D3.2 Mashup environments

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Executive Summary

The aim of this deliverable is to present the infrastructure developed in WP3 that enables the creation and sharing of mashup environments. This deliverable reports the outcomes of the work conducted so far under Task 3.2: Mashups of personal and social inquiry tools.

In the DoW, the weSPOT mashup environments are described as:

"Elements of the online learning spaces will be combined to generate mashups of new components and functionalities, which will be adapted by students in order to meet their needs and preferences. This approach will also allow the individualisation of the components, tools, and functionalities of the inquiry environment, and their adjustment or replacement by existing inquiry tools. In particular, this infrastructure will offer the following facilities:
- *Enable students to select their preferred tools in order to personalise their inquiry environment, this includes the linking of basic workflow components to legacy systems as LMS like Moodle, Blackboard, LifeRay, and Elgg.*
- *Allow students to share their inquiry workflows, collaborate and provide feedback to each other, this includes an integration with Facebook and other main social networks."*

This deliverable presents the implementation of the weSPOT mashup environments according to the description provided in the DoW. In particular, the mashup approach adopted by the weSPOT inquiry space is presented with particular emphasis on the integration with external systems and tools, notably Learning Management Systems (LMSs), social networks, as well as Google gadgets.

The work described in this deliverable has led to the following publications:

- Mikroyannidis, A., Okada, A. & Scott, P. (2013) Personal Learning Environments for Inquiry-Based Learning. *PLE Conference.* Berlin, Germany.
- Mikroyannidis, A. (2014) The weSPOT Inquiry Space: A Personal and Social Environment for Inquiry-Based Learning. Submitted to the Demo track of the *9th European Conference on Technology-Enhanced Learning (ECTEL)*, Graz, Austria.

Introduction

This deliverable describes the infrastructure offered by weSPOT to its users enabling them to build and share mashup environments. First, an overview of the weSPOT mashup approach is provided through a presentation of the adopted architecture in the weSPOT toolkit. This is followed by a description of how external tools and systems have been integrated with the weSPOT inquiry space and what this integration offers to teachers and students. In particular, the mechanisms for the integration of Learning Management Systems (LMSs), social networks and Google gadgets are presented, both from a technological point of view, as well as from the usage point of view of the teacher and the student. Finally, the deliverable is concluded with an outlook of the next steps regarding the further development and testing of the weSPOT mashup environments and integration mechanisms.

The weSPOT mashup approach

As described in D3.1, weSPOT adopts a personal and social approach for supporting IBL in secondary and higher education. The aim of this approach is to support students in:

1. Personalising their IBL environment.
2. Building, sharing and enacting inquiry workflows individually and/or collaboratively with their peers.

These principles have driven the development of the weSPOT inquiry space[1], a personal and social IBL environment, which has the weSPOT Inquiry Workflow Engine at its core for building and sharing inquiries.

The weSPOT inquiry space has been built based on the following requirements:

1. A widget-based architecture enables the personalisation of the inquiry environment, allowing teachers and students to build their inquiries out of mash-ups of inquiry components.
2. Students can connect with their peers and form groups in order to build, share and execute inquiries collaboratively.
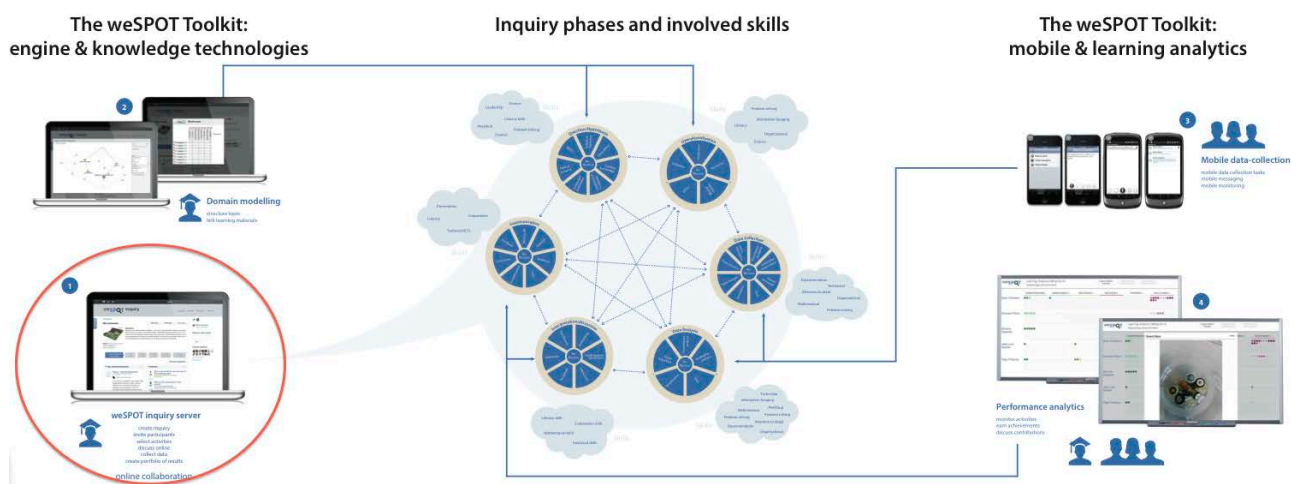

