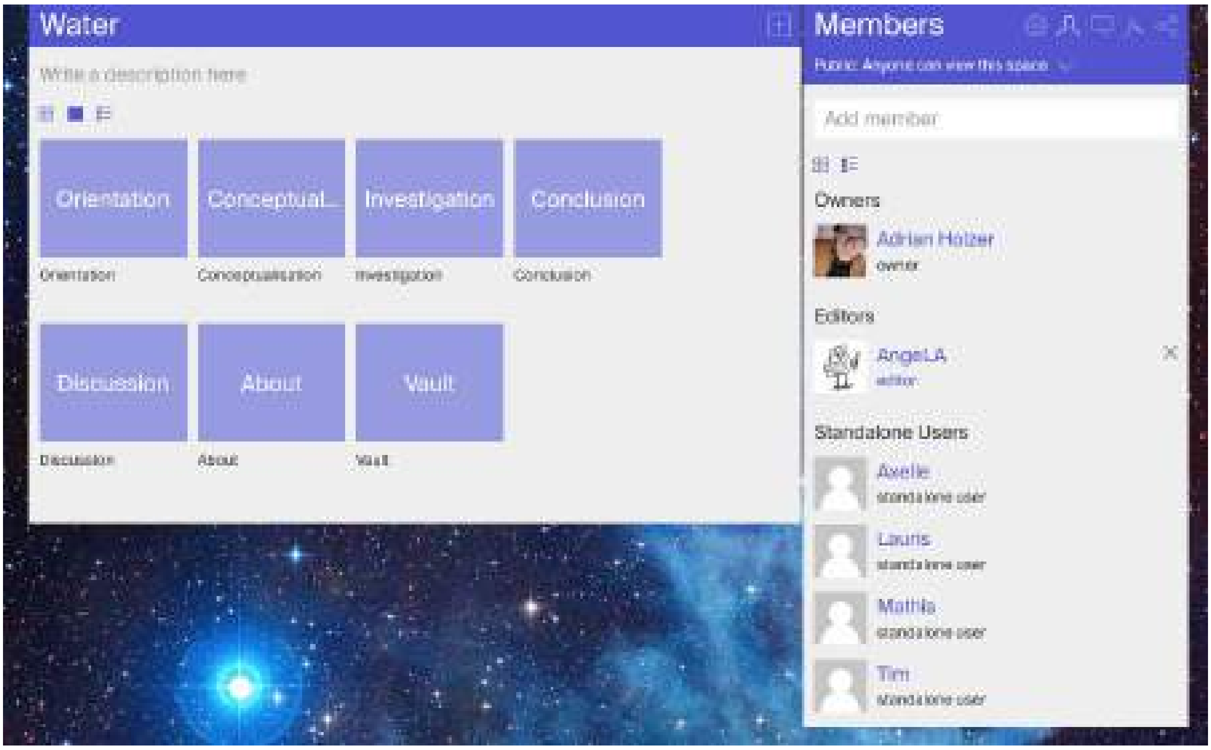


Figure 3.11. Visualisation of the Standalone users of the ILS in the Members area.

3.2.7 Social features

In *Graasp*, there is also a discussion mechanism implemented with the option to mention space members in the discussion who will be notified by email of this message as shown in the Figure below. Furthermore, users can rate and favorite spaces and resources. This is especially useful when teachers are designing an ILS collaboratively.

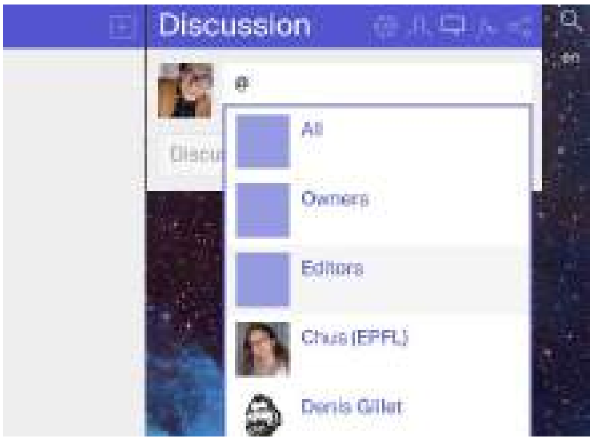


Figure 3.12.Social features available in the discussion area. Users can devote their messages to all members, owners, editors or specific members.

3.2.8 Tracking user activities

Since D5.4, ILS-specific contextual users were introduced in *Graasp* for a more fine-grained user activity tracking with properly enforced privacy. We have also extended the number of action types being tracked to be able to monitor the interaction in more details. In addition, Google Analytics has been set up for the ILS Platform allowing to collect high-level web metrics related to the project dissemination, such as number of visitors, number of visits, number of sessions, bounce rate, etc.

As mentioned above, now, in the ILS Platform the teacher can navigate to the ILS and click on the student's picture, this will open this student's ILS and allow the teacher to see the ILS from the student's perspective with all the content produced by the student. Note that when a teacher accesses the Standalone view of a user their traces are registered as reviewers and not as students in order to keep the traces clean.

3.3 Non-functional requirements and the release

Hereafter we describe the changes in the non-functional requirements in the ILS Platform since D5.4.

3.3.1 Ubiquitous access

In order to improve access from schools with low bandwidth we have made performance improvements by only loading visible items and made database querying more efficient. Taken together these improvements can reduce the loading time by a factor 5 on an average ILS.

3.3.2 Usability

The usability of the Go-Lab Portal is monitored in the participatory design activities with WP3 and the large scale pilots conducted by WP7.

The results of these activities are continuously taken into account by the technical team to improve the portal.

We also have introduced uservoice, a feedback service, in *Graasp* to allow users to directly relay comments to the developer team.

3.3.3 Internationalisation

The ILS Platform is now available in English and French. We are currently translating it further into Spanish, Portuguese, Greek, etc. The approach taken for translating it to other languages is by using the App Composer[6] (explained in detail in the next section). This makes possible for teachers to add translations, assisted by sentences taken from Google Translate and Microsoft Translator API. Then, the App Composer takes these translations and exports them in the same format used by the ILS platform for internationalisation. Finally, the ILS platform developers can take the translations and apply them in the platform.

3.3.4 Scalability

Our uptime for graasp.eu for the last year is 99.3% in average. Also we moved the server to a larger data center at EPFL.

