A new design hope: designing sustainability for all and the LeNS worldwide open network[1]

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1. English review: Rita de Castro Engler

1 Sustainable development and the role of design

The concept of sustainable development entered the international scene in the early 90s. Most authors agree that we are "beyond all limits" and close to the collapse of the ecosystem (KLEIN, 2015; UN, 2015; NETWORK, G. F. 2018). Some examples of scientific analyses and estimations to illustrate the situation are: by the middle of the 21st century, 5 billion people in 60 countries may be faced with water scarcity (BUREK *et al.*, 2016); each year, 7 million people prematurely die due to air pollution (WHO, 2018); the number of undernourished people reached 815 million as of 2016, indicating a critical state of food insecurity in the world (FAO, 2017). These are just a few of endless studies forecasting that the system is about to collapse, which implies a system discontinuity, i.e. an urgent radical change, is required, as well as preventive actions as opposed to acting after the damage has been done. It is fairly obvious, and we recognise that this calls for an active role for designers, to envision and design radically new sustainable solutions for all. In other words, since the '70s, Design for Sustainability (DfS) has emerged and increased its role as a promising field for achieving a radical system change (CESCHIN *et al.*, 2016; VEZZOLI, 2018).

2 Design HEIs challenges

DfS is a field of action that has been developing since the 90s and it is still evolving at a rapid pace. However, DfS hasn't been able to bring substantial change at a global scale due to the inadequacy of its dissemination. There is a need for designers to have updated theoretical knowledge as well as updated know-how that enable them to be oriented towards sustainable design practices. Eventually, design Higher Education Institutions (HEIs) and design researchers/educators need to be able to build a new generation of designers with a solid knowledge base, as well as effective methods and tools to be able to play an active role in the transformation of our consumption and production patterns.

Design HEIs must play a key role, acting effectively and promptly to establish a radically new agenda aimed at responding to sustainable development issues and sharing a new ethos locally and globally.

3 LeNS: the vision, the ethos and its evolution

Since 2007, the *Learning Network on Sustainability (LeNS)* has been operating within this framework; it is an open multi-polar network of design Higher Education Institutions (HEI) aiming at the diffusion of Design for Sustainability (DfS) in research, education and practice. "Education is the most powerful weapon which you can use to change the world" said Nelson Mandela once which widely agreed to be true. That means it is fundamental to build a new generation of designers (and design educators) who are aware, committed and well equipped to be active and effective in contributing to the transition towards a sustainable society, for all.

FIGURE 1 – The LeNS world open network. Source: www.lens-international.org

LeNS was founded in 2007, with the launch of the homonym European Union (EU) bioregional funded project (LeNS, 2007-2010, Asia Link programme) with 7 partner universities from Europe and Asia, when the DfS discipline was too slowly diffused (and many times without the right conceptual and operative tools) in design HEIs. Nowadays, the LeNS network includes 141 HEIs grouped in 16 LeNS regional networks in every continent (see FIG. 1).

Even though most of the regional LeNS networks were launched without financial support, it is true that its development and growth has been greatly supported by three consecutive European Union (EU) multi-regional programmes, i.e. including even non-European partners. These projects are the following:

- 2007-2010: LeNS: Learning Network for Sustainability project funded by European Union Asia link, biregional Europe–Asia;
- 2013-2016: LeNSes: Learning Network for Sustainable energy systems project funded by European Union Edulink II, biregional Europe–Africa (see more on http://www.lenses.polimi.it);
- 2015-2019: LeNSin (on going): international Learning Network for Sustainability project funded by European Union Erasmus+, multiregional Europe–Mexico–Brazil–South Africa–India–China (see more on www.lens-international.org).

4 The LeNS open ethos

In the period when the LeNS network was first launched and the first web-platform was being designed and implemented (2007), there were already web-platforms developed by organisations and universities to promote and support an open source and open access educational and learning model (MATERU, 2004; PEÑA-LÓPEZ, 2007). However, today, in the open education and open research scene, there are not just a few front-runners anymore. This is, in fact, part of a world-wide debate about having research outcomes open and accessible to all, and there are now plentiful programmes on OER (Open Educational Resources) (KERRES, 2015) as well as some web-platforms dedicated to them. The exponential diffusion of Open Resources (TUOMI, 2013; SANTOS-HERMOSA, 2017; WELLER, 2015) has proven more and more over time the rightfulness of this vision and the relevance of the LeNS ethos and its main tool, i.e. the web-platform.

In this chapter, we explain the approaches of open-access, free of charge, and multipolar learning-by-sharing ethos, strategies and models adopted within LeNS.