Figure 1: The weSPOT toolkit associated to the weSPOT IBL model

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[1] http://inquiry.wespot.net

As shown in Figure 1, the weSPOT inquiry space (highlighted in the red circle) supports all phases of the weSPOT IBL model, by enabling teachers to setup an inquiry and students to carry it out collaboratively in groups. Other tools of the weSPOT toolkit support specific phases of the weSPOT IBL model. For example, the mobile and learning analytics tools are mainly associated with the Data Collection and Data Analysis phases of the IBL model.
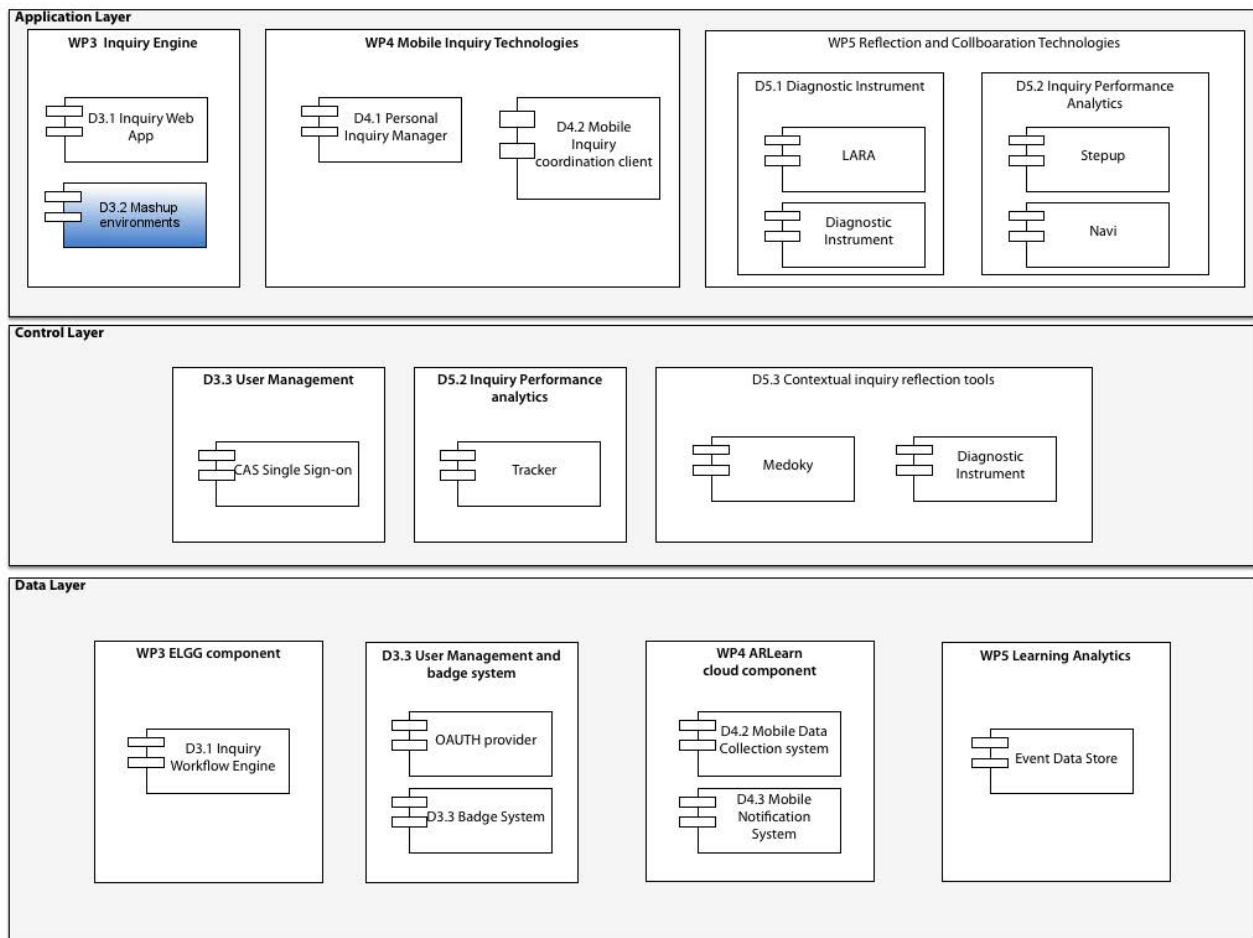

