



# GO-LAB

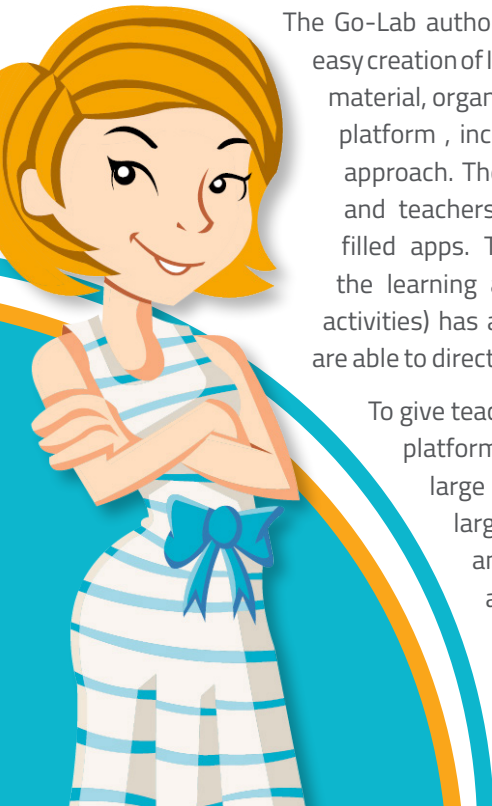
GLOBAL ONLINE SCIENCE LABS  
INQUIRY LEARNING AT SCHOOL  
FOR TEACHERS, HEADTEACHERS  
AND POLICY MAKERS



## Go-Lab & the creation of inquiry learning spaces (ILSs)

The 4-year (10/2012-10/2016) Go-Lab project, opens up remote science laboratories, data archives from science experiments, and virtual models (together called "online labs") for large-scale use in science inquiry learning. This is done by offering an online portal containing a series of *online labs* and "apps" - dedicated tools that support (scaffold) students in an inquiry learning process, and an *authoring facility* for designers/teachers which enables the creation or the personalization of *Inquiry Learning Spaces* (ILSs) in which labs, apps, and additional material (text, video, etc.) are combined in an inquiry cycle to offer students complete inquiry learning experiences.

The number of online labs included in the Go-Lab portal ([www.golabz.eu](http://www.golabz.eu)) has reached over 400 by October 2016, making Golabz a unique landing place for online labs. The collection of labs includes laboratories from well-known repositories as PhET, Amrita labs, Photodentro, EasyJava Labs and RemLabNet. The apps cover all aspects of the inquiry process. Golabz now also includes a large set of teacher generated ILSs with the number of ILSs now totalling close to 400 in a variety of languages.



The Go-Lab authoring platform (<http://graasp.eu/>) enables the easy creation of ILSs including, labs, apps, and other multimedia material, organised in an inquiry cycle. The Go-Lab authoring platform, including the apps, follows a modern autosave approach. The apps are directly configurable by teachers, and teachers can provide students with (partially) pre-filled apps. The background infrastructure for enabling the learning analytics facilities (based on artefacts and activities) has also been put into place. Moreover, teachers are able to directly inspect the work of each individual student.

To give teachers technical and design support a "support platform" on Golabz is provided which presents a large set of instructional videos, a set of FAQs, a large set of "Tips & Tricks" for designing ILSs, and a community forum. The support pages also give access to the Go-Lab MOOC and the Go-Lab tutoring platform that supports the interaction between teachers and between teachers and (Go-Lab) experts.

## Large-scale Pilots

Throughout project's 3 main implementation phases- covering the period from February 2013 to June 2016, approximately 1300 teachers have been involved to the project. During that period, partners and national coordinators were engaged in a large variety of activities in order to train and support pilot teachers and schools, to help them to overcome general or local difficulties faced, to propose, implement or develop innovative educational lessons, to closely monitor their progress and provide further assistance and guidance.

Activities with teachers and students involved ILSs and labs from various science curriculum domains. The online labs that partners demonstrated and introduced to schools, teachers and students during the pilot phases, were from all three categories, simulations/virtual labs, datasets and remote labs. These included: Electricity lab, Geogebra, Impact calculator, PhET-Buoyancy, PhET-Density, Star in a box; Datasets: Hypatia, ESA-SOHO archives, Sun4all Salsa; Remote labs: Archimedes, Faulkes-Telescope, Radioactivity and VISIR. At the same time, the following subjects have been addressed: Physics, Astronomy, Technology/Informatics/Electronics, Chemistry, Biology and Maths.