[6] http://composer.golabz.eu/translator/web/index.html#/app/http://composer.golabz.eu/graasp_i18n/

4 The App Composer

The App Composer is a set of tools that aim to let teachers create, adapt, integrate or translate new or existing applications and make them available in the Go-Lab ecosystem. Since it is focused on teachers, it does not require technical knowledge such as programming or configuring advanced files, and everything is done with visual components or internal integrations among Go-Lab components. The main tool is available at http://composer.golabz.eu/. This URL is linked on *Lab publishing rule* page at *Golabz*.

4.1 New features and changes since the initial release

For a better overview, we list all the new features and changes since the initial release of the App Composer in this section. They are ordered according to the requirements in line with D5.4 which are also depicted as use cases in Figure 1.2. More detailed information is given in Section 4.2.

App adaptation

- The App Composer Adapt detailed in D5.4 is still available but applications can also be configured in the ILS itself.
  - URL: http://composer.golabz.eu/composers/adapt/

App creation and integration

- EasyJavascript has been integrated in the ILS Platform so teachers can create JavaScript simulations without programming using Easy Javascript Simulations[7] and add these simulations to an ILS.
- App Composer Embed has been implemented so teachers can take existing non OpenSocial web pages, and wrap them as OpenSocial supporting multiple languages. This way, these existing web pages can be easily added to the repository.
  - URL: http://composer.golabz.eu/embed/

App translation

- The App Composer Translator has been rewritten to simplify the process, and so as to include new features (such as the usage of Microsoft Translator and Google Translate to assist teachers translating applications or sharing translations among translated applications).
  - URL: http://composer.golabz.eu/translator/

4.2 Functional requirements and the release

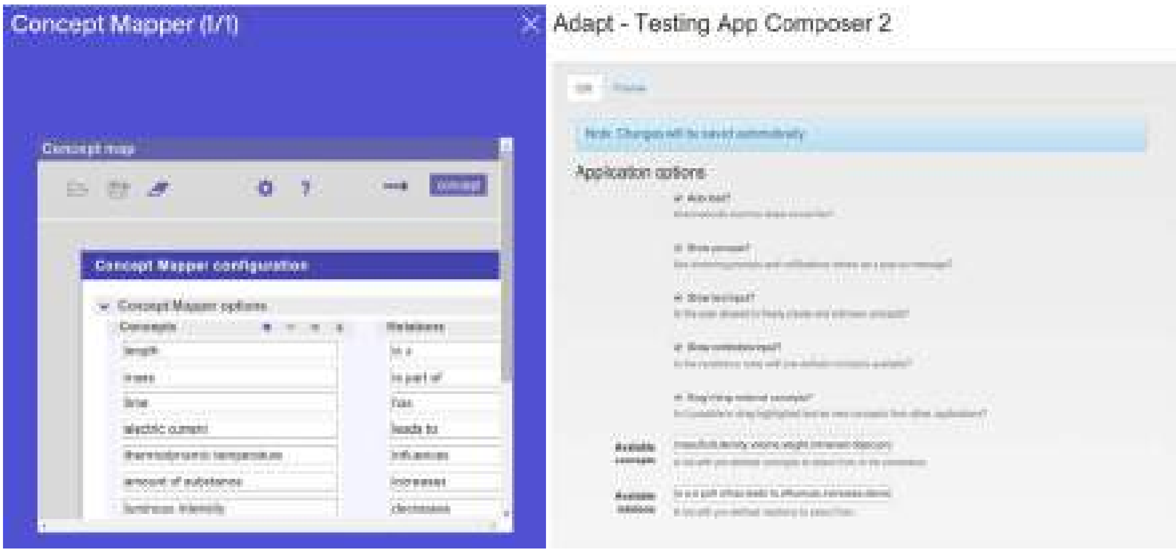
4.2.1 Adapting existing apps

Teachers must be able to adapt existing apps and tools without coding or requiring advanced knowledge. It is very useful for teachers to be able to retrieve existing adaptations of a given application. To this end, the App Composer provides the Adaptor, which is a component where one can select existing tools registered in the Lab Repository from a list (or put the URL directly if it is an external app). If it is a tool that supports one of the documented mechanisms for being adapted, it will show the options that the lab owner has provided and the teacher can select among them to customize the app. Teachers can see existing adaptations of that tool by other teachers.

[7] http://www.um.es/fem/EjsWiki/

A new mechanism has been designed where the teacher does not need to go to the App Composer, but configures the apps directly in the ILS Platform. The configurations are pushed internally to the App Composer, and those configurations from other users which are already stored can also be retrieved. This way, the user experience is simpler, and the teacher can still see what existing adaptations are already in the App Composer, which will play the role of configuration repository.

Both approaches are compatible and will be kept and maintained for supporting different tools.



Concepts	Relations
length	is a
mass	is part of
time	has
electric current	leads to
thermodynamic temperature	influences
amount of substance	increases
luminous intensity	decreases