Figure 2: The overall weSPOT toolkit architecture (adapted from http://wespot.net/en/software)

Figure 2 shows the overall architecture of the weSPOT toolkit. It consists of an Application layer, a Control layer, and a Data layer. In this deliverable, we will focus on the Application layer and the Mashup environments software component in particular (highlighted in Figure 2). Figure 3 shows the architecture of the mashup environments that are offered by the weSPOT inquiry space. Teachers and students interact with a number of inquiry components, which are available as widgets. These components are used within particular phases of an inquiry and enable teachers and students to create and edit hypotheses, questions, answers, notes, reflections, mind maps, etc. Some of these components communicate with the web services APIs offered by external providers. For example, the data collection component sends and receives data to and from the ARLearn server by calling its web services. All components send user-tracking data to the Learning Analytics server via its web services API. A full list of the available inquiry components and their categorisation according to the weSPOT IBL model is provided in Table 1.
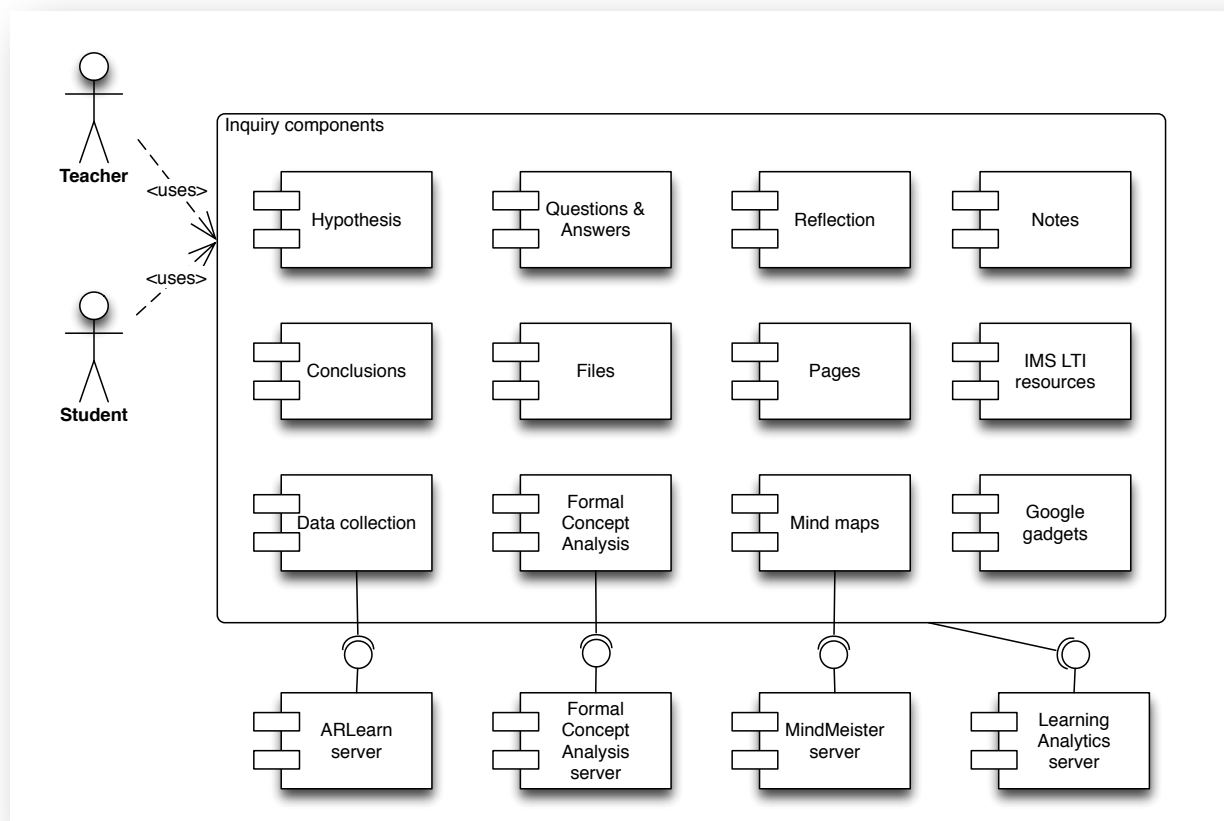
Figure 3: Architecture diagram of the weSPOT mashup environments