**What Headteachers say...** *"It takes time to convince colleagues to change their ways of teaching and adopt new methodologies such as flipped classroom or ILS. Sometimes the barrier of language is a problem to overcome. The positive thing is that the implementation of Go-Lab opens minds for new practices, methods and exchange between teachers all over Europe."*

*"A big problem is that the educational process is strictly restricted within given frameworks. It gives very few margins to teachers who wish to innovate, to do something different and if they try to do something different, they will get very tired with all the bureaucratic procedures, etc."*

**What Teachers say...** *"... students themselves incorporated the inquiry model through the platform at the end of last school year, created their own scenarios, their own small ILSs or changed already existing ones. In other words, the students became the teachers through this programme."*

*"I was able to step back as a teacher, more than I was expecting. As students progressed through the ILS my role became increasingly guide and facilitator rather than instructor. The students' own creativity began to show during the lessons, and they became more inquisitive ... the fact that I can adapt my teaching to incorporate a new teaching style has also boosted my confidence. I feel that, with additional use of Go-Lab, I can encourage students to become more independent thinkers, with myself as a mediator and support in the lessons."*

## Recommendations That Can Help to Provide Continuity

Evaluation information gathered during the project through large-scale evaluation, common studies, case studies, workshops and exchanges with teachers and students, highlights the positive impact recorded in relation to teachers' skills, scientific knowledge and their capacity to use inquiry learning. Students have also welcomed the use of Go-Lab as part of their learning while clearly indicating a positive change towards their overall attitude and understanding of scientific topics.

In order to further enhance the use of project's outcomes and facilitate teachers in capitalizing its possibilities, ensuring the project's continuity is essential. A selection of recommendations addressing teachers, headmasters, and policy makers is provided below:

### For teachers:

1. Offer students a series of ILSs to achieve an effect on their inquiry skills. Whereas knowledge effects are immediate, inquiry skills effects take a longer time.
2. Stimulate students to spend sufficient time on an app and/or let them return later to the app to complete the task. Let them interact with all apps and labs and allocate enough time for each learning activity.
3. Consider that students with distinct levels of prior knowledge need different amounts and forms of support. If the topic of the ILS is entirely new to students, orient them on the topic before starting with their experiments. If they already have a basic knowledge, provide them with tools that structure the task without too many restrictions.
4. Create facilities in an ILS to revive prior knowledge. For instance, by giving students a quiz with questions that refers to things they have already learned or by asking them to make a concept maps of what they already know.
5. Design ILSs suitable for a range of abilities, which have mandatory activities for all students and some more challenging optional activities for those who finish the mandatory parts earlier.
6. Encourage balanced collaborative work between students. Design ILSs to support both individual efforts and collaboration, while considering when and how this approaches are beneficial for the tasks to be developed.
7. Students using computers appear to expect a high degree of interaction. Design ILSs which are as interactive, stimulating, and enjoyable as possible.
8. Monitor the students' behaviours and knowledge. If you notice that they have incorrect ideas about the domain, make sure they conduct enough experiments to be able to adjust their initial ideas and draw correct conclusions.
9. Reflection is a key cognitive process where students get to 'learn from their learning'. In order to better support inquiry learning outcomes, encourage their reflective capabilities by using the Go-Lab reflection tool.
10. Put the lab work in context. By putting experiment in context, students can understand why these are important and see what their findings mean and where can they be applied.
11. Consider designing ILSs involving a blended combination of real, online labs or even lessons involving only real labs. ILSs using virtual labs can also be useful as a preparation activity for real lab lessons and for learning reinforcement.
12. Explain to students that it doesn't matter whether their hypothesis is true or false, if it is well formulated; that there is no pre-fixed number of experiments, as long as they do enough to validate their hypothesis; and that there is no unique design for a good experiment, as long as their investigation is sound.
13. Organize text, tools, and videos in units. Restrict the amount of information per phase and limit scrolling by adding extra phases and splitting the tasks.
14. Create ILSs implementing features of both remote and virtual experiments. To build excitement and engagement in the learning process, use different physical mechanisms to investigate the scientific variables of interest.
15. Give students clear instructions. Things that seem obvious for more experienced users (pressing a button or tab, clicking on an item to change its appearance or characteristics) might not be clear to new users.
16. Monitor students' learning by using Go-Lab's learning analytics apps. Using these apps can help to identify students who might need support and feedback during lessons.
17. Make sure that students get good introductions to the inquiry approach and the tools to be used. If you plan to use lab work and inquiry tasks regularly, design your ILSs to have a gradual increase in complexity.
18. If students work with Go-Lab for the first time, do not include too many tools. Even if most of the tools are quite intuitively and have similar interfaces, it still takes a time for students to familiarize with each tool.
19. Include instruction videos about the tools. Go-Lab already many videos aimed at teachers, but these can easily be used in an ILS for the benefit your students.
20. Envisage Go-Lab as an integral part of the school's science curriculum infrastructure and explore how it can be integrated with other technical and pedagogical components.

