Deliverable D1.6

Data Management Plan

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WP/Task	Work Package 1 / Task 1.6
Title	D1.6 OSOS Data Management Plan
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Abstract	This deliverable is the Data Management Plan document, which describes the various types of data in OSOS, the procedures followed to collect them and the measures that will be taken in order to ensure that no confidential information will be leaked. Furthermore, the storage, archiving and preservation plan of the data are also sketched, along with OSOS plan to comply with the Open Data Initiative. The main goals of OSOS's Data Management Plan (DMP) are to (i) Outline the types of data that have already been generated at the current stage of the project or foreseen to be generated at later stages, including the context and procedures of this generation, (ii) Outline the protocols that will be followed to assess the generated/collected data with respect to their sensitivity, (iii) Outline the data acquisition plan, (iv) Outline the measures and tools that are foreseen for the adequate management of the data from the ethical and security points of view and (v) Outline the guidelines that will be followed in the project with respect to the Open Data initiatives.
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Executive summary

The formal Data Management plan consists of an online document written in the templates within the 'DMPonline' tool: part of the the Open Research Data Pilot (ORD) funded under Horizon 2020[1]. The OSOS DMP is live at: https://dmponline.dcc.ac.uk/plans/20437. The online DMP is available to view at the above URL. The DMP is to be considered as a living document, with edits implemented over the course of the OSOS project.

The document consists of three elements:

- Initial DMP: a first version of the DMP to be submitted within the first six months of the project
- Detailed DMP: updated over the course of the project whenever significant changes have arisen.
- Final review DMP: reflecting all updates made over the course of the project.

In accordance with the guideline on data management in Horizon 2020, the following aspects are discussed in the DMP:

- dataset reference and name,
- dataset description,
- standards and metadata,
- data sharing and archiving and preservation (including storage and backup).

The remainder of the deliverable is structured as follows:

- Section 1 describes the date and the settings in which data is and will be generated.
- Section 2 outlines, the data collection processes, based on the F.A.I.R principles are outlined.
- Section 3 presents the allocation of resources.
- Section 4 presents how the data are handled regarding confidentiality.
- Section 5 outlines the ethical and confidentiality considerations with respect to the OSOS data.
- Section 6 includes the References.
- Section 7 includes the APPENDICES, consisting of the OSOS Privacy Policy, the OSOS XML Schema Sample and the Technical Details of the Search API.

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[1] Guidelines on FAIR Data Management in Horizon 2020, version 3.0, 26/7/2016 (http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/oa-pilot/h2020-hi-erc-oa-guide_en.pdf)

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1 Data Summary

1.1 Purpose of the data collection/generation and relation to OSOS project

The main goal of the OSOS project is to **develop a framework that could facilitate the transformation of schools to Open Schooling Hubs.** An Open Schooling Hub will be an open, curious, welcoming, democratic environment which will support the development of innovative and creative projects and educational activities. It will provide a powerful framework for school leaders to engage, discuss and explore how schools will facilitate open, more effective and efficient co-design, co-creation, and use of educational content. Towards this objective, the consortium will develop the **Open Schooling Roadmap** to support schools to reflect on, plan and undertake changes in education for 21st Century learning. The role of the Open Schooling hubs will be varied with tasks expanding from proposing school projects, adapting them in order to fit the Open Schooling approach of the project, to providing guidance and reflective feedback. A devoted social platform will be developed (as part of the Inspiring Science Education infrastructure) to support the process, to facilitate the sharing of ideas and project and to map the schools' development.

A **series of exemplary cases across Europe (and beyond) will be indentified and piloted in a core group of schools that will act as Open Schooling Hubs. A** pool of cases will thus be created, based on whole-school projects and initiatives from science centres and museums or research centres that promote creative problem solving, discovery, learning by doing, experiential learning, critical thinking and creativity, simulating the real scientific work. These activities include use of data analysis tools, access to unique resources, to animations and simulations of physical processes and experiments, educational games and projects presenting the basic concepts of science, and more. Based on the Open Schooling framework (WP2) these educational cases will be enriched and expanded taking account of (and utilizing) every student's extended learning relationships (peer-peer, student-teacher, involving parents or external mentors or businesses), so that learning is something that can happen at any time, in any place, and with a wider range of coaches, science communicators, mentors, and experts.

The initial core group of Open Schooling Hubs will be expanded to a large community of schools that are establishing links with the local communities, research centers and industry while they are developing common projects to solve big problems and meet big challenges of our society. Each one of the 100 Open Schooling Hubs will develop a network of at least 9 additional schools to form a national network of schools where the Open School Culture is introduced. Overall more than 1,000 schools will be involved in the project in two implementation phases.

It is obvious that during the lifetime of OSOS, data of different nature will be generated and collected. These data are user and machine generated, which means that they may contain sensitive personal information, and thus a clear plan is required on how they are to be managed, i.e., stored, accessed, protected against unauthorized or improper use, etc. The development of the virtual learning community section will be enhanced by the Open Schooling Hub Community Support Environment that will provide tools for community building and support. A large set of data will stem from the systematic validation of the OSOS approach and activities in order to identify their impact in terms of the effectiveness and efficiency. The proposed validation methodology offers a framework for validating the introduction of innovation in schools so that piloting and field testing results can be collated and analyzed systematically and then disseminated widely, thus ensuring rapid impact and widespread uptake. The key areas of interest of the proposed validation methodology will be Science Pedagogy, Organisation issues (e.g. impact on the curriculum), Technology – tools, services and infrastructure, Economic – value for money, added value, Cultural and linguistic issues.

The purpose of this Data Management Plan, regarding the OSOS project is to:

- specify the data that will be collected during the activities of OSOS,
- investigate the best practices and guidelines for sharing the project outcomes and facilitating open access to research data, while ensuring compliance with the established ethical and privacy rules, and
- define how the data collected in the project will be made available to third parties.

The DMP needs to be updated over the course of the project whenever significant changes arise, such as (but not limited to): (i) new data, (ii) changes in consortium policies (e.g. new innovation potential, decision to file for a patent), (iii) changes in consortium composition and (iv) external factors (e.g. new consortium members joining or old members leaving). The DMP will be updated as a minimum in time with the periodic evaluation/assessment of the project. If there are no other periodic reviews foreseen within the grant agreement, then such an update needs to be made in time for the final review at the latest. Furthermore, the consortium can define a timetable for review in the DMP itself.[2]

1.2 Types & Formats of collected/generated data

In this section we are describing the OSOS infrastructure for data collection and generation and the types of data to be collected during impelemantion (WP5) and impact assessment studies (WP6).