The weSPOT inquiry space enables its users (teachers and students) to create mashups of their preferred inquiry components, assign them to different phases of an inquiry, share them with other users and use them collaboratively in order to carry out an inquiry. When creating a new inquiry, users are provided with a set of recommended inquiry components for each phase of the inquiry. They can then customise these sets of components by adding, removing, or arranging inquiry components for each phase of the inquiry.

Figure 4 shows an example mashup of inquiry components for a particular phase of the "Batteries discovery" inquiry. The phase is labelled "Discuss the findings" and corresponds to the "Interpretation / Discussion" phase of the weSPOT IBL model. In this phase, the members of the inquiry use collaboratively three inquiry components in order to discuss and interpret their findings. They use the "Inquiry discussion" component to exchange their views asynchronously in discussion forums. They also use the "Questions" component in order to provide answers to the key research questions of this inquiry and vote for the best answers. Finally, they are creating and sharing mind maps containing interpretations of their findings via the "Mind maps" component.

The weSPOT inquiry space offers a number of core inquiry components for carrying out an inquiry, like the ones featured in the previous example (see Table 1 for a full list). However, users can also use external tools alongside the internal core inquiry components. These tools can originate from external Learning Management Systems (LMSs), such as Moodle or Blackboard, or from external repositories of widgets, such as the Google gadget directory. Users can create and share mashups consisting of their preferred internal and external tools in order to meet their needs and preferences, thus enriching the weSPOT inquiry space with additional functionalities offered by external providers. The following sections describe the mechanisms that we have developed for the integration of external tools and resources originating from LMSs, social networks and Google gadgets.

Table 1: List of the weSPOT inquiry components

Inquiry phase	Inquiry component	Description
Question / Hypothesis	Questions	Displays the inquiry's questions & answers
	Hypotheses	Displays the inquiry's hypotheses
Operationalisation	Notes	Displays the notes for the inquiry
	Pages	Displays a list of the inquiry's pages
	Bookmarks	Displays the inquiry's bookmarks
Data Collection	Mobile data collection tasks	Displays a list of mobile data collection tasks for the inquiry
	Image Slider	Displays an Image Slider
Data Analysis	Files	Displays a list of the inquiry's files
	Learning Analytics and Reflection Environment	Displays the user's analytics dashboard
	Formal Concept Analysis	Allows the analysis and visualisation of the concepts of the inquiry
Interpretation / Discussion	Inquiry discussion	Shows the latest discussions
	Mind maps	Displays a list of the inquiry's mind maps
	Questions	Displays the inquiry's questions & answers
	Blogs	Displays the inquiry's blog posts
Communication	Conclusions	Displays the inquiry's conclusions
	Reflections	Displays the inquiry's reflections
	Pinboards	Displays the inquiry's pinboards (collections of widgets)
	Twitter	Displays a list of tweets
	Twitter search	Displays a custom search from Twitter
Inquiry Help	Help: Question/Hypothesis	Help for the Question/Hypothesis phase
	Help: Operationalisation	Help for the Operationalisation phase
	Help: Data Collection	Help for the Data Collection phase
	Help: Data Analysis	Help for the Data Analysis phase
	Help: Interpretation	Help for the Interpretation phase
	Help: Communication	Help for the Communication phase
Other	Free HTML	Lets users type their own content in HTML
	Inquiry activity	Shows the activity of an inquiry in an inquiry component
	RSS Feed	Shows a RSS feed
	Tag cloud	Shows a tag cloud based on all the content on the site, in the inquiry or from the user
	Content by tag	Lets users find content by a tag
	Google Gadgets	Lets users add Google Gadgets to the inquiry
	Remote Tools	Lets users add IMS LTI Tools to the inquiry