4.1 Favouring free access to didactic content

Some of the existing OER web-platforms are focused on favouring free access to didactic content, as can be seen in several solutions implemented by various universities. Examples of this are the Massachusetts Institute of Technology's *Open Course Ware (see http://ocw.mit.edu),* Carnegie Mellon's *Open Learning Initiative (see http://oli.cmu.edu/)*, or the *Open Course Ware Consortium (see* https://www.oeconsortium.org/*)* (developed in collaboration with more than 200 HEIs). In these platforms, it is possible to freely access and download course materials (texts, slide show presentations, and video recorded lectures) that reflect the undergraduate and graduate subjects taught in the related institutions. The same approach has been regarded as an advanced practice to inspire the first realisation of the LeNS web platform.

4.2 Development of learning resources following a certain standard

In some other initiatives, the focus is on the development of so called learning objects (in the LeNS network they are called Learning Resources, i.e. *courses, lectures, tools, case/criteria, projects)* following a specific standard, as, for example, the *Centre for Excellence for the Design, Development and Use of Learning Objects* (BRADLEY;BOYLE, 2004; BOYLE, 2006). Similarly, in the LeNS web-platform, it is possible to access learning objects that are developed using the same multimedia format and standards instead of having didactic material in different and heterogeneous formats. This trait facilitates the adaptation and design, by other teachers, of specific learning paths (for example, combining learning resources belonging to different courses).

4.3 Facilitating the reuse and adaptation of the same contents built in a modular logic by other teachers and researchers

Another approach of the LeNS network and its web-platform is to facilitate the reuse and adaptation of the open access content by other teachers and educators by designing and building the didactic material in a modular logic such that the contents could be easily re-adapted and re-assembled by other teachers in relation to their specific learning needs and local agenda. Early examples of this approach are *Connexions*

(Baraniuk *et al.*, 2004) and the *Sharing Learning Objects in an Open Perspective* project (RAVOTTO, 2007).

4.4 Free access to teaching methods and modalities along with the learning content

Besides allowing free access to learning content (didactic materials), the LeNS web-platform is also aimed at allowing free access to teaching methods and modalities. This approach was also adapted by *LeMill* (TOIKKANEN, 2008). It permits educators to download didactic materials identifying the best teaching modalities according to the contents to be taught.

In some of these web-platforms, the upload of content is restricted to specific persons (for example to professors or to the partners of a project consortium); in other cases, even the development and upload of learning content is open to everybody (for example see the previously mentioned *Connexions* and *LeMill*). In the case of LeNS web platforms, only the partner HEIs of the LeNS Network can upload courses. However, joining the LeNS network itself is a very open and easy process. Therefore, it can be said, in other words, that the LeNS web-platforms are characterised not only by a free fruition of knowledge, but also by a collaborative production of knowledge driven by the inclusive ethos of the LeNS project.

5 LeNS process and approach

LeNS' growth has been supported and facilitated, as previously mentioned, by three consecutive EU supported multiregional projects.

All 3 EU projects have been characterised by a set of activities, desk research, case studies, seminars, transcultural pilot courses and online learning modules; and each of them has been evaluated by appropriate internal and external expert observers, aiming at evaluating and refining the outcomes, i.e. various formats of learning resources as a result of each of those activities. In all 3 EU projects, a set of consecutive pilot courses (involving teachers from different contexts) was organised to both test and improve the learning-by-sharing open mechanism as well as testing and refining the knowledge-base and know-how (methods and tools) developed.

All the learning resources were shared with others right after the end of each course. Then, these resources were eventually reused and remixed in each following pilot course. They were taken through a sort of multi-polar evolutionary improvement process. These iterations with a systematic feedback and report loop resulted in the articulation of research, learning resources (The learning resources' main structure is further elaborated in section 8.1), and the refinement and redevelopment of the LeNS web-platforms and LeNS labs.

Both the strategies for an active, cohesive, open and multipolar network of networks, and the open ethos have been formalised into a *manifesto* firstly signed in Bangalore in 2010 (see www.lens-international.org/). In fact, during the last decade, the number of HEIS joining the network, despite not being partners in any of the EU funded projects, has rapidly grown (see section 3).

6 The motivations of LeNS Web Platform's open access, free of charge modular learning structure

The LeNS web platform is an open platform that allows a decentralised and collaborative production and fruition of knowledge. It can be described as a web-platform hosting a set of open access learning resources and teaching materials, organised as: *courses* (lecture videos, slide shows, texts, audio, etc.); *lectures; tools; cases and criteria;* and *projects*. Any design researchers/educators, as well as design students, designers, entrepreneurs and interested persons/organisations worldwide could have access to the learning resources in the platform to *download* (free of charge), *modify, remix and reuse* them (in an open access logic). The open educational resources are meant to be shared, copied, used, adapted and re-shared easily. In order for this to be done efficiently, it needs a platform that is developed particularly to meet its ethos. Available information technologies made this possible and helped widen the creation and use of open learning resources for research and education.