1.2.1 The Connection of OSOS data with ODS and ISE generated data

The OSOS project aims to validate its approach with the very large school communities who are currently using the services offered by the Open Discovery Space (ODS) socially empowered portal (http://portal.opendiscoveryspace.eu/) (main outcome of the major European initiative funded by European Commission's CIP-ICT Policy Support Programme) (Athanasiades et al, 2014).

The ODS portal is currently used by **5.000 European Schools** from **20 European Member States.** The use of ODS services (combined with the functionalities of the Inspiring Science Education (ISE) tools) has resulted to substantial growth in digital maturity (ematurity) of the participating schools, even for schools which were considered as e-mature when they joined the network. The participating school communities became core nodes of innovation, involving numerous teachers in sharing educational content and experiences (Sotiriou et al, 2016).

The **Inspiring Science Education** services allow and guide the teachers to participate in a dynamically expanded collaborative network of school/ thematic/ national/ international communities. Thus, the participating school communities became core nodes of innovation, involving numerous teachers in sharing educational content and experiences (Sotiriou et al, 2016). Schools that were involved in ODS and ISE large scale initiatives have developed innovations locally, and while the consortium sought to understand what works across the innovation programme as a whole.

Based on the principles of creative community involvement and design-based research, the ODS approach was designed as **a three-step process**, aiming to stimulate, incubate and accelerate the uptake of innovative eLearning practices in school communities and national policies. **Figure 1** presents the ODS innovation approach in its final format.

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[2] Guidelines on FAIR Data Management in Horizon 2020, version 3.0, 26/7/2016 (http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/oa-pilot/h2020-hi-erc-oa-guide_en.pdf)
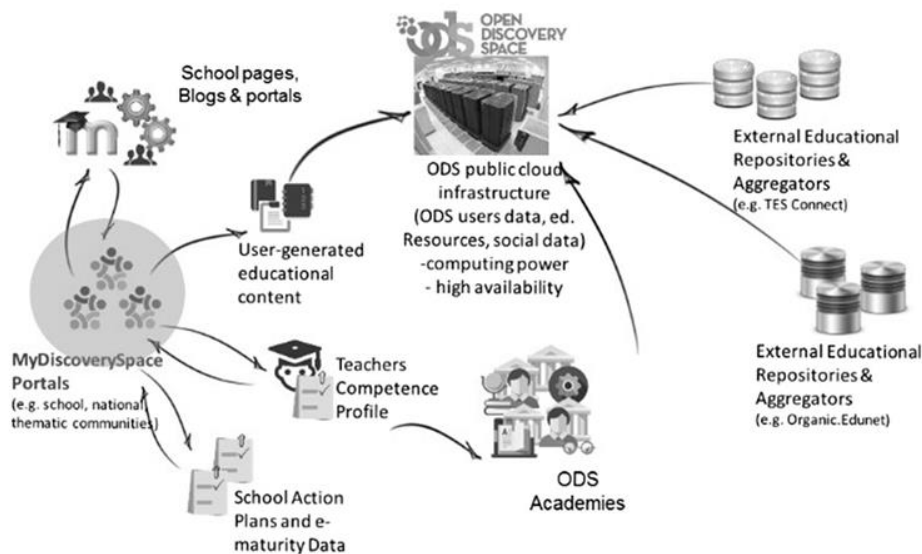
Figure 1: The ODS approach

As a first step (following the agreement of the school management) a local team of teachers is analyzing the school needs and identified areas in which the school can best demonstrate innovative approaches and projects. At this level, initial scenarios have been implemented to pioneer future-oriented practices and to experiment with eLearning resources and technology- enhanced learning applications. The resulted detailed action plan (for at least one year) includes targets and milestones toward their achievement. At this phase, ODS offered a rich database of creative initiatives with access to numerous resources, guidelines and support (also online through webinars and hangouts) as well as examples for the coordination of action plans offering funding opportunities for the realization of the school action plans (e.g., in the framework of ERASMUS+ program).

The second step was aiming to encourage the uptake of resource-based learning practices and to engage a wider school community (by involving more teachers in the projects and initiatives) in implementing resource-based educational scenarios in various curriculum areas, as well as to reflect on the use of tools, resources and practices through a series of practice reflection workshops. This phase was supposed to create the steady and supportive development of new learning techniques and methodologies, leading to sustained improvement. The development of strong communities of practice around the implementation scenarios was regarded a crucial element in the success of proposed interventions. Its focus was not only on the integration of digital resources into syllabi, but also on subsequent adoption of the modernization of the school organization, teachers' professional development. Localized assessment approaches estimated the impact on both, individuals and schools as an organization, as well as on the development of effective cooperation with organizations like universities and research centers, informal learning centers (e.g., museums), enterprises, industries and the local communities.

The objective of **the third step** was to accelerate the educational changes regarded as effective and to expand them to significant parts of the school, always keeping in mind the school's main needs (as defined in phase one). Attention was given to exploiting knowledge management techniques (sharing what is known within ODS school communities); synthesizing evaluation; and accelerating diffusion within national agencies (to reach more users). Insights from ODS's work on online communities, as well as from synthesizing school needs, also aimed at supporting the acceleration of diffusion within national agencies. In the framework of OSOS the project team, using the extended experience from the large scale pilots over the last years, will design and implement localized approaches and strategies in different countries and in the different school settings.

1.2.2 Types and format of collected / generated data by direct input methods

OSOS best practices will act as accelerators of the introduction of OSOS approach in the participating schools. They will help innovative schools to proceed more and develop their innovative ideas to new localised projects that could provide new solutions for the school and its community, for bridging the gap between formal and informal learning settings and creating new opportunities for personalisation at different levels (student, teacher, school).