Figure 4: A mashup of inquiry components for the Interpretation/Discussion phase of an inquiry

Integration with Learning Management Systems

In order to integrate external resources originating from legacy LMSs, such as Moodle, BlackBoard and more, we have used the IMS LTI specification[2]. LTI stands for *Learning Tools Interoperability* and has been developed by the *IMS Global Learning Consortium[3]*. The IMS Global Learning Consortium is a non-profit member organisation with a mission to enable the growth and impact of learning technology in the education and corporate learning sectors worldwide. The IMS Global Learning Consortium develops open interoperability standards and supports their adoption with technical services and programs that highlight effective practices.

The LTI specifies a standard way of integrating learning applications with platforms like LMSs, portals, or other educational environments. As shown in Figure 5, the primary use case behind the development of the LTI specification is to allow the seamless integration of web-based, externally hosted applications and content with other platforms. For example, an interactive assessment tool or a virtual lab hosted by a LMS can be securely connected to another educational platform in a standard way without having to develop and maintain custom integrations for each platform.
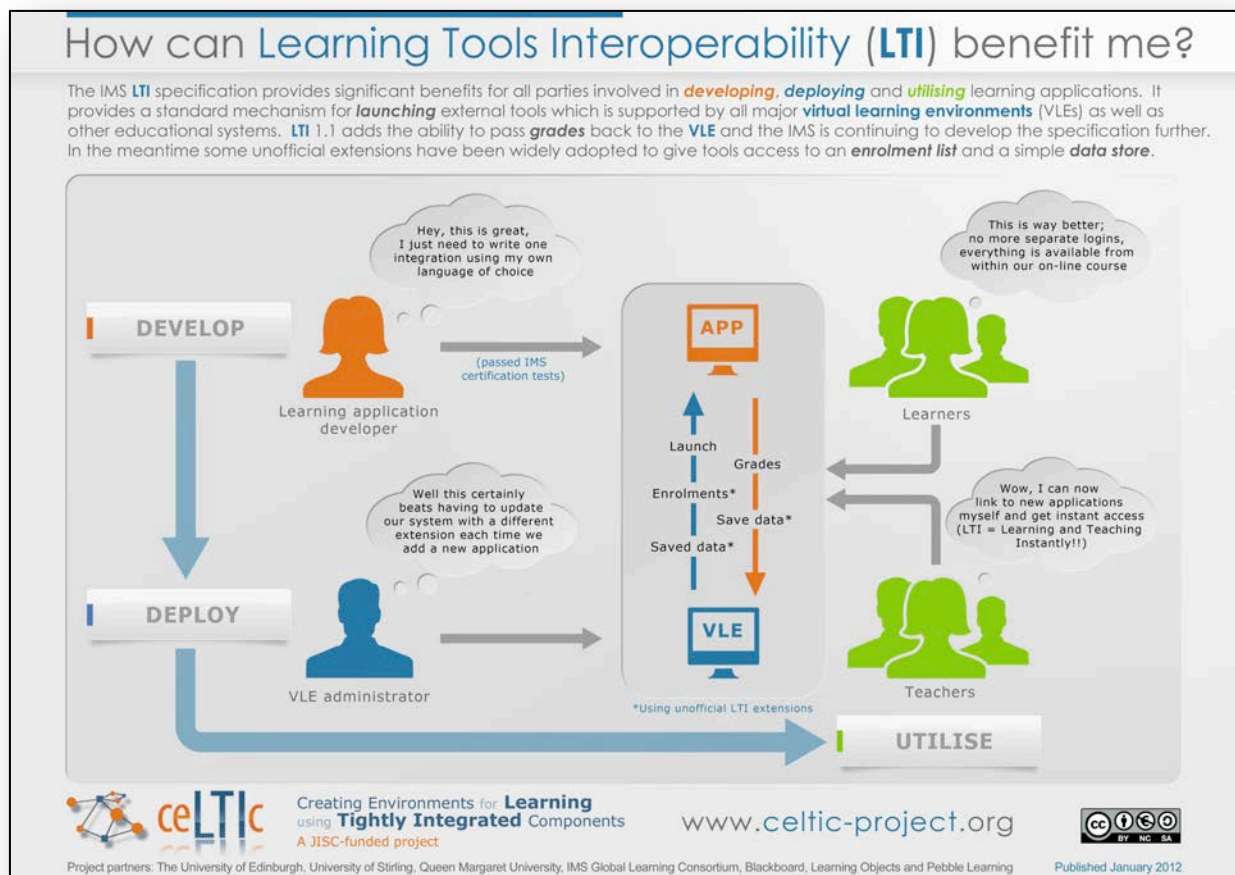