The following text illustrates why and how the LeNS Web Platform – a *web-based*, *free-of charge*, *open-access*, and *modular l*earning model – favours a more effective researching, teaching and learning mechanism,

potentially capable of tackling some of the problems related to the traditional methods of producing and transmitting educational information (within the field of DfS). In the same way, the threats related to this kind of learning model are presented and discussed right after in section 7. The sections in question are written based on a literature review, analysis of the existing open-access and open-source web-platforms, and the results of the LeNS project gathered so far.

6.1 Facilitating knowledge dissemination

A possible path to facilitate knowledge dissemination through teaching materials is making them free and available online. This enables the least expensive option and the easiest access, since users can use teaching materials online at no-charge, or download and print them (in full or only the necessary parts). Moreover, geographic location is no longer a barrier for having access to research results and teaching materials. The matter of access to knowledge becomes even more crucial in a research field like DfS, since it is characterised by still being an open field of research; it is far from being disseminated as it could and should be (there are some concepts that are already consolidated); and sustainability is an issue requiring urgent actions by all parties worldwide (as explained in the introduction). Moreover, this is an area in which knowledge evolves at a rapid pace, and therefore *free online access* can potentially allow rapid dissemination of updated knowledge, with obvious positive effects on teaching, learning and research.

6.2 Facilitating the upgrade of knowledge

Knowledge is in constant advancement: new ideas, concept and theories are introduced; existing information is reviewed and refined, while outdated information is removed. The traditional process by which this takes places includes publication in books and refereed journals; research results are submitted to publishers, pass through a peer-review process for independent verification and, finally, are published. This is an important process to guarantee the scientific reliability of what is published; nevertheless, it could be inefficient where knowledge evolves at a rapid pace. In other words, for rapidly changing knowledge, the traditional process

of transmitting research results could be supported by other innovative ways of knowledge sharing.

Researchers and teachers (and students), should have complementary ways to access to the most updated knowledge and discoveries in their respective fields.

To reduce this delay, some researchers have increasingly adopted, via internet and through information technologies, and informal exchanges of knowledge with the most well-known scientific communities. In online environments, colleagues can share knowledge freely, allowing works to be annotated, discussed, reworked and rapidly republished (HENRY, 2004). For these reasons, an *online platform* where knowledge is shared can potentially increase the dissemination of new ideas and research results, thus facilitating a ready access, review and update of information. Moreover, this fresh shared knowledge stimulates innovation, since researchers can immediately start to build on it. Open access materials and open source tools can be accessed and obtained at no cost, but they can also be updated and the contributions made can be shared with others as well, keeping content timely, enriched, and relevant.

6.3 Creating shared educational standards in design for sustainability among a large worldwide group of collaborators

Collaborating on OER through the LeNS web-platform could help to achieve shared educational standards among a group of collaborators such as researchers and educators working in the same field in a country, region or worldwide; and ensure consistency among their educational resources.

6.4 Reducing the cost of course materials

LeNS might help reduce costs of course learning materials regarding the production and distribution. Cost-efficiency of OER has been shown in many studies (BLISS *et al.,* 2013; Wiley et *al.,* 2012). New course materials can be created reassembling and/or reusing the existing ones that are on the LeNS web platform. This is more cost effective than creating course materials from scratch.

6.5 Decreasing social inequality for researchers and teachers caused by restricting access to academic research

One of the motivations of the open access movement is to solve the problem of social inequality created by restricting access to academic research through high prices (SUBER, 2012). This especially disfavours researchers and teachers in low and middle income contexts. LeNS, as a project, is not targeted exclusively to those contexts, nevertheless its ethos well supports the researchers, educators and students in low and middle-income contexts, i.e. it is coherent with the aim of supporting social equality for all researchers by easing the economic challenges to accessing academic research in the DfS field.

6.6 Decreasing social inequality for students caused by restricting access to high-quality education

Even students can benefit from this kind of transmitting of knowledge, since learning resources can be constantly reviewed and updated. Moreover, they can access these materials on their own to supplement the education they receive in a classroom. Availability of OER could help them overcome the barriers preventing them from accessing the knowledge they need, such as high cost. UNESCO sees OER as a means of promoting access and equity (UNESCO, 2012) based on the premise of the United Nations Universal Declaration on Human Rights that "Everyone has the right to education" (FARROW, 2016).

6.7 Facilitating collaboration between researchers/teachers

In the research fields with rapid development, like DfS, it is of key importance that researchers/teachers work with each other across institutions and geographic boundaries in order to increase the focused sharing of knowledge and experience. This allows research results to be readily discussed, refined and translated into teaching materials. This way, colleagues from the same scientific community can collaborate directly with each other, modifying and integrating contributions produced and edited by others, therefore keeping the knowledge up to date; reuse of knowledge is encouraged and new ideas can readily evolve (Baraniuk *et al.,* 2004). For

this purpose, an *online web platform* stimulates collaboration between researchers/teachers which can potentially foster the advancement of knowledge and therefore foster the realisation and delivery of higher quality courses (BJÖRK, 2001).