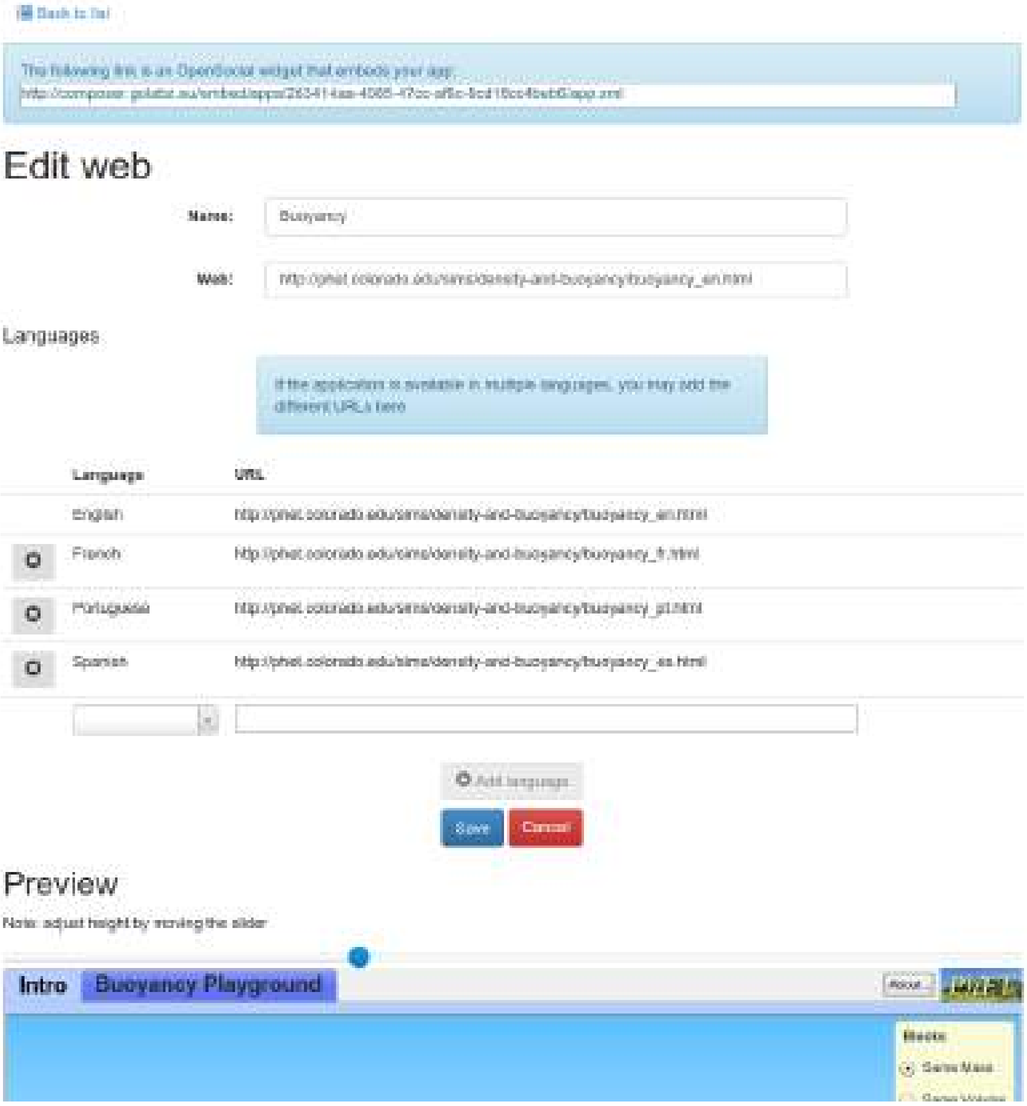
Figure 4.1. Screenshot of the Concept Mapper being adapted on the ILS directly (left) or in the App Composer (right).

4.2.2 Creating and integrating apps

Lab owners are informed in the Go-Lab Repository to use the App Composer to create their OpenSocial gadgets for their labs, which is a prerequisite to publish an online lab on the Go-Lab Portal. To this end, the App Composer introduces a new tool called App Composer Embed (http://composer.golabz.eu/embed/), which enables teachers or lab owners to embed existing web pages in OpenSocial applications.

So as to add an app or lab in the Go-Lab Repository, it must be provided as OpenSocial. So as to also add existing resources in regular HTML format, the App Composer Embed was introduced. As explained in the Go-Lab Repository publishing lab rules[8] (see Figure 2.1), the lab owner can use it to create an OpenSocial wrapper of the existing web resource. As depicted in Figure 4.2, an App Composer Embed user requires the user to enter the web resource in different languages (if available) and select the height of the final app. On top of the application, the App Composer provides an OpenSocial link. This link that can be used to add the web resource in the Go-Lab Repository. Students in ILS configured in any of those languages will load link or another; otherwise the default one will be shown (English).

[8] http://www.golabz.eu/lab/publishrules



Back to list

The following link is an OpenSocial widget that embeds your app:
http://composer.golabz.eu/embed/apps/263414aa-4065-47cc-af6c-5cd18cc4bab6/app.xml

Edit web

Name: Buoyancy

Web: http://phet.colorado.edu/sims/density-and-buoyancy/buoyancy_en.html

Languages

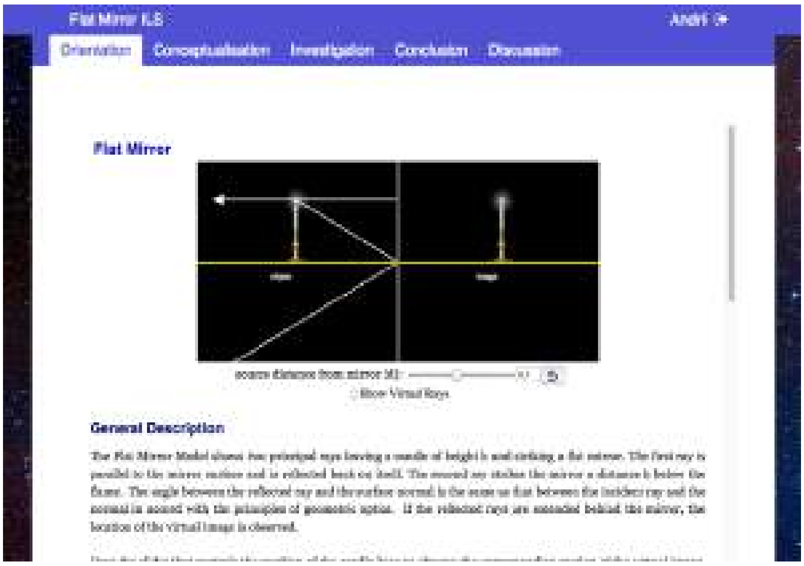
If the application is available in multiple languages, you may add the different URLs here

Language	URL
English	http://phet.colorado.edu/sims/density-and-buoyancy/buoyancy_en.html
French	http://phet.colorado.edu/sims/density-and-buoyancy/buoyancy_fr.html
Portuguese	http://phet.colorado.edu/sims/density-and-buoyancy/buoyancy_pt.html
Spanish	http://phet.colorado.edu/sims/density-and-buoyancy/buoyancy_es.html

Preview

Note: adjust height by moving the slider

Figure 4.2. Screenshot of the editing of an application with the App Composer Embed.