> **Overall, data will be collected and/or generated from the following sources:**
>
> (i) **Questionnaires and other direct input methods**, capturing data from headmasters, teachers, students and external stakeholders (see subsection 1.2.3 for details and D6.1 and D6.2- under preparation to be delivered on M8)
>
> (ii) **Existing and new data which will be developed during the whole school transformation process** and stored in the OSOS platform. These include content types already existing in the OSOS Infrastructure (inherited from the ODS/ISE portals) but also new content types, such as projects and accelerators (see subsection 1.2.4 for details)
>
> (iii) **Existing and new data generated by the use of the OSOS platform and collected through shallow and deep analytic tools** (see subsection 1.2.5 for details)
>
> (iv) **Data collected and produced for dissemination and exploitation of project results**, following the guidelines set at the project's Grant Agreement[3]: Dissemination of Results — Open Access — Visibility of EU Funding (see subsection 1.2.6 for details)

Based on the OSOS approach, **Figure 2** depicts the datasets that will be generated (D6.1), collected and used during the full cycle of the school transformation with the support of the OSOS support mechanism (WP3).
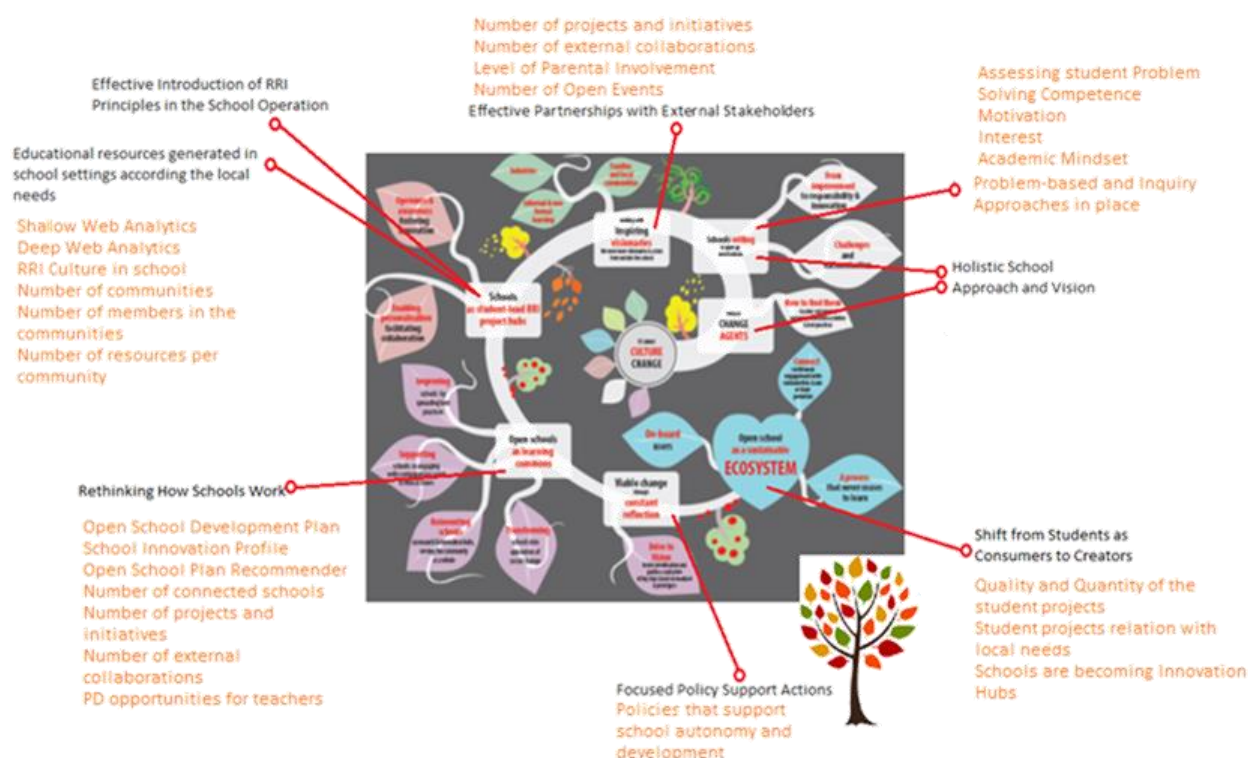

Figure 2: Impact Assessemnt focus areas and data generated through the school transformation cycle

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More specifically, the OSOS Infrastructure will support a series of tools (**Open Schooling Incubators**) for the involved practitioners (to develop their projects, to share their best practices with others, to disseminate their work) and a series of best practices (**Open Schooling Accelerators**) that the participating schools can adopt to their local communities needs in order to demonstrate their potential to act as core nodes in them. OSOS will use the **Inspiring Science Education** services to offer numerous tools for the school communities that will be involved in the project.

1.2.3   Types and format of collected / generated during the OSOS Evaluation Framework

The OSOS team is developing a comprehensive OSOS Evaluation Framework consisting of a set of measurable quantitative and qualitative indicators and impact assessment tools to gauge the effectiveness and impact of the OSOS approach. The Evaluation Framework is also drawing from current interlinking validation methodologies for RRI in education e.g. EnRRIch, UNESCO global citizenship goals, ENGAGE2020 and the EC guidelines. OSOS Evaluation Framework will draw on the following evaluation and validation methodologies:

Science Pedagogy (this will consist of quantitative and qualitative assessment, on continuum scale of 'mass', 'density', 'temperature' and 'reflectivity' in our definition of RRI-enhanced science pedagogy, which is pedagogy involving the following principles: Sparking Interest and Excitement; Understanding Scientific Content and Knowledge; Engaging in Scientific Reasoning; Reflecting on Science; Using the Tools and Language of Science; Identifying with the Scientific Enterprise)

Organisational Cultures and Culture Change (quantitative and qualitative assessment of the teaching institutions, hubs and curricula under the following criteria: artifacts (visible), espoused beliefs and values (may appear through surveys) and basic underlying assumptions (Schein, 1985)

Technology – tools, services and infrastructure (quantitative and qualitative assessment of the teaching technology pedagogies and infrastructures, while not enforcing 'tech-push', but to utilise Mark Prensky 's (2005) cultures of tech innovation, with indicators of 1) 'Dabbling' 2) Old things/old ways 3) Old things/new ways 4) new things /new ways. This is to include direct classroom tools, formal and informal processes, community-building and social media approaches)

Economic /other value, added value (using the SMEV model of 'Socially-Modified Economic Valuation (Munck et al 2014) a Harvard-devised model which uses a 'social weighting' measuring the social contribution of collaborative community educational activities.
This value accompanies or 'shadows' the actual economic value. Thus, activities in socially disadvantaged areas would be 'worth' more in terms of social value generated. Measurements can be done on the basis of, as examples:

- number of partnerships between schools, local communities and local industry;
- number of stakeholders involved and interactions;
- structured or flexible interactions: equity of social capital/ social power of stakeholders in the process;
- tools and skills acquired by the stakeholders as a result of open schooling activities;
- tools and skills attachment to pedagogical/ RRI goals.