In the book *Open Access,* Peter Suber (2012, p. 44) writes that:

> Now that the internet is at our fingertips, open access is within the reach of researchers and research institutions acting alone and needn't wait for publishers, legislation, or markets. Authors, editors, and referees—the whole team that produces peer-reviewed research articles—can provide open access to peer-reviewed research literature and, if necessary, cut recalcitrant publishers out of the loop.

As such, the LeNS web-platform can not only escalate robust knowledge building in the field of *DfS* (as far as it is produced in an open sharing research environment), but also accelerate it by providing free access to more content and making them available earlier than the other means of dissemination.

6.8 Creating a bridge between researchers and enterprises, NGOS, and governmental institutions

Access to research literature is key for innovative enterprises, and a range of governmental and non-governmental services (TENNANT *et al.,* 2016). The LeNS Web Platform, while functioning as a bridge between various parties in academia, could also connect academia and researchers with enterprises, NGOs, governmental institutions and other organisations providing them access to the latest research outcomes and thus, fostering innovation within those establishments.

6.9 Facilitating knowledge adaptation in relation to different contexts

In research fields like DfS, in which the vision and approach to be adopted vary in relation to the context characteristics and sustainability agenda, it is important to find innovative sharing mechanisms. In fact, knowledge and the way in which it is delivered to learners must take into consideration the great diversity of each context (in terms of economic,

social and cultural characteristics). Going into the specific case of DfS, we must ensure that the development and delivery of teaching materials reflect both a shared macro agenda on sustainability, and localised, contextual sustainability agendas that respond to local needs and demands in the economic, social and cultural levels.

For these reasons, knowledge transmitted in a *modular* and *open-access* modality (but also organised in courses in order to answer different teachers' needs and starting conditions, i.e. new course activation or course upgrade), could meet the previous mentioned needs, enabling easy adaptation by teachers in relation to local needs and specific context. Moreover, if this process is shared through a *web-platform*, it could also facilitate and stimulate teachers operating in similar contexts to share experiences and teaching materials.

7 The threats of a free, open access, open-source and modular learning model

The production and sharing of knowledge in an open mindset is not only linked with potential benefits and opportunities, but also with potential threats and problems. The main problem is in fact the control of the scientific reliability of the produced content (MATERU, 2004). In addition, there is also the issue of knowledge dispersion when open platforms accept any kind of content (not focused to specific themes), targeted to any kind of user.

7.1 Threats regarding the scientific reliability of teaching materials

If the upload of learning resources in a web-platform is open to everybody, it is quite clear that there is a problem related to the scientific reliability of the available content. The scientific reliability of the OER was identified as one of the most important deterrents of OER (ALLEN, 2014). To tackle this weakness, a possible answer could be to establish a scientific board to guarantee the scientific quality of the uploaded content. In addition, or as an alternative, the possibility of uploading materials could be restricted to specific institutions/teachers. To tackle these issues the LeNS network has adopted a very effective innovative strategy, which will be presented in SECTION 8.

7.2 Barriers to address the scientific community

If knowledge platforms are open to different and unrelated topics (for example, from arts to engineering to history, etc.) they run the risk of becoming too dispersive and, as result, being unable to address the scientific community in an effective way. In order to tackle this potential problem, an open web-platform should focus on specific and targeted topics, as in the case of LeNS, which develops learning resources targeting DfS issues. Furthermore, in LeNS, besides the regionally based LeNS platforms, thematic LeNS platforms could also be launched (as is the case of the Learning Network on Sustainable Energy).

8 LeNS: a decentralised Open Learning E-Platform (OLEP)

The LeNS platform is a decentralised Open Learning E-Platform, a platform of locally-based platforms. In other words, a platform that has a series of regionally-based platforms (each of them installed on servers of one of the HEIs in each regional LeNS Network and each platform regionally managed by the partners of each regional LeNS Network). This structure has been conceptualised, designed and implemented with the aim of safeguarding and guaranteeing the scientific reliability of the uploaded learning resources (decentralised responsibility of scientific quality checking), as well as the process of enrichment and enlargement of the learning resources. This has increased and will continue to increase the scientific quality, diversity and overall quantity of available learning resources. Further arguments on controlling scientific reliability of the learning research and adaptation of the learning research to the local context are made in the 6th chapter.

The distributed nature of the Platform is based on the same principles of Distributed networked Economies regarding sustainability and resilience in particular (JOHANNES, 2005; LENSIN POLIMI TEAM, 2018; PETRULAITYTEA, 2017; VAN DEN DOOL *et al.*, 2009). Because there are distributed platforms rather than a central one, we can ensure that there is no disruption (short term or permanent) to the whole network when one platform is down. This is especially important for the long term sustainability of OER platforms due to lack of a commercial business model.