General Description

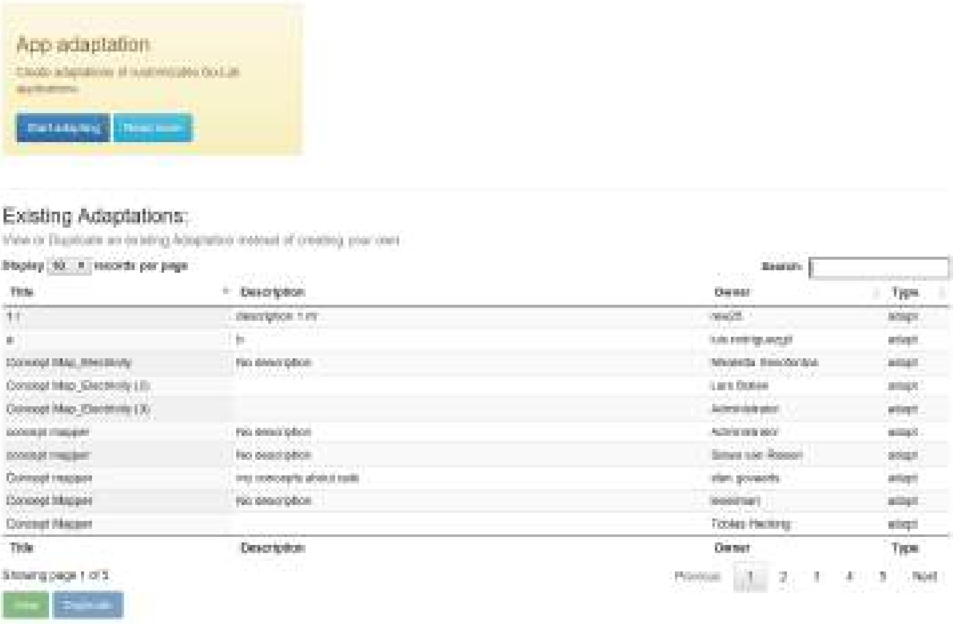
The Flat Mirror Model shows two principal rays leaving a candle of height h and striking a flat mirror. The first ray is parallel to the mirror surface and is reflected back on itself. The second ray strikes the mirror a distance h below the flame. The angle between the reflected ray and the surface normal is the same as that between the incident ray and the normal in accord with the principles of geometric optics. If the reflected rays are extended behind the mirror, the location of the virtual image is observed.

Figure 4.3. Screenshot of an Easy Javascript Simulation integrated into the Flat Mirror ILS.

Additionally, support for Easy Javascript Simulations has been added to the ILS Platform (see Figure 4.3). Easy Java Simulations is a well known system for developing simulations without programming, using a graphical interface. Originally, the system only generated Java applications that required a Java runtime environment. However, since version 5, it includes also the option to generate the simulations as a web application with standard web technologies such as HTML and Javascript.

The simulations have been integrated into the ILS, directly matching one of the requirements of the App Composer: the creation of new simulations without programming. In order to make it possible to integrate Easy Javascript into ILSs, the Inquiry Learning Platform (*Graasp*) was modified. Specifically, we adapted the Express web routing in order to serve files when requested using a relative path (e.g. "../img/background.jpg"). Easy Javascript web applications often use relative path to address external resources including images, javascript libraries and css files.

Finally, the App Composer Adaptor lists the list of existing adaptations developed in the App Composer. This way, when an application is selected (e.g. the Concept Mapper), the list of existing adaptations by other users of this particular application is listed, so the user can start with a new adaptation or duplicate an existing one of the other teacher. This feature is only available for those adaptations added by teachers using the App Composer Adaptor, not with those adaptations added by teachers in the ILS directly.



App adaptation

Create adaptations of customizable Go-Lab applications.

Existing Adaptations:

View or Duplicate an existing Adaptation instead of creating your own

Display 10 records per page

Search:

Title	Description	Owner	Type
1 1	description 1 m	[illegible]	adapt
a	b	[illegible]	adapt
Concept Map_Electricity	No description	[illegible]	adapt
Concept Map_Electricity (2)		Lars Bollen	adapt
Concept Map_Electricity (3)		Administrator	adapt
concept mapper	No description	Administrator	adapt
concept mapper	No description	[illegible]	adapt
Concept mapper	[illegible]	[illegible]	adapt
Concept Mapper	No description	[illegible]	adapt
Concept Mapper		Tobias Hecking	adapt
Title	Description	Owner	Type

Showing page 1 of 5

Figure 4.4. App Composer Adaptor listing existing adaptations.

4.2.3 4.2.3 Translating apps

To support Go-Lab in European schools, the internationalisation of apps is required (see deliverable D5.1). The App Composer enables teachers to collaboratively translate apps to different languages, but at the time of this writing. Teachers using the App Composer can translate any OpenSocial application which has been adapted to the standard OpenSocial internationalization tools. Internally, the App Composer pushes the translations to an intermediate database that can be consulted by the ILS Platform. This way, both teachers and students use the App Composer in a transparent way: if a Greek teacher translates one application to Greek, another teacher in another school will see the application translated, even if the second teacher has never used the App Composer.

When entering in the App Composer Translator (http://composer.golabz.eu/translator/), teachers see the list of applications regularly retrieved from the Go-Lab Repository (Figure 4.5), including its description and the languages it has been already translated. The more green a language is displayed, the more messages it has been translated, and if it is surrounded by a black border, the translation is complete.

Teachers can then select any application and attempt to translate it. Clicking on the "Translate" button enables teachers to start translating one application, showing the number of messages translated in that language, as depicted in Figure 4.6. Then, a list of texts to be translated are shown in English and teachers are expected to type the translations. However, to make the process easier, a list of suggestions is provided in each text, as depicted in Figure 4.7.