## For headteachers & policy makers:

1. Encourage teachers (at all levels) to engage in the use of Go-lab's wide range of tools, help and support facilities by: incorporating its use into teacher training programmes; promoting and contributing to the appropriate use of support resources; and introducing teachers to new pedagogical styles and roles in teaching and learning.
2. Provide teachers with dedicated time and space to create their own ILSs. Enabling them to better adapt ILSs to their own and their school's needs by: dedicating part of their working day to class/lesson preparation and by promoting collaborative and cross-curricular projects, where teachers can work together to prepare and build ILSs, while better rooting these kind of experiences in their organizations.
3. Enhance flexible forms of training and recognition. Professional development courses should offer a variety of models for teacher training, including online and distance-based courses. Training should also include recognition tools for teachers-innovators in their fields.
4. Facilitate the successful adoption in curriculum of school innovations. School leaders and teachers should aspire to incorporate these within the school's developmental plan and innovation strategy. Policy makers, should allow schools some curriculum autonomy when implementing new teaching and learning styles in their classrooms.
5. Foster the creation of school structures, regional hubs and a network of Regional Go-Lab Ambassadors. Creating a collection of department folders and regional clouds (per school, per department and per subject), that will contain not only the links to the relevant ILSs per subject, but also an explanation of what preceded the ILSs, how the lessons were implemented and other tips & best practices. This structure, should be supported by the development of a regional program for teacher exchange, further enhancing interschool exchange, sharing of best practices and cross-curricular activities and harmonizing curriculum inclusion within the regions.

## Acknowledgements

The Go-Lab project started in November 2012 with a set of fresh ideas on inquiry learning, the role of online labs and how to support students and teachers in the learning, instruction, and authoring. Now four years later we have a unique portal ([www.golabz.eu](http://www.golabz.eu)) with over 400 online labs and around 10.000 user sessions per month and a full-fledged Go-Lab authoring platform ([www.graasp.eu](http://www.graasp.eu)). Teachers have created a total number of close to 1500 ILSs, we estimate that around 200 ILSs have been implemented in the classroom with more than 20 student users, and close to 400 ILSs have been published on the Go-Lab portal. Labs, apps, and the Go-Lab authoring platform have been translated into many languages and Go-Lab is used far beyond the countries of the Go-Lab partnership. All these achievements could only be reached because we had the privilege to work with a large and growing set of enthusiastic and competent teachers who co-created Go-Lab together with the Go-Lab team, making it an environment that really suits teacher needs. Implementations of new approaches and tools in education often require a longer time span. We are, therefore, very happy to be able to continue Go-Lab in a follow-up project that is called Next-Lab. Next-Lab will start in January 2017 and it will continue to improve the Go-Lab platforms and also continue teacher training and support activities. It will also extend Go-Lab with new facilities such an option for students to collaborate online, a modelling tool, and apps for 21st century skills, ePortfolios, and peer assessment. In Next-Lab a foundation will be led for a sustainable environment. In realising this, we look forward to continue the great cooperation with our Go-Lab, then Next-Lab, teacher community.



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[www.go-lab-project.eu](http://www.go-lab-project.eu)

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