As an open platform dedicated to the DfS topic, with an innovative way of navigating through the platforms (such as local platforms of Chinese partners, Indian partners etc.) and its resource types (courses, lectures, tools, cases/criteria, projects) using switches as well as an advanced search engine designed particularly to allow *easy access to its open source content* i.e. effectively locating relevant learning resources, the platform is intended to overcome one of the biggest deterrents for open educational resources (OER) (ALLEN, 2014; BUTCHER, 2015; JOHN *et al.*, 2016).

It was decided in 2008 that the same LeNS *web platform (OLEP)* should be open access and free of charge, i.e. it can be downloaded, installed in other local servers and adapted/reconfigured in relation to specific needs, areas of interest and themes. That means any educational institution (or teacher) can in fact 'generate' a new *LeNS-based* web-platform, reconfiguring it by re-defining partners, the scientific board, the specific themes (that are related to design for sustainability), and the geographical representation. Members of new 'replicated' LeNS platforms are responsible for the scientific reliability of the uploaded contents. The LeNS platform could be defined as a decentralised open access web platform (in fact, the first one!).

Therefore, the LeNS Web platform (of platforms) has been developed as a regenerative, 'replicable' web platform. In other words, as far as the same LeNS web-platform is downloadable free of charge as open-access:

- any educational institution, teacher, or sustainability-focused network can generate a new LeNS-based web-platform, reconfiguring it by re-defining partners (the scientific board), the sustainability focus, and the geographical representation;
- any new generated web-platform uploads and manages learning resources independently (also controlling the scientific reliability);
- any new generated web-platform is linked to the others. Even though the platforms are regionally based to upload learning resources locally, it is designed in a way that allows searching and access to the content of any other platform with switches (on the interface) to turn the platforms it is linked to on and off.

A proliferation of locally/content-based interconnected networks of design communities is in this way supported (and promoted). As of now, distributed LeNS Web Platforms from LeNS Brazil, LeNS China, LeNS India, LeNS Mexico, LeNS South Africa, LeNS Europe, LeNS Italy, and the thematic LeNSes energy system Platform are up and running (FIG. 2). Each of these affiliated and thematic networks are linked with each other in a multi-polar structure, simultaneously independent as well as interlinked by an overall platform allowing navigation among all the connected platforms.

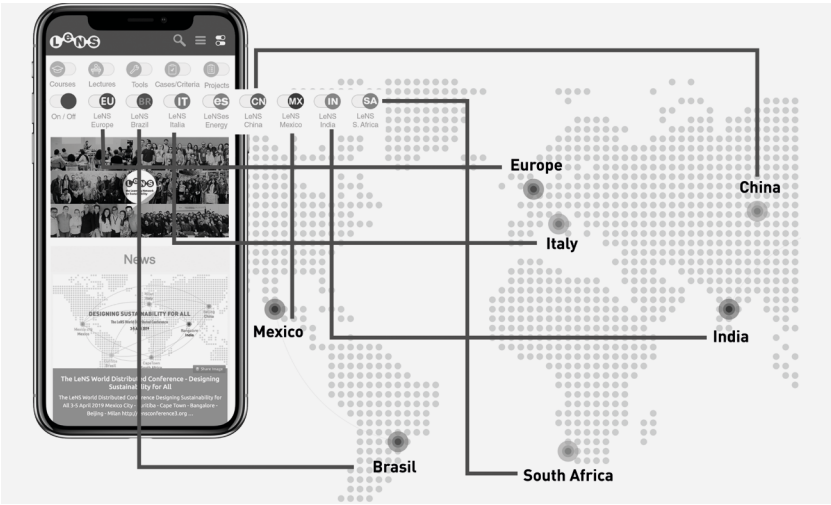

FIGURE 2 – Distributed LeNS Open Learning E-Platform of Platforms (OLEP): one can move among the platforms using switches on the interface. Source: www.lens-international.org

In other words, the LeNS project has the ambition of being a catalyser for actions and exchanges on education (and research) in DFS worldwide, through the production of the previously mentioned package of open-access courses (OLEP), and a replicable web-platform designed to be easily distributed on a worldwide scale. It has already moved from the seven existing locally-based platforms to the 14 established LeNS regional networks. In fact, it is open to establish and include new LeNS regional networks.

8.1 The learning resources' main structure

The OLEP contents consist of the education resources developed in/for the courses in the LeNS partner HEIs. These contents are structured particularly for courses related to DfS, making them easily accessible and the most useful for the users of the platform, especially for the most prominent user types that are teachers and researchers working in the field of DfS. As already introduced, the main categories of the OLEP resources (FIG. 3) that are made accessible on the platform's home page menu are courses, lectures, tools, case / criteria, and projects. Below, each of these main categories are explained in detail.