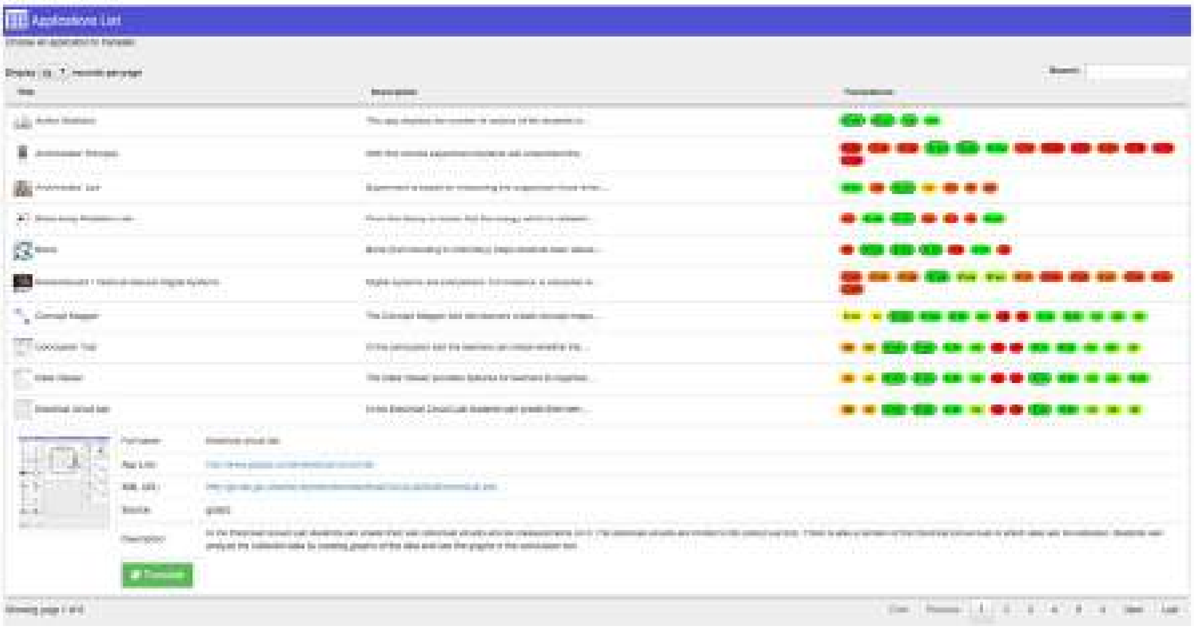
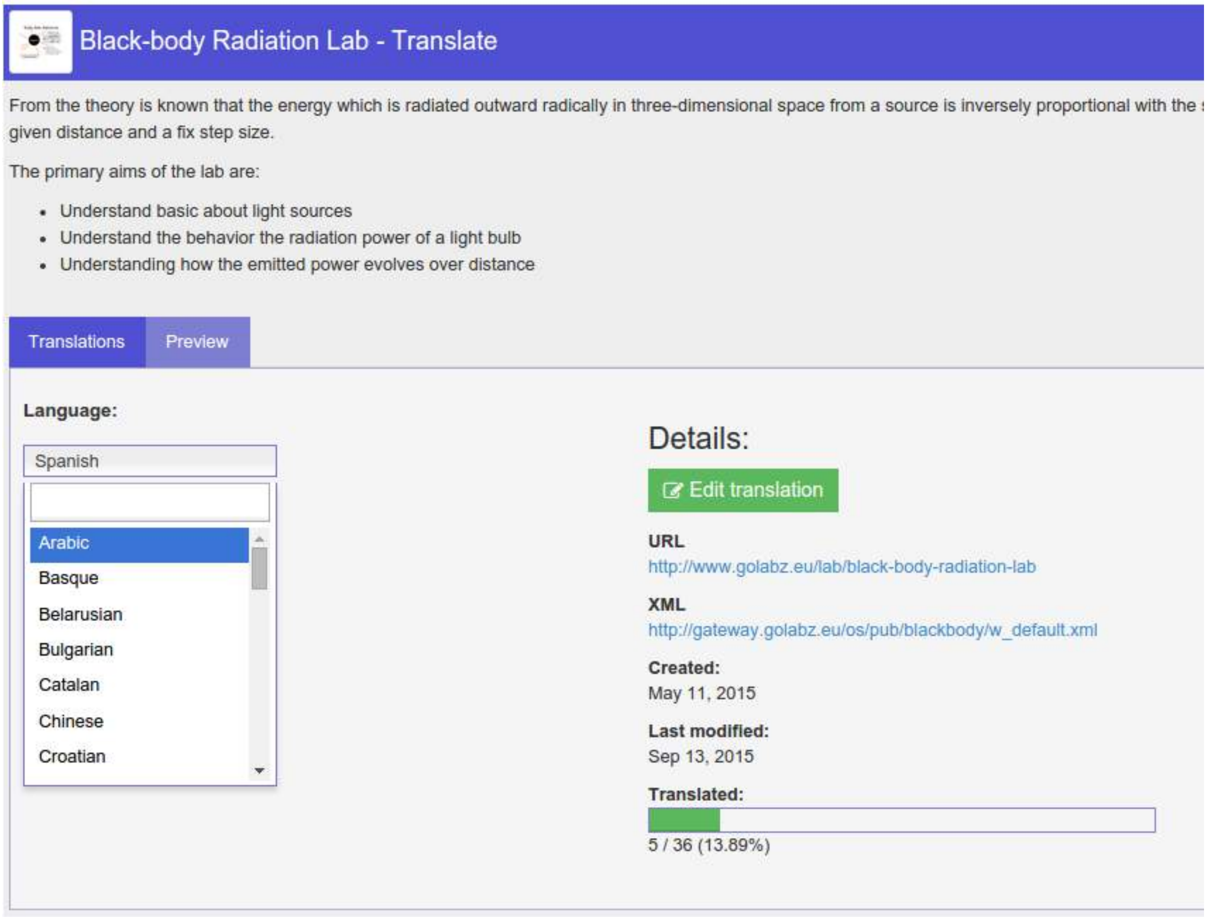


Figure 4.5. The App Composer Translator list of applications.



Black-body Radiation Lab - Translate

From the theory is known that the energy which is radiated outward radically in three-dimensional space from a source is inversely proportional with the s given distance and a fix step size.

The primary aims of the lab are:

- Understand basic about light sources
- Understand the behavior the radiation power of a light bulb
- Understanding how the emitted power evolves over distance