Figure 5: A usage scenario of the IMS LTI specification[4]

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[2] http://www.imsglobal.org/lti/index.html

[3] http://www.imsglobal.org/

[4] http://www.imsglobal.org/images/celticposter.pdf

The weSPOT inquiry space has been setup to act as an *LTI Tool Consumer*, meaning that it can offer resources originating from *LTI Tool Providers* (LMSs and other educational platforms). An extensive number of LMSs currently support LTI, including Moodle, BlackBoard and Sakai[5]. This means that content and tools from these LMSs can be integrated in any weSPOT inquiry, as described in the following scenario.

Let us consider a scenario where a teacher wants to use a Moodle course within a weSPOT inquiry. We will use the same example inquiry as before, i.e. the "Batteries discovery" inquiry. The Moodle course in question is an introduction to sustainable energy. First, the teacher needs to configure the Moodle course by selecting the "LTI Provider" option in the Administration menu of the course, as shown in Figure 6. In the configuration page shown in Figure 7, the teacher can select to offer the whole course, a particular section of it, or a tool like a discussion forum or a quiz. The teacher can also specify here the shared secret key that will be needed by the Tool Consumer to access the course.
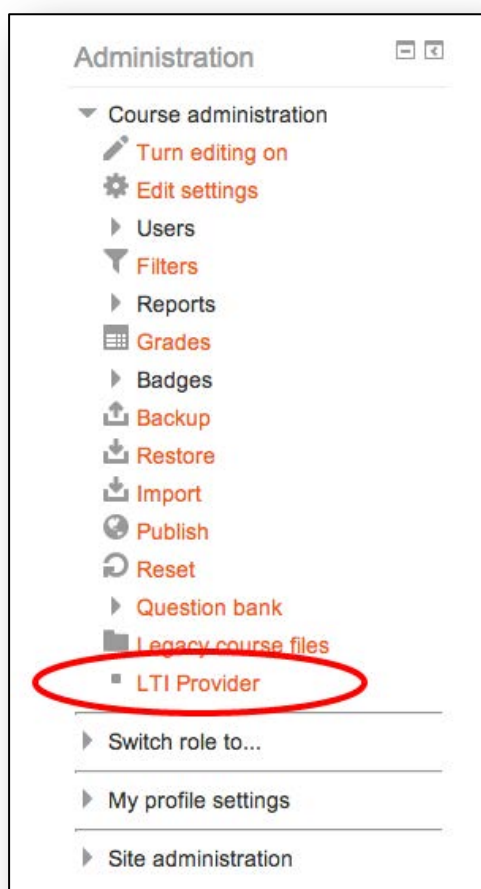

Figure 6: Setting up an LTI Provider in Moodle

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[5] http://www.imsglobal.org/cc/statuschart.cfm

Figure 7: Configuration of a Moodle course as an LTI Provider

In the weSPOT inquiry space, the teacher needs to create a new LTI tool by filling in the form shown in Figure 8. In this form, the teacher specifies the name, description and URL of the course, as well as its shared secret key. The teacher can also select the user data that will be sent to Moodle, i.e. the name, email and profile details of users.

The course is then ready to be used in the "Batteries discovery" inquiry. As shown in Figure 9, the teacher has included the "Remote tools" component in the "Plan the method" phase of the inquiry. This component allows students to launch the course without leaving weSPOT, as shown in Figure 10. User authentication is done automatically; Moodle authenticates the students with their weSPOT accounts. Their user data, i.e. name, email address and profile details, are sent to Moodle, which automatically registers them as students in this particular course.