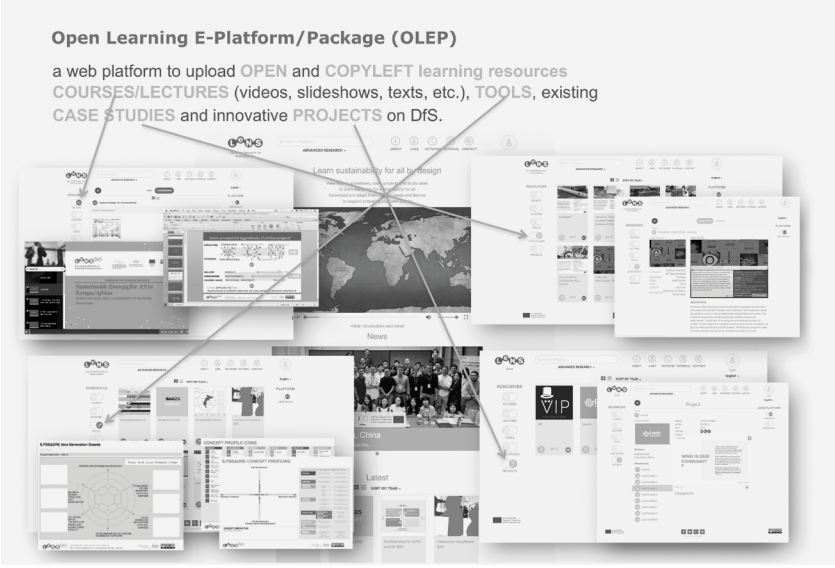

FIGURE 3 – Main sections of the OLEP (on DfS). Source: www.lens-international.org.

COURSES: This category is for the specific courses that are in the LeNS partner institutions. There might also be pilot courses or courses that are under development that a teacher is planning to launch in the future. Within these courses, users could view the lectures of the courses, which is also the next main category. The lectures within a course could be grouped according to wider subjects they are related to. Courses can be sorted in the list view according to author, country, year, language or category. They can be accessed using

the advanced search function filtering them according to the tags: language, author, country, year and/or institution.

LECTURES: This category is for each lecture within a course, which usually has one or more core topics taught in a day in a class. Each lecture contains the teaching materials and tools that are part of that lecture oriented to support students, teachers, or designers. These materials may include slideshows; slideshow + video recorded lecture; slideshow + audio recorded lecture; video; text; or other formats. Lectures can be sorted in the list view according to author, country, year, language or category. They can be accessed using the advanced search function filtering them according to the tags: language, author, country, year, institution, contents, course and/or format.

TOOLS: This category is for the tools to be used by students of the courses (either to learn a DfS topic or to support a design process in a student design project); or by designers or any interested person to use in real-world design practices. Tools can be sorted in the list view according to author, country, year, language or category. They can be accessed using the advanced search function filtering them according to the tags: language, author, country, year, institution, category, and/or producer.

CASE / CRITERIA: This category is for case studies in DfS. They may be related to the courses (e.g. case studies teachers created to teach a subject or case studies students created as part of a course activity) or they may not be affiliated to any existing course as they may be created by researchers working on topics that are not yet part of any existing curriculum. Their aim is to support the teaching of DfS subjects, to support researchers working in DfS or to support research to be made as part of a design process by either students or designers. The list of case studies can be viewed in relation to the Design Criteria they are related to. They can be sorted according to year, title, author, country, language or type. They can be accessed using the advanced search function filtering them according to the tags: language, author, country, year, institution, category, producer, and/or designer.

PROJECTS: This category is for student (/learner) projects related to DfS. They are mainly for student projects made in a course or made for a competition call. The aim of this section is to support project calls or submission processes

in courses or competitions; to create synergies among students, learners, designers, and businesses worldwide through sharing project ideas; and to support researches in the field. Projects can be sorted in the list view according to author, country, year, language or category. They can be accessed using the advanced search function filtering them according to the tags: language, author, country, year, institution, and/or course. The OLEP contents in general can take different formats: *texts* in different formats, such as print-on-demand from the publisher (with ISBN code), printable in common printers (whole or partially), readable on screen, editable files (for open-sources documents, modifiable by the user); *slideshow presentations;* composed presentations that integrate *video-recorded lectures* (teachers classes and students presentations) *with slideshow presentations*; *audio* or *audio/video files* (e.g., recorded lectures); *software* and other *tools*; *archives* and *databases of best practices*, *examples*, etc.

8.2 OLEP functionalities

CONNECTION OF DISTRIBUTED OLEP PLATFORMS

The OLEP platform of platforms is designed as a distributed network. Each OLEP platform is managed independently in terms of technical, technological, functional and scientific management. On the other hand, each platform that is part of the same Network (in this case, the LeNS Network) is connected with each other. From one platform, a user can search content in any other platform by choosing them through the switches on the interface (see FIG. 2).