URL
http://www.golabz.eu/lab/black-body-radiation-lab

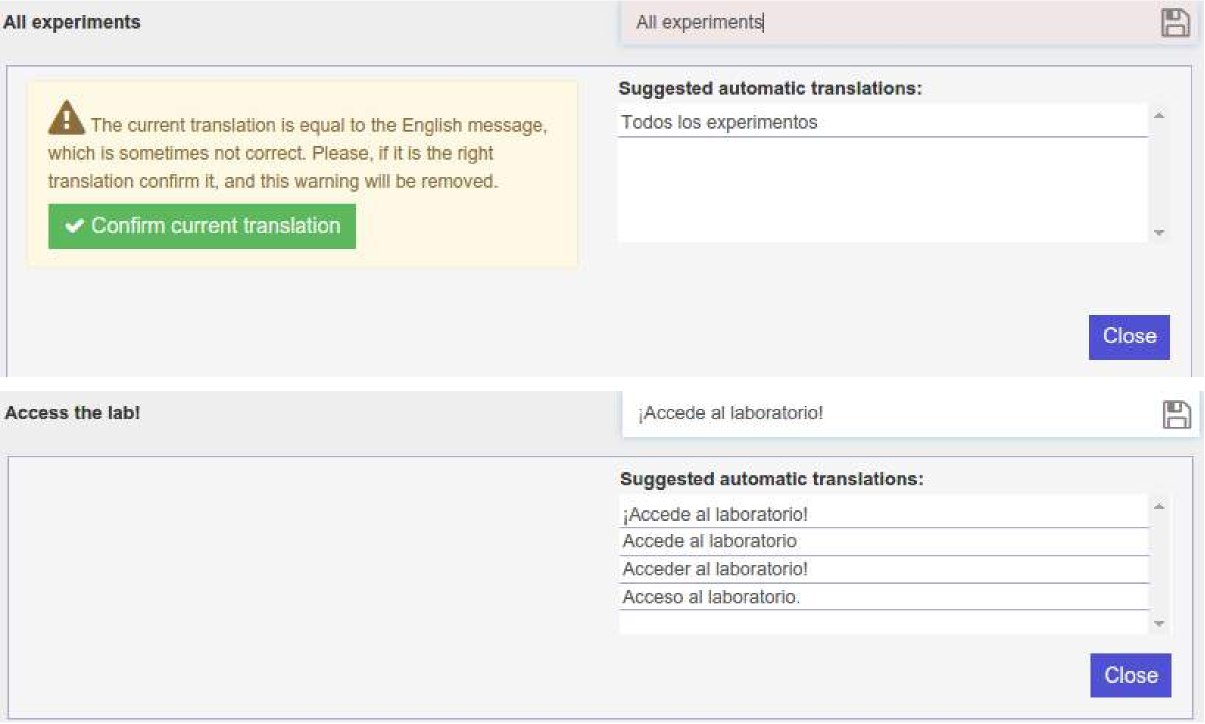
XML
http://gateway.golabz.eu/os/pub/blackbody/w_default.xml

Created:
May 11, 2015

Last modified:
Sep 13, 2015

Translated:
5 / 36 (13.89%)

Figure 4.6. Translating an application: First step.



All experiments — All experiments

The current translation is equal to the English message, which is sometimes not correct. Please, if it is the right translation confirm it, and this warning will be removed.

Suggested automatic translations:
Todos los experimentos

Access the lab! — ¡Accede al laboratorio!

Suggested automatic translations:
¡Accede al laboratorio!
Accede al laboratorio
Acceder al laboratorio!
Acceso al laboratorio.

Figure 4.7. Two examples of suggested translations.

The suggestions mechanism uses different sources:

1. It uses the existing translations in existing applications. If a lab owner provides translations to Spanish of certain texts, they are retrieved and used as a suggestion.
2. It uses translations provided by App Composer users in other applications.
3. It uses translations provided by Google Translate and Microsoft Translator API.

Every few minutes, the system checks the repository for changes in the Go-Lab Repository, adding new apps or new texts in existing apps. If new texts are available, it uses the Microsoft Translator API and Google Translate to find translations to all the supported languages. This way, whenever a teacher attempts to translate an application, the list of suggestions is already generated.

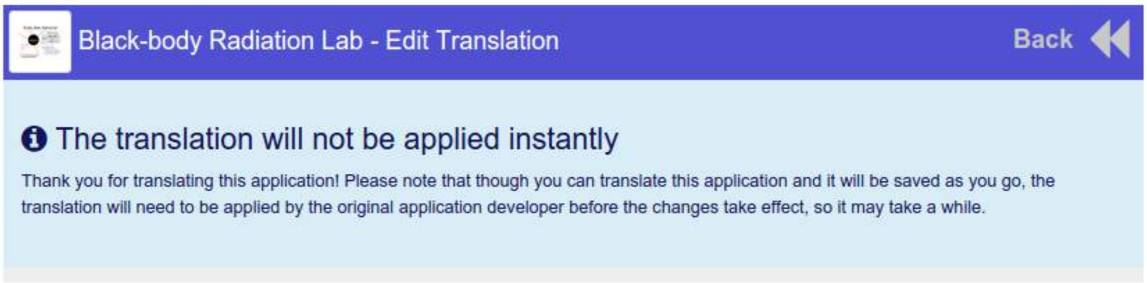
Additionally, many apps share a set of shared components (such as configuration mechanisms or help or saving information into the Vault, etc.). The App Composer Translator provides a mechanism to let app developers to customize namespaces in the translations. For example, if two applications share a component, they can declare that both applications have the same namespace, and those common texts will be assumed by the App Composer to be equivalent. This way, if 5 apps share 10 messages, and somebody translate this text to a particular language (e.g. Spanish), the App Composer will also translate those texts in the other 4 apps. Furthermore, if a new app is added to the Go-Lab Repository, if it shares any existing translation, it will automatically be applied.

Finally, in most of the OpenSocial apps, they use the OpenSocial internationalization format for supporting different languages. The App Composer is integrated with the ILS Platform. So in all these cases new translations are automatically available in any ILS. So once a teacher translates an application, in a matter of minutes (while changes are propagated) any student in an ILS containing that application and customized to that language will see it translated. If a teacher translates only part of the application, those texts will be published, and the rest of the texts will be taken from the English version of the application. Therefore, the final user will see the application in English but with part of the terms in their language. Additionally, when the developer adds new terms to the application, the system fills the the existing translations with the new terms in English. However, the App Composer correctly marks which messages were taken from the default language (English) and which ones were not, so it can accurately tell translators which applications are missing translations, and once in the translation interface, it marks the missing messages in a different colour.