Cultural and linguistic issues quantitative and qualitative assessment of teaching and community interaction under 1) didaktik, 2) Vygostsky social learning (Vygotsky, 1978), and communities of practice (Lave and Wenger , 1991), with particular emphasis on gender and language.

Different methods and techniques are being employed, including a mix of quantitative and qualitative methods such as document and statistical analysis, interviews, focus groups, tracking of student

interest/progression, online survey tools etc. To collect quantitative data an evaluation template with standardized questions and reflection points are being developed. Each OSOS National Coordinator and pilot hub contact point will populate the evaluation template and submit quarterly reports. Data with headings to capture specific information such as the number of industry role models engaged, number of students engaged with industry, number of partnerships created etc will be then analysed by the evaluation team.

During evaluation, the main issues to consider include:

- How many partnerships between schools, local communities and local industry have been created as a result of a pilot open schooling hub?
- How many stakeholders were involved and how many interactions took place?
- Were these interactions structured or flexible?
- Were the interactions dominated by any particular stakeholder or was the process flexible allowing for mutual learning two-way knowledge transfer?
- What tools and skills were acquired by the stakeholders as a result of open schooling activities?
- Did these tools and skills contribute to more scientifically interested and literate students and, more generally, society? If yes, how?

Other evaluation techniques and methods to be employed are including:

- tracking the number of institutions that adopted the Open school hub model at staged intervals over the project cycle;
- conducting surveys with random sample of citizens pre and post engagement in the OSOS open school hub and comprehensive assessment of potential changes in attitudes, behavior, knowledge attainment.

The project is also evaluating the potential of OSOS model to integrate more effectively RRI in OSOS pilot schools and more generally in schools across Europe. Specifically, it will assess to what extent teachers, students and other stakeholders engaged through OSOS open schooling approach have a holistic view of science, scientific research and major scientific developments. The RRI component of evaluation will include student/teacher pre-post engagement reflections; integration of RRI principles into school curricula and teaching practices etc.

These reflections and evaluation of curricula and practices will reveal changes in awareness/knowledge aspects/behaviour in relation to the RRI principles - such as gender, ethics, open access, open science, public engagement, governance, socio-economic development and sustainability, social issues related to scientific developments. In addition, impact of the OSOS model on industry partners and non-formal education providers will also be assessed, in particular whether industry partners incorporated any learnings into their business processes, corporate social responsibility (CSR) and public engagement (PE) strategies as a result of the OSOS engagement model.

1.2.4   Types and format of collected / generated data by users of the OSOS Platform

To support the realization of the transformation process, OSOS will deploy an open learning content infrastructure that aggregates existing repositories and tools into a critical mass of e-learning contents, covering around 1,000,000 e-learning resources from 75 educational repositories across the globe. Moreover, OSOS adopts social networking tools and offers the opportunity for the development of lightweight school-based portals to support the development of school-generated content, the assessment of the school's openness level and its cultural change.

The OSOS infrastructure will be based on the existing services offered by the Open Discovery Space (ODS) socially empowered portal (http://portal.opendiscoveryspace.eu/) (main outcome of the major

European initiative funded by European Commission's CIP-ICT Policy Support Programme). Apart from community building and support tools numerous content creation and content delivery tools will be available for teachers and students to facilitate the creation of their projects.

1.2.4.1 School Competence Assessment Tools

As a crucial tool for assessing the openness level of a school, a self-evaluation instrument, will be offered to the participating schools head masters. It will be assessed the use level of the school openness of with an emphasis on the introduction of the RRI culture in six key areas: (1) leadership and vision, (2) curriculum and use of external resources, (3) open school culture, (4) professional development, (5) parental engagement and (6) resources and infrastructure. Based on the school's reference data, actionable analytics will be provided, allowing head teachers and key stakeholders to monitor the school development and the impact of the proposed innovation process.

1.2.4.2 School Development Plan Templates

Pilot schools will be asked to cater for a holistic school development plan in using a provided template. That plans will provide a robust base for automating and facilitating the task of periodic school self-assessment based on reliable criteria, such as development of innovative projects and initiatives, school external collaborations, teachers' professional development plans and school portfolios that may also include information on teacher-generated content, effective parental engagement strategies. The proposed School Development Plan Template is presented in Appendix I. It will be used in the framework of the first pilot phase and it will be tested in about 100 schools in different European countries.

1.2.4.3 Community Building Tools

OSOS project will capitalize on the ODS school communities which currently involve 5.000 schools from all over Europe. The graph presents the thematic communities that have been developed by these schools. 0ne can see that the communities are dominated by science and interdisciplinary projects which can form a unique space for implementation of the Open Schooling Activities. Several relations among various communities and other content in the portal are created. The communities are the places of creation of user generated content. The communities created by the Teachers are automatically related also with the School where these Teachers are working to. The level of access of the Communities define the also the level of their content. The "public" communities are accessible to all visitors of the portal and the content follows the restrictions that their creator enforces. The "private" communities allow access to the content only to their members and as a next level the restrictions of the creators of the content are applied. Each community might contain several modules that serves the organization and promotion of its members' activities. These modules are Croups, Events, Discussions, Activities, Blogs and Polls), they follow specific structure in the portal and they are created by the members of the communities.

1.2.4.4 Advanced Search Mechanisms

The OSOS platform will act as a harvester of educational resources (using the advanced ODS facilities and search mechanisms), in aggregating targeted contents from a variety of science-related sources and using the appropriate search and filtering mechanisms. Users can also search for schools involved in the project, as well as for thematic communities organized by teachers to share materials and experiences.