NAVIGATING AMONG SINGLE OLEP PLATFORMS WITHIN THE NETWORK

A user can also navigate among different platforms that are part of the same Network. Moving to another platform can be done by switching off all platforms except one, in other words when all platforms are switched off, the user will be navigated to the platform they switch on. Once a user is logged in to their local platform (or any platform in which they signed up); if they move to another platform from there, they stay logged in. This functionality is designed so that users don't have to sign up in each platform and they don't have to sign in every time they switch from one platform to another. User profiles and credentials are kept and managed only in the platform they signed up from and only the state of being "logged-in" is transferred to the other platforms as the user navigates through them.

8.3 Modalities of accessing the learning resourses on the platform

RESOURCE SWITCHES: The main content categories (Courses, Lectures, Tools, Case/Criteria, Projects) are explained in section *"8.1 The Learning resources' main structure"*. These categories (FIG. 4) are made accessible to the user with switches on the platform homepage. Users can turn on one or more of the switches in order to view the contents belonging to a certain category or certain categories.

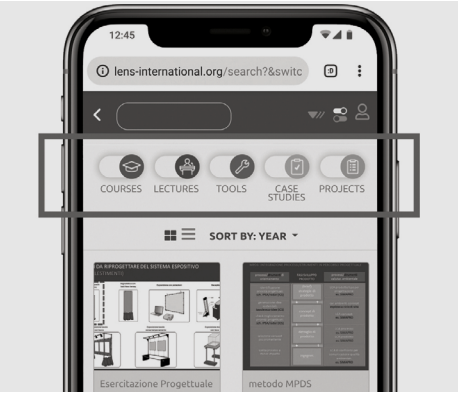

FIGURE 4 – Resource Switches (in mobile device view)
Source: www.lens-international.org.

SEARCH: All the content that exists in a big network could be tremendous. Therefore, it is very important to ease finding and accessing appropriate learning resources (BUTCHER, 2015, JOHN *et al.*, 2016). For this reason, there is a fast search function accessible from the top of any page that works in combination with the platform switches. Resources switch such that searching is done within the switched-on platforms and resource categories.

ADVANCED SEARCH: In addition to the fast search that is accessible from any page, there is also an advanced search function which can be activated through a button placed next to the fast search function (FIG. 5). Advanced search also works cooperatively with the platform and resource switches. In addition, there are filters in the advanced search to assist in the search of content by further narrowing down the results. Each resource type has a different filter associated with them and in the advanced search, only the filters that apply to the turned-on resource types are activated.

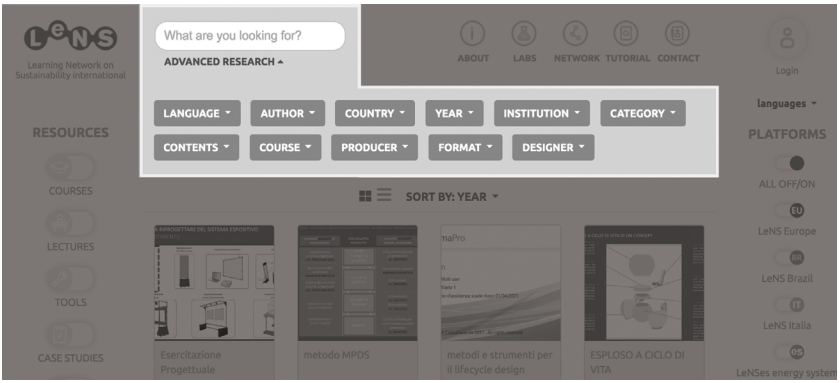

FIGURE 5 – Advanced Search Functionality Source: www.lens-international.org.

VIEWING AND DOWNLOADING LEARNING RESOURCES: Once the user finds content they are interested in using in one of the three ways explained in the previous section, they could click on it to view the details of it (FIG. 6). In *tools, case studies and projects* resource types, there are individual objects (which might contain one or more files related to that object) such as a case study or a tool. In *lectures* the user can view and download Power Point Presentations and/or Videos (recorded lectures with the voice and video recording of the lecturer along with the images of the presentation) as well as any other object related to that lecture such as tools. In *courses*, the user can view the detailed information of the course and a bundle of lectures (grouped into main topics of the lecture) within that course.

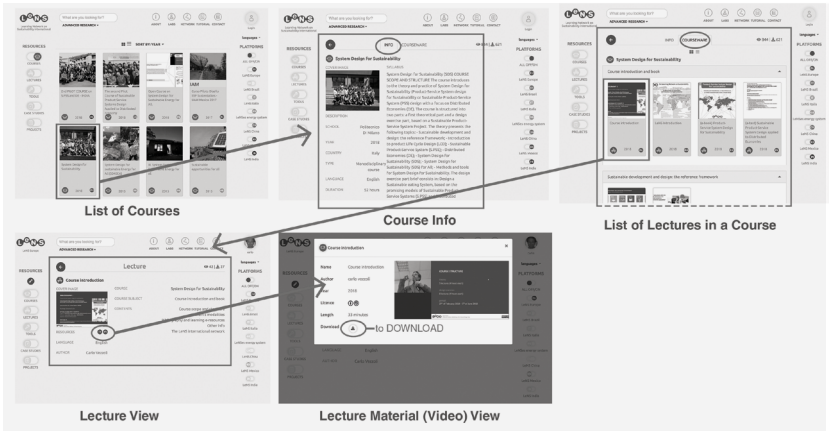

FIGURE 6 – Screen flow from Course View to Lecture view to object view. Source: www.lens-international.org.