However, in some particular cases, the app developer provides the texts using the OpenSocial internationalization format, but the app itself does not consume it. For example, all legacy laboratories use their own internationalization systems, but can export which terms need to be translated in the OpenSocial format. In those cases, the Smart Gateway takes the custom internationalization mechanism of each laboratory and exports it as OpenSocial. This process is explained in the deliverable D4.7, section 3.4.4. In these cases, the App Composer informs of this situation to the user, as depicted in Figure 4.8. Once translated, the App Composer will automatically send an email to the lab owner explaining what new translations are available, and it provides a link to the translation, which can be downloaded in different formats (OpenSocial, .po, JSON, jQuery i18n plug-in) in the developers area[9], as depicted in Figure 4-9. This way, lab owners can take these translations and use them in their laboratory manually as they receive the e-mail. This requirement has been developed in collaboration with WP2, which found that it was relevant to provide mechanisms to translate

[9] http://composer.golabz.eu/translator/dev/apps/

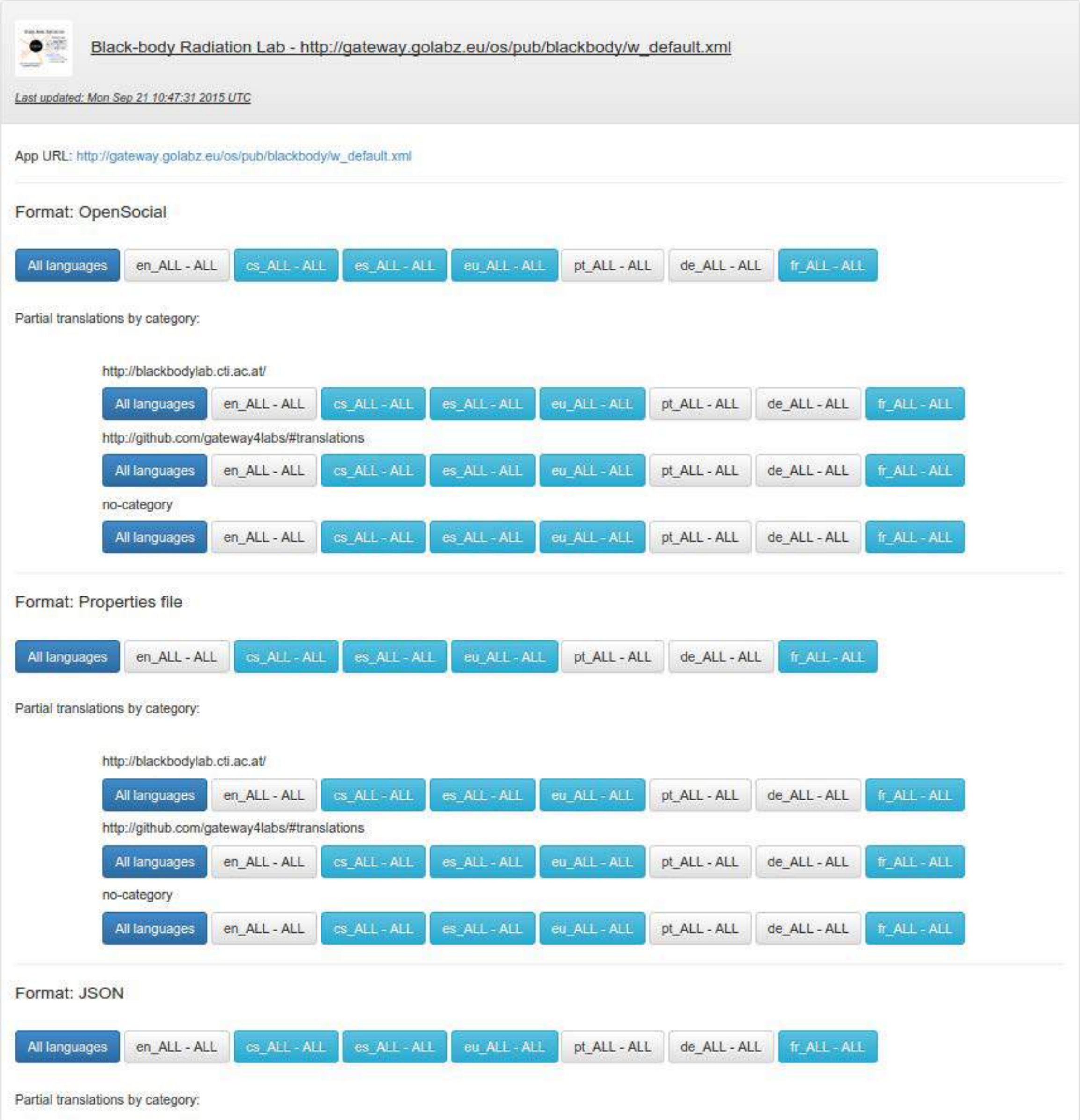
laboratories, as explained in the deliverable D2.3 - “The Go-Lab inventory and integration of online labs – labs offered by external partners and federations”.



The translation will not be applied instantly

Thank you for translating this application! Please note that though you can translate this application and it will be saved as you go, the translation will need to be applied by the original application developer before the changes take effect, so it may take a while.

Figure 4.8. The App Composer explains that some apps will not be automatically translated, requiring that the lab owner needs to apply the translation.



Black-body Radiation Lab - http://gateway.golabz.eu/os/pub/blackbody/w_default.xml

Last updated: Mon Sep 21 10:47:31 2015 UTC

App URL: http://gateway.golabz.eu/os/pub/blackbody/w_default.xml

Format: OpenSocial

All languages | en_ALL - ALL | cs_ALL - ALL | es_ALL - ALL | eu_ALL - ALL | pt_ALL - ALL | de_ALL - ALL | fr_ALL - ALL

Partial translations by category:

http://blackbodylab.cti.ac.at/

All languages | en_ALL - ALL | cs_ALL - ALL | es_ALL - ALL | eu_ALL - ALL | pt_ALL - ALL | de_ALL - ALL | fr_ALL - ALL

http://github.com/gateway4labs/#translations

All languages | en_ALL - ALL | cs_ALL - ALL | es_ALL - ALL | eu_ALL - ALL | pt_ALL - ALL | de_ALL - ALL | fr_ALL - ALL

no-category

All languages | en_ALL - ALL | cs_ALL - ALL | es_ALL - ALL | eu_ALL - ALL | pt_ALL - ALL | de_ALL - ALL | fr_ALL - ALL

Format: Properties file

All languages | en_ALL - ALL | cs_ALL - ALL | es_ALL - ALL | eu_ALL - ALL | pt_ALL - ALL | de_ALL - ALL | fr_ALL - ALL

Partial translations by category:

http://blackbodylab.cti.ac.at/

All languages | en_ALL - ALL | cs_ALL - ALL | es_ALL - ALL | eu_ALL - ALL | pt_ALL - ALL | de_ALL - ALL | fr_ALL - ALL

http://github.com/gateway4labs/#translations

All languages | en_ALL - ALL | cs_ALL - ALL | es_ALL - ALL | eu_ALL - ALL | pt_ALL - ALL | de_ALL - ALL | fr_ALL - ALL

no-category

All languages | en_ALL - ALL | cs_ALL - ALL | es_ALL - ALL | eu_ALL - ALL | pt_ALL - ALL | de_ALL - ALL | fr_ALL - ALL

Format: JSON

All languages | en_ALL - ALL | cs_ALL - ALL | es_ALL - ALL | eu_ALL - ALL | pt_ALL - ALL | de_ALL - ALL | fr_ALL - ALL

Partial translations by category:

Figure 4.9. Translations can be later downloaded by app developers.