1.2.4.5 Educational Design and Authoring Tools

In order to help teachers to become developers of educational activities and scenarios a series of simple and more advanced authoring tools will be available. The authoring tools are promoting the development of projects and they are adapting the inquiry learning cycle as a core pedagogical model, allowing always flexibility to the teacher to modify the sequence of the educational process. In order to facilitate the creation of high-quality teacher-generated content and scenarios, model templates

capturing rather popular science education approaches (learning cycle, 5E model), as well as cross-curricular scenarios and lesson plans, were developed as a source of inspiration for teachers (Sotiriou et al. 2011). Each OSOS community member will be allowed to customize the sources and even the platform components that they used to create, search and curate content. An advanced authoring tool will be developed to facilitate the creation of the students' projects. The aim is to help them to become creators of educational activities which will reflect on the real educational needs of their classrooms as well as they are providing solutions to their local communities. This includes the following four-step process (see **Figure 3**):

- Feel: Students identify problems in their local communities. They can also select topics related to global challenges. Students observe problems and try to engage with those who are affected, discuss their thoughts in groups, and make a plan of action, based on scientific evidences.
- Imagine: Students envision and develop creative solutions that can be replicated easily, reach the maximum number of people, generate long-lasting change, and make a quick impact. They are coming in contact with external actors, they are looking for data to support their ideas and they are proposing a series of solutions.
- Create: Students are implementing the project (taking into account the RRI related issues) and they are interacting with external stakeholders to communicate their findings.
- Share: Students share their stories with other schools in the community and local media.
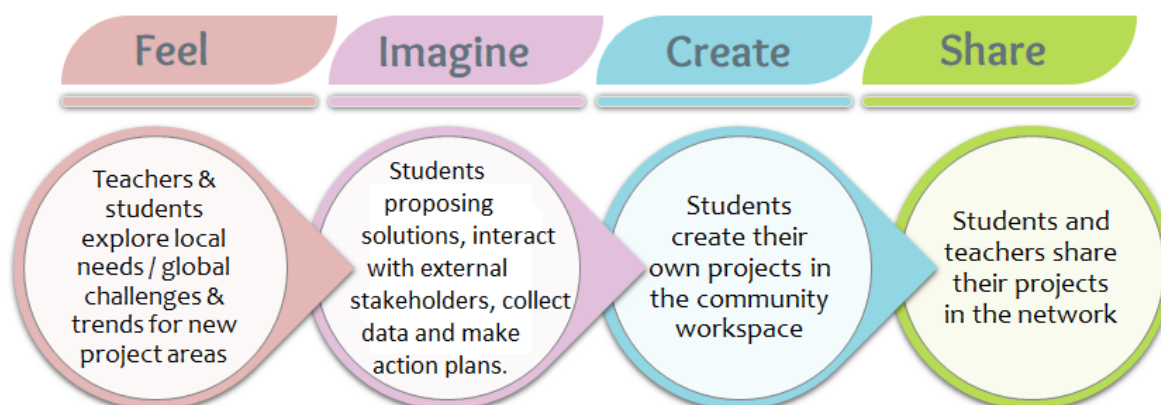

Figure 3: The OSOS platform will offer students the opportunity to develop their projects following a simple four step process

1.2.4.6   Training Academies

With the aim of supporting the effective engagement of teachers, headmasters and school communities (including parents), OSOS training academies provided the starting point for equipping them with the competences they need to act successfully as change agents in their settings. OSOS training academies will provide extended online materials, webinars and hangouts on a regular basis (both nationally and internationally) while delivering guidelines for the generation of creative training events and activities, such as face-to-face workshops, week-long courses at national or international level. Collaborative professional development is expected to have a positive impact on teachers' repertoire of teaching and learning strategies, their ability to match these to their students' needs, their self-esteem and confidence and their commitment to continuous learning and development. During the implementation process, personal and individualized support is a necessary prerequisite (in addition to the provision to the suite of supporting tools) to empowering teachers to engage in innovative practices.

Instead of suggesting a one-fits-all approach to the forms and types of pilot activities, the schools will be free to choose or design the types of school- based activities and the curriculum areas that they will target. This is regarded a form of school innovation to respond to each school individually with an aim to foster commitment. An implementation thus includes multiple types of activities, ranging from school-based interventions (that design, develop and implement small scale projects and local stakeholders) to collaborative activities across countries designed by the schools in collaboration with national coordinators.

The Academy will thus develop and test a complete training program for headmasters and teachers to enable the introduction of responsible innovation in the European schools. In addition, it will build a permanent support mechanism for the introduction, the adoption and the acceleration of responsible innovation in schools through the creation of an OSOS sub-network of schools and teachers willing to participate in innovative training activities. In line with the OSOS approach the training academy will focus on a methodological & pedagogical framework outlining the key stages of the development of innovation support in schools and will include areas such as:

- School needs analysis tools,
- School leaders and teachers supporting structures
- Tailor-made and CPD relevant Teacher/Learning online communities,
- A guide to how turn innovative ideas into real classroom activities
- A guide to teachers in becoming authors of educational content.

The professional development training program for teachers and school leaders will help facilitating the implementation of the necessary changes, the development of the necessary diagnostics and intervention skills to best plan and then diffuse innovation in their own contexts. An effective professional development approach will provide the starting point for equipping teachers with the competences they need to act successfully as change agents, developing a terminology necessary to describe the dynamics of innovative change processes, and making them able to recognize different forms of resistance and addressing it in their own context.

1.2.5 Use of data provided by the OSOS portal web analytic tools

Existing and newly generated data will be used for the assessment of the "technological" dimension of the project, including the community building inside and outside the schools, the introduction of innovation in school settings, the teachers' and students' work, the use of the portal services and the generation of new content. The data available for this type of assessment will be available to the responsible project partners and partially to the headmasters of the schools as managers of the schools' workspaces and the relevant communities in the portal.

The data that will be used for the assessment and presentation of relevant progress in various aspects will be generated:

(a) with the use of the **portal analytics tool** that underlies in the portal infrastructure and access directly the data repositories of the portal and

(b) **google analytics** that are mostly used to monitor the traffic of the visitors throughout the portal pages. These two tools and the use of the data that generated are following presented.