Edit a Registered BLTI Tool

Name
Human-readable name to identify this tool

> An introduction to sustainable energy

Url
Remote Tool Url

> http://projects.kmi.open.ac.uk/role/moodle/local/ltiprovider/tool.php?id=4

Resource Key
(leave this field blank to have your key auto generated)

> Course: An introduction to sustainable energy

Resource Secret
(leave this field blank to have your secret auto generated)

Description
User-readable description of this tool

Embed content   Remove editor

B *I* U | ABC ≣ ≣ ↺ ↻ ∞ ∞ 🖼 66 HTML 🖼 🖼 🖼

The search for sustainable energy will dominate the twenty-first century. This course provides an introductory overview of the present energy systems and takes a brief look at where the world may find energy in the future – cleaner use of fossil fuels or renewable energy sources?

Word count: 46 p

Callback URL
Tool callback URL

Preferred Height

Send naming details

◉ Yes
◯ No

Send email details

◉ Yes
◯ No

Send profile details

◉ Yes
◯ No

Custom parameters
Each parameter has to be in a single line and format is "name=value"

Embed content   Remove editor

B *I* U | ABC ≣ ≣ ↺ ↻ ∞ ∞ 🖼 66 HTML 🖼 🖼 🖼

Word count: 1 p

Launch tool [Launch tool in Elgg ⇕]

Debug Launch

◯ Yes
◉ No

[Register] Cancel

Figure 8: Setting up access to a Moodle course in weSPOT

Figure 9: A Moodle course featured within a weSPOT inquiry

Figure 10: Launching a Moodle course from inside weSPOT

Integration with social networks

The following elements of social networks have been integrated with the weSPOT inquiry space:

- Social login
- Social sharing of inquiry resources

The next sections explain in more detail how these elements have been integrated, as well as how they can be used by teachers and students.

Social login

Users of the weSPOT inquiry space can login with their Facebook, Google, or LinkedIn account. Authentication is handled via the OAuth protocol[6], meaning that Facebook, Google and LinkedIn act as OAuth providers. Users who choose to login in this way are asked to login to their preferred OAuth provider. If the authentication in the OAuth provider is successful, they are then forwarded back to the weSPOT inquiry space, where the authentication process is completed. If this is the first time they use this means of authentication, a new weSPOT account is created for the new user, importing the user's profile data from the OAuth provider, i.e. their name, email address, profile picture, profile description and URL of the user's profile on the OAuth provider.

It should be noted that in line with the EU and national regulations that do not allow minors to have social network accounts, weSPOT also offers an alternative means of authentication via an account users create specifically for the use of the weSPOT tools. This account is common across all weSPOT tools, e.g. the weSPOT inquiry space, ARLearn, etc.

Social sharing of inquiry resources

Users of the weSPOT inquiry space have the ability to share any inquiry resource, e.g. a hypothesis, a data collection task, an inquiry phase, or a whole inquiry, in their preferred social network. They can do this by selecting the "Share" option from the right sidebar of the weSPOT inquiry space, as shown in Figure 11. When selecting this option, users are presented with a list of popular social networks, such as Facebook, Twitter, Tumblr, and more. They can then publish the inquiry resource in their selected social network and share it with their contacts on that network.
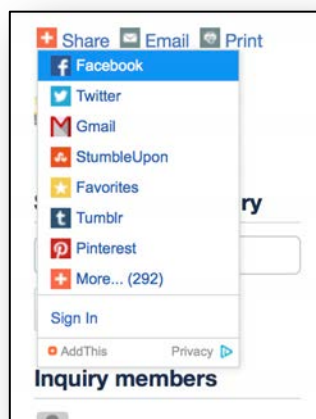

Figure 11: Sharing weSPOT inquiry resources on social networks

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[6] http://oauth.net/

Integration with Google gadgets

In order to widen the variety of external tools available to use inside a weSPOT inquiry, we have enabled users to include any Google gadget in their inquiries. Google gadgets are standard web widgets, consisting of components built in XML, HTML, and JavaScript. XML is used to describe the specifications of the widget and contains instructions on how to process and render the widget. The XML description of the widget can contain all of the data and code of the widget, or it can have references (URLs) for where to find the rest of the elements. HTML is used to deliver the static content of the widget. Finally, JavaScript is used in order to add dynamic elements to the widget. Google gadgets are available for free from the Google gadget directory[7].