4.3 Non-functional requirements and the release

Apart from the previous requirements, there are also several non-functional requirements that impact the design of the App Composer.

4.3.1 Usability

The teachers who will use the App Composer will have a varying degree of computer expertise. For this reason, usability is an essential requirement.

First of all, OAuth is implemented in the App Composer, so users do not need to register in the App Composer, but only in Graasp. While at the time of this writing every user registered in Graasp can add or modify translations, we are investigating the need and possibility to limit this right to a subgroup of teacher that could for example be members of a particular Graasp. This way, we could avoid potential vandalism by unknown Graasp users, while we keep the system flexible (anyone in the space could add translators, and unregistered users will have a button to request becoming translators).

In the case of the App Composer Translator, the percentage of texts to be translated is always the minimal possible, since it crosses translations between different applications as long as the developers mark these translations as equivalent with the namespace mechanism. Additionally, it uses different sources for retrieving suggestions, such as Google Translate, Microsoft Translator API, existing translations by the original lab owners, or translations made by the teachers. Finally, the App Composer Translator uses a color scheme that resembles the one of *Graasp* and ILSs.

In the case of the App Composer Embed, the user interface is minified so it only has the two options required: language support (if languages are supported, so it is not mandatory), and the desired height of the external resource.

In the case of the App Composer Adaptor, the user interface for selecting the different options is the same for all the apps, and in the preview mode teachers can see the results of the selected options for that app.

4.3.2 Scalability

A single instance of the App Composer will be integrated with the portal. Third parties might deploy adapted versions of the App Composer. The App Composer should be able to serve thousands of teachers, so scalability is fundamental for providing a proper user experience.

In the App Composer Translator, all the translations are stored in an intermediate cloud MongoDB database, so there is no connection from the users rendering applications to the App Composer (since Shindig contacts directly this intermediate database). The App Composer Translator is only used when a teacher is actually translating an app. Additionally, the App Composer Translator uses a distributed task queue called Celery[10] which relies on Redis. Every 5 minutes an event is triggered and it checks if there is anything new in the Go-Lab Repository as well as in all the translation files of those apps translated. It stores permanently the past requests to external services (Google Translate, Microsoft Translator API) so it never performs the same request twice, reducing the amount of external requests. So, even if there was a considerable number of teachers translating concurrently an application, the queue system guarantees that it will not require more resources in the synchronization system, but only more time.

In the App Composer Embed and the App Composer Adaptor, teachers and students are only downloading a single OpenSocial file which is generated on the fly by obtaining the

[10] http://www.celeryproject.org

original file. This file is typically small, and no other resource (such as CSS, JavaScript or images) is downloaded from the server. Additionally, it is a completely stateless server which could be easily scaled horizontally to support a higher balance of users if required. With the new approach for configuring applications, the configurations are stored and retrieved from the Vault in the ILS Platform.

4.3.3 Internationalisation

The App Composer is available in English, but it has been parameterized with standard internationalisation tools such as gettext and angular-translate. However, translating these components has not been a priority given that the tool is not used by students and the App Composer Translator already requires the English knowledge for translating text from English to their language. In any case, the App Composer Translator has been implemented in a way that can translate external applications in other technologies (such as external laboratories), and provide the developers the translations. In the future, the App Composer will expose its internal messages to be translated in the format that the App Composer supports, so the App Composer will be able to be translated using the App Composer Translator.

5 Conclusion

In this deliverable, we have highlighted the changes which we have made to the initial releases of the Go-Lab Portal and the App Composer (cf. D5.4). These changes are ordered based on the requirements collected in D5.2. Some requirements have been extended or revised based on the feedback of reviewers, participatory design results (WP3), community support (WP6), pedagogical suggestions (WP1), technical constraints and experience obtained in the first three years of the Go-Lab project.

Compared to the initial releases D5.4 (also the latest deliverable to this one), we have worked on reviewers' feedback on D5.4 and of WP5 raised at Year 2 review. One related recommendation by the reviewers was to ensure localisation of the Go-Lab Portal for sustainability. In D5.6 both the Go-Lab Portal and the App Composer have employed certain proactive strategy to the internationalisation aspect, which has been discussed in the non-functional requirements section in each chapter. Considering the sustainability, the repository will use a third-party translation service, while the ILS Platform has been developed in both French and English with ongoing handling of other languages. The App Composer Translator supports the localisation well.

The reviewers provided remarks to D5.4 which have been addressed in the latest development of the final releases. The bug of adding apps in the initial releases of the App Composer etc. have been fixed. The recommendation functionality has been integrated in the portal. Individual online labs, apps, and ILS have been developed and fix the problems, so that they could work better in the ILS Platform and the repository, e.g. the problem of "Hints for formulating hypotheses". And the big ideas are specified by user study of over 300 teachers conducted in Work Package 2 (cf. D2.1).

Accordingly, a large amount of content and system maintenance work has been carried out in the final releases. The Go-Lab Portal needs to handle the resources (labs/apps/ILS) which are added into *Golabz* continuously. Although a lot of the resources are not developed by the Go-Lab consortium but by third party lab owners e.g. RemLabNet, PhET or individual teachers, the Go-Lab Portal has to check whether they could be displayed well in the repository, whether they could be used to create ILS, and whether they could be further used in the ILS Platform smoothly. The sustainable releases of the Go-Lab Portal and associated end-user solutions will be documented first internally in G5.5 (M42) and finally in D5.7 (M48).

The final releases of the Go-Lab Portal and the App Composer integrates project-wide visions, solutions and outputs collaboratively agreed upon, designed, implemented and validated. The delivered solutions combine repositories, analytics, services, rich open educational content, as well as competences (experts, resource providers, teachers and user communities) to support inquiry learning with online labs at schools and to pave the way towards a sustainable impact for STEM education in Europe and beyond.

6 References

Gormley, C., & Tong, Z. (2015). *Elasticsearch: The definitive guide*. O'Reilly Media, Inc.

Harlen, W., (Ed.). (2010). *Principles and big ideas of science education.* Gosport, Hants: Ashford Colour Press Ltd., ISBN: 9780863574313.