It is mentioned that all information tracked, logged and presented respects and **follow the anonymity** of the registered users of the ISE portal. The privace policy regarding the collection and use of the data provided by the users in the portal, a relevant Privacy Statement is online available and presented in the Appendix in &7.1. During the project **no row / unstructured data will be collected or generated.**

1.2.5.1 The use of data through portal analytics tool

The information that is tracked and collected from the Analytics Tool (http://portal.opendiscoveryspace.eu/analytics) is used to monitor the following elements in the portal that is the basis also all of the analysis behind the design and implementation of the Tool:

- Content generation
- Schools, teachers, students and stakeholders engagements and participation
- Schools, teachers, students and stakeholders collaboration and networking
- Community building
- Evolution of portal
- Re-use and access of portal content

Considering these dimensions, the base information needed to be collected from the different repositories of the portal containing the poral data, in order to be used by the visualization and the reporting tool are defined per entity/object of the portal and analysed taking into account: (i) The role of the users that take the relevant triggering actions, (ii) The time period of the analysis, (iii) The type of the content that is related to these actions/events

In order to support all these dimensions and specifications, the total of the actions in the portal that are taken from the visitors and users are tracked. The entire lists of the actions that are monitored and the events that are tracked are presented in **Table 1**

SUMMARY OF TRACKED EVENTS	Activities	Academies	Activities	Blogs	Comment	Communities	Competence Profile	Connections	Discussions	Events	Groups	Help	Multimedia	Polls	Resources	Tags	Training Activities	Urls	User
When, who and how a user accesses the portal content?	Access	x	x	x		x	x		x	x	x	x	x	x	x			x	x
	Search					x									x	x			x
	ViewFullMetadata														x				
When, how often and who adds and changes the Portal content?	Add	x														x	x		x
	Post				x														
	New		x	x		x			x	x	x			x	x				
	Update						x												
	Edit					x													
When, who and by which mean the portal users adds social information to the Portal and under which content?	Bookmark		x	x					x	x	x				x				
	Rate		x	x					x	x					x		x		
	Share		x	x		x			x	x	x				x		x		x
	Unbookmark		x	x					x	x	x								
	Comment			x					x	x					x				
	Like				x														
When, how often and who is networking through the Portal? who is the most active in networking and which are the un-liked to follow?	Follow		x					x		x									x
	Unfollow		x							x									x
	Invite					x													
	Join					x					x								
	Leave					x					x								
	Remove							x											x
When each user access and leaves the Portal?	Login																		x
	Logout																		x
	Registration																		x

Table 1: Summary of tracked events by the Portal Analytics Tool

During the OSOS project, this tool and the tracking and reporting mechanisms will be properly extended to cover and support the analytics also for the new content types and the new services / features of the portal. The portal analytics tool provides access to the statistics and their reports. **The analysis and the presentation of the data do not include any personal information of the users and they remain anonymous**.

Figures 4-8 present some examples of the supported analysis of the data. These examples are based on data produced by the ISE project, but similar analysis will be provided for the OSOS project too.

Community building and networking: refers to analytics related to the growth of the communities, regarding their number, their relations (network of communities) and the number of their members.
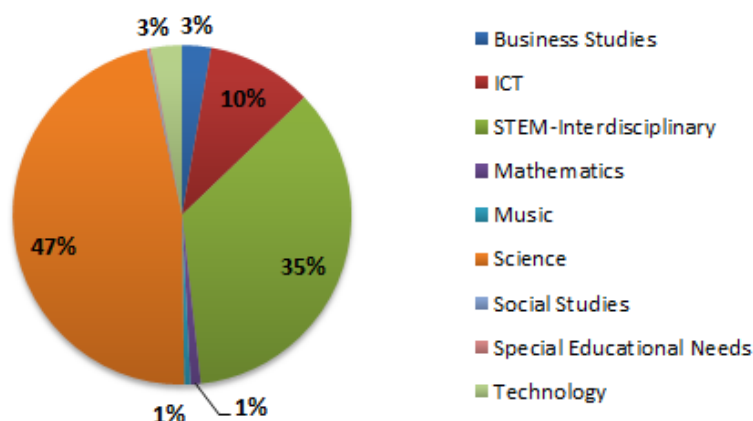

Figure 4: ISE communities per domain: presents the number of the communities created by the registered users of the portal per subject domain

User generated content: these statistics present the growth of the user generated content, uploaded in the communities that they participate in, as members and might be resources, projects, events, groups, activities, blogs, discussions and polls.
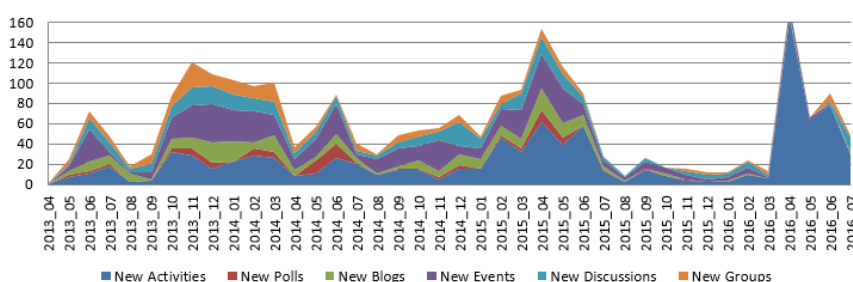
Figure 5: Growth of community nodes: presents the growth of the content that is contributed by the members of the communities in the portal for a specific time period

Schools' engagement and participation: for the different time periods of the project, this type of statistics present the number of the schools enganged in the project activities using the portal services.
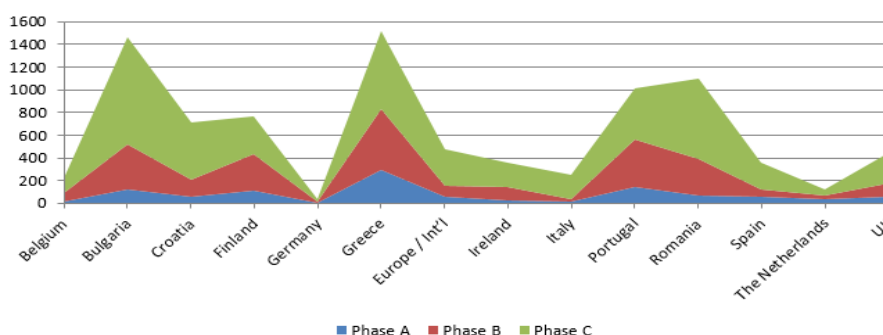
Figure 6: School participation: presents the number of the schools per country that participate in the project activities, using the portal services