In order to add a Google gadget to an inquiry, the inquiry owner (i.e. the teacher) needs first to add the "Google gadgets" inquiry component to a phase of the inquiry. In the configuration of the component, he needs to provide the title of the gadget, its code and optionally the height of the gadget, as shown in Figure 12a. The code of any Google gadget is available to copy from the Google gadget directory. Figure 12b shows an example Google gadget as a weSPOT inquiry component. This Google gadget displays a YouTube video on how to create a battery.

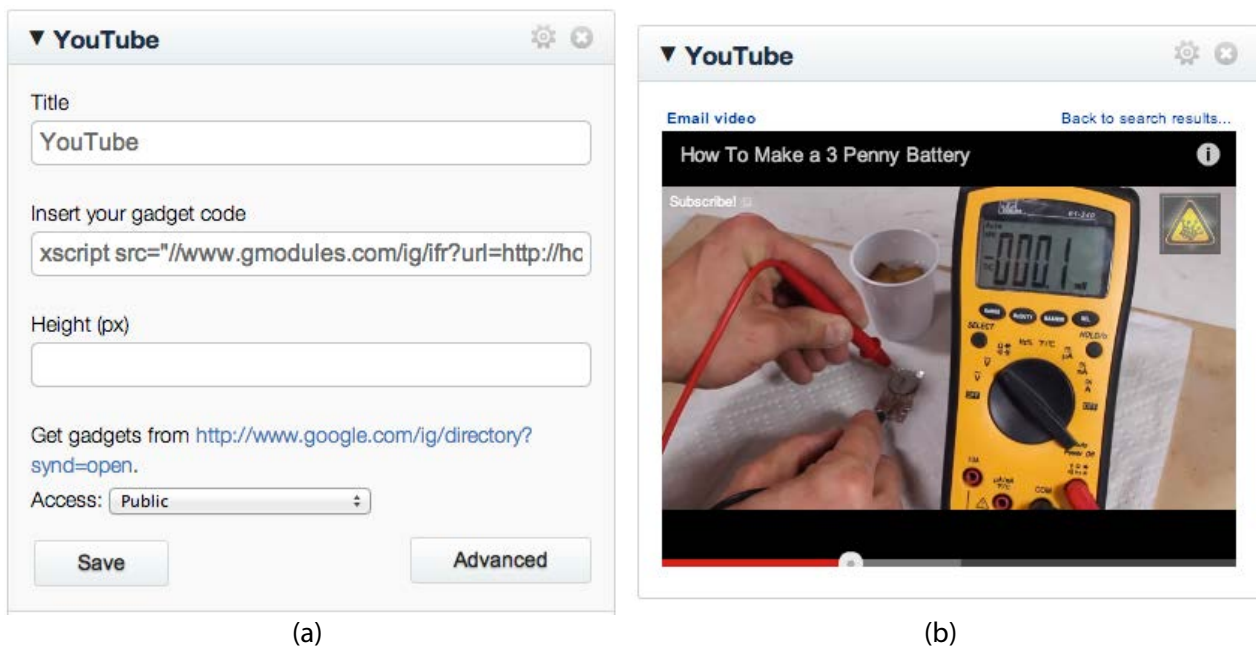(a)   (b)

Figure 12: (a) Configuring a Google gadget as a weSPOT inquiry component and (b) displaying a YouTube video inside the gadget

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[7] http://www.google.com/ig/directory?synd=open

Conclusion and next steps

This report presents the work conducted so far under Task 3.2 of WP3, regarding the development of the infrastructure that enables the weSPOT mashup environments. In particular, we have developed an IBL environment that follows a widget-based architecture and allows users to build their inquiries out of mashups of inquiry components, share these mashups and use them collaboratively with their peers. In order to address their particular needs, users can also include in their inquiries external tools and resources, originating from LMSs, such as Moodle or Blackboard, or from external repositories of widgets, such as the Google gadget directory. They can also use their preferred social network to authenticate themselves, as well as share their inquiry resources in their social networks.

We are now in a stage of the project where we are preparing our toolkit in order to run a series of real-life pilots with selected groups of users (teachers and students) mainly in secondary education. These pilots will help us acquire a better insight into the usefulness and shortcomings of our tools and will give us the opportunity to further improve them in order to offer a better experience to our users.