UPLOADING AND MODIFYING RESOURCES: Teachers who are part of the LeNS consortium can upload and update the learning resources. They represent the OLEP scientific board, which can control the e-package updating, safeguarding the scientific reliability of the new materials. External teachers and users of OLEP are enabled to upload learning resources only if the scientific board allows them.

To upload a new course (learning collection), the user enters the 'upload/modify' area, sets up the structure of the course (defining the Learning Subjects (LS) and related Learning Resource titles), and, within each LR title, uploads the related LRs.

9 The LeNS Open Labs

The LeNS Labs are the second main tool of the LeNS network. They are spaces equipped to use a set of tools, resources and facilities to support Design for Sustainability (DfS) research, education and practice; accessible to students, teachers and researchers as well as local interested stakeholders. A network of LeNS Labs has been established with the economic support of the Erasmus+ project in Partner Institutions, i.e. in Brazil, Africa, Mexico, China, India. However, besides the partner institutions of the projects, any institution willing to open a LeNS Lab could do so with their own funds with just a simple letter of intent and become part of the Network. In fact, many other LeNS Labs worldwide have been opened and are listed on the http://lens-international.org/labs website.

The aims of the LeNS Labs can be summarised as but not limited to:

- the dissemination, sharing and development of a knowledge-base and know-how on Design for Sustainability, supported by the LeNS Platform of platforms;
- promoting research activities, teaching and internationalization through being connected to the multipolar worldwide scheme of LeNS_Labs, as well as with local and global HEIs, with an intercultural approach to favour knowledge cross-fertilisation;
- strengthening the link with local productive sectors, NGOS and governmental institutions acting as a hub for these various actors.

10 LeNS and its implications for research, education, practice and society

It must be clarified that in spite of such a wide expansion of OERs over the past few years, they have not been enough to achieve the goals of the OER movement and there is still long way to go (MURPHY, 2013; UNESCO, 2012; UN, 2015; WELLER, 2015) in terms of 1) wider diffusion of OERs in practice, 2) expansion of awareness of them among both learners and educators 3) and taking the right direction for a future motivated to serve the whole of humanity globally rather than certain stakeholders. These are the same visions that the LeNS network inherited when it was first established (when the open access movement had yet to gain popularity) and still has today, among a large panorama of the open access movement.

The LeNS network has expanded not only with the financed partners of the 3 consecutive EU projects, but also with many other institutions joining the LeNS Network without financial support. Such growth was supported and facilitated by a very inclusive strategy and vision of the LeNS community that allows new members to join with a letter of intent, without any cost or obligation, as well as by the following win-win opportunities:

- knowledge-building as open access resources speed up learning-by-sharing for researching and teaching i.e. through allowing the remix/reuse of others' resources;
- improved opportunities for public fundraising of a new established regional LeNS due to being part of such a wide and successful international network.

The incredible growth of the LeNS network could be explained with the following main driving forces:

- as sustainability is being incorporated in the worldwide agenda, in all levels, there is a clear perceived growing demand of design for sustainability;
- open access education is increasingly being adopted in the education system throughout the world, and it is increasingly accepted as being vitally important to tackle the many issues the humanity is facing now (UNESCO, 2012).

LeNS is characterised by being *open* (because its contents are freely available for teachers, students, designers, companies, NGOs and interested persons; and they can be downloaded, altered and reused), *multi-polar* (because there is no hierarchy and any person can talk to anyone belonging to the network, *interconnected* (because there is a continuous exchange and sharing of contents and didactic materials), and *regenerative* (because the same web-platform can be downloaded and reconfigured to meet specific needs).

LeNS allows a *process of mutual learning*, facilitating a ready access, exchange, review and update of knowledge. In this sense, LeNS is intended as a sort of *cross-learning mechanism* among design researchers and educators. For this reason, LeNS can potentially speed up the achievement of research results on one hand, and their dissemination on the other.

LeNS, fostering a new generation of design researchers and educators, resulted over the years of its evolution and expansion, in being an effective project to contribute to the promotion of a new generation of designers effectively capable of having a role as catalysers and enablers of the transformation of our consumption and production patterns, with consequent positive implications for the whole society. LeNS, envisioning a new ethos for the HEIs of design worldwide, and reaching 141 universities in 29 countries from all continents since its foundation in 2007, represents a "New design hope". For a sustainable society that is OPEN, MULTI-LOCAL and FOR ALL.

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