Social data in the portal: since the portal provides a number of social services to its users for networking and also sharing the content in and out of the portal using social networks' featurtes, these statistics regard the extend of use of the social services and the growth of relevant social content created in the portal.
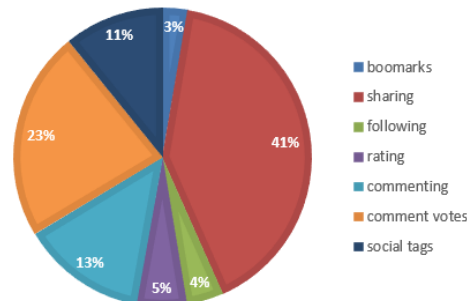

Figure 7: Social data in ISE Portal: presents the distribution of the social data generated in the portal by the use of social services and represents the preferences of the users on these services while networking and sharing content

Type of content used in the authoring tool: this is related to the type of the content that is used / embedded in the authored content by the users and shows how and with which resources the users select to enrich their content.
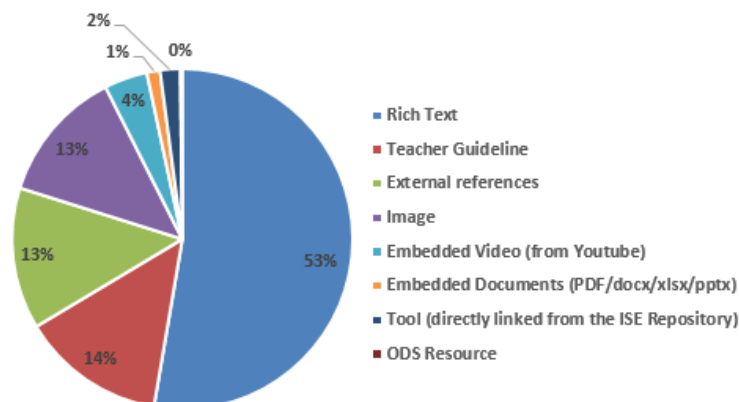
Figure 8: Type pf content used in learning scenarios: presents the multimedia or simple textual content that is used by the Teachers when creating their own educational resources

The queries that are executed to produce such analysis are discriminated into specific categories in order to be more easily manageable. In particular, the following query categories are defined:

- Portal related queries,
- Community related queries,
- Group related queries,
- Training Academy related queries,
- Specific Page related queries. Those queries can be viewed under a specific Community, Group or Training Academy. Each one Analyst can create his/her own queries and have no access to the queries created by other Analysts. Only the administrator of the portal has access to the entire set of queries information and results.

1.2.5.2   Google analytics service in the portal

To better support the needs of the portal to monitor the access of its pages from the visitors (either they are registered or not), the google analytics service (https://analytics.google.com) is also activated and supported by the application infrastructure.

The main objectives and use of this service are:

- To monitor and present the access of the portal pages
- To assess the returning visitors and the newcomers
- To monitor the flows that the users follow in the portal while navigating
- The time that the users "spent" in the portal and in individual pages
- The basic geographical allocation of the visitors
- The basic technological aspects of the terminals tha the visitors use to access the portal (mobile, desktop, types of browsers, etc.)

Some examples that are mainly applicable for the use of google analytics portal are presented in **Figures 9 to 11**
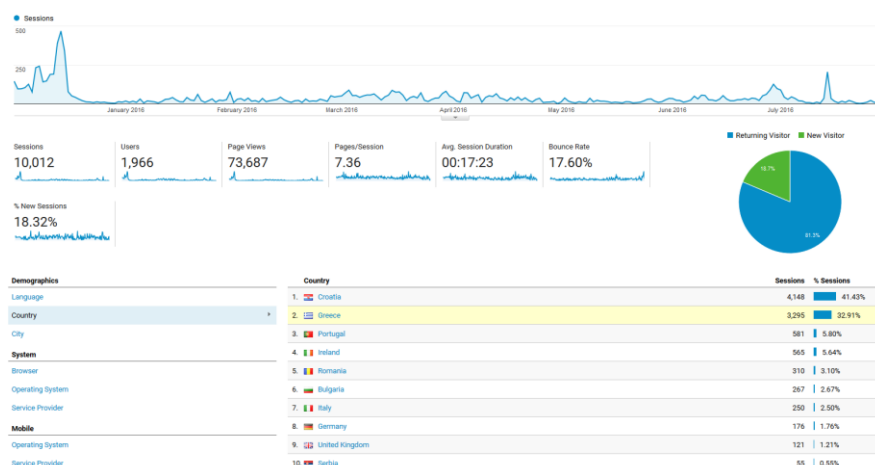
Figure 9: Basic statics about the visits and the visitors' profile of the portal using google analytics

**Figure 10: Measuring the returning visitors of the portal with the use of google analytics**
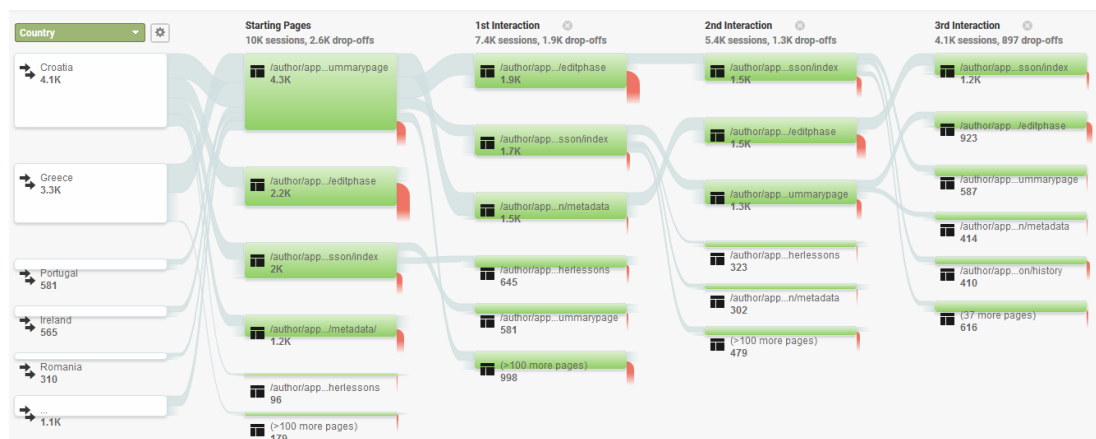
Figure 11: Monitor the visitors' navigation flow in the portal with google abalytics

1.2.5.3 Use of portal data for supporting the assessment tools in the project

OSOS project focuses among other critical objectives, to the assessment methodology and measurements of the project impact on the Schools and the involved teachers, students and stakeholders while implementing "open schooling" activities planned. To fully support this, the portal is necessary to provide some information on specific structure to support first of all the interoperability and feed of information to the project assessment tools. Towards this direction, the portal will support properly designed web services to make the necessary information available in a secure and fully protected manner. This web services will not be available to the public and personal information of the registered users will be transferred.

1.2.6 Data deriving from dissemination and exploitation activities

OSOS is a leading project in the field of Open Schools. Its infrastructure, approach, methodologies, tools and deliverables will act a reference to future calls and projects in this area. Taking into account the guidelines set by the H2020 Online Manual[4], the consortium will employ a variety of dissemination, raising awareness as well as exploitation strategies that will target to reassure the dissemination of project's activities and outcomes at national, European level and beyond. Furthermore, it will provide the mechanisms for effective community building and active participation in order to encourage a better sharing of experiences among practitioners across Europe. To maximize dissemination and impact outcomes key stakeholders from all necessary areas of expertise are included in the consortium. These institutions are highly reputable within their respective peer groups and thus have a significant networking and consensus building capacity. To be more specific, OSOS addresses the recommendations set at the H2020 Online Manual as follows:

1.2.6.1 Link project to the policy context

OSOS is aiming to support a large number of European schools to implement Open Schooling approaches by a) developing a model that promote such a culture, b) offering guidelines and advice on issues such as staff development, redesigning time, and partnerships with relevant organisations (local industries, research organisations, parents associations and policy makers), and c) suggesting a range of possible implementation processes from small-scale prototypes through to setting up an "open school within a school" or even designing a new school while it is testing and assessing them in more than 1,000 school environments in 12 European countries.

The themes of the project activities developed and pursuit in participating schools that will take place will focus on areas of science linked with the Grand Societal Challenges as shaped by the EC, will be

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related to RRI and will link with regional and local issues of interest. The RRI principles are not currently integrated to the national educational policies. Members of the consortium are actively involved in such large-scale initiatives that are trying to support the implementation of the EU policy and to create a critical mass of stakeholders who will effectively facilitate the introduction of RRI principles in the national curricula and to the school practices across Europe. Collaboration between formal, non-formal and informal education providers, enterprises and civil society is being enchanced through OSOS in order to ensure relevant and meaningful engagement of all societal actors with science and increase the uptake of science studies and science based careers, employability and competitiveness

1.2.6.2   Involvement of potential end-users and stakeholders

The main target groups of the OSOS dissemination plan are the head-teachers and STEM teachers and their students in the participating countries as well as the members of outreach groups of science centers, research, commercial and industrial organizations at local, national and European level. Specific dissemination measures are proposed for another important target group, namely the curriculum developers and the educational policy makers through the publication of an evaluation report, guidelines and outcomes document.

1.2.6.3   Application of project results

The project partners, both individually and in collaboration, have been developing, testing and promoting innovative educational applications and approaches for European schools (supported by relevant appliances and resources) for many years, which promote sharing and applying of frontier research findings in schools, supporting the developments of 21st century competences through creative problem solving, discovery, learning by doing, experiential learning, critical thinking and creativity, including projects and activities that simulate the real scientific work. The aim of the project is to analytically map the process for the effective usage scenarios of the afore-mentioned applications in school environments as part of curriculum-led learning (integrating/embedding them in the everyday school practice) and or extra-curricular activities (e.g. visits to museums, science centers, research centers, field trips), coupled with home- and community-centered (informal) learning experiences. Each open schooling hub will bring together representatives from industry and civil society associations who – in cooperation with school community – will scan the horizons, analyse the school and community needs and will cooperate to design common projects and to propose innovative solutions.

1.2.6.4   Barriers to application of project results.

Currently there are numerous reform efforts to spark innovation in education systems in the member states. Most of them are focusing on the introduction of innovative teaching approaches and methodologies (inquiry learning, problem solving, project based work) in school settings. Nevertheless, the majority of teachers and schools are remaining committed in the traditional, safe and well-established approaches.

Member states have centralized methods in their disposal to improve education, in general, and to make STEM careers more attractive to students, in particular. But no approach can be successfully sustained without bright, well-prepared, and wellsupported teachers seamlessly interweaving the school environment and practice into an open and dynamic ecosystem that involves communities and stakeholders that are currently acting outside the schools.

The lessons from numerous studies (e.g. PISA, 2014) are simple: recruit the best to be teachers, train them extensively and well, give them the freedom to develop teaching skills, independence from centralised authority, and ample time to prepare lessons and to interact with peers and educators outside the classroom (Burris, 2012). The OSOS support mechanism is supporing the full cyxle of the envisaged school transformation and conventional teachers' mindset.

1.2.6.5 Thinking ahead. Once the project is completed, what further steps are needed to apply it in actual practice?

The OSOS support mechanism offers open, interoperable and personalised solutions meeting the local needs, supports school leaders capture innovation, to decide on the appropriate strategy to diffuse innovation to the school and through constant reflection is guiding them towards the transformation of the school to Open Schooling Hubs and finally to sustainable innovation ecosystems. The partners of the OSOS consortium have extensive expertise and experience working with networks of professional practitioners and consequently have the capacity to deploy effectively the project approach for community building in order to develop, involve and sustain large communities of schools and teachers who will integrate the proposed activities in their settings. OSOS aims to create a multi-directional and multi-level information flow, which will allow partnership and recipients to learn from each other by assimilating and acting on the information acquired. The extended and effective dissemination approach will allow for the development of a wider collaboration and engagement in the project approach and outcomes. The OSOS Open Schooling roadmap aims to constitute a common set of guidelines, recommendations and key messages on and from the project's overall achieved outcomes and followed methods. This will provide a useful reference for helping educators and outreach groups and other key stakeholders including curriculum developers and educational authorities in designing, integrating and implementing open schooling and innovation practices in education programmes across Europe and beyond. It will be offered in all partnerships' languages, in hard copy and electronic format.

1.2.6.6 Implementation of open access and support to the Commission's Open Reasearch Data Pilot

The OSOS project is part of the Open Research Data Pilot. Therefore, it has developed a data management plan in the first 6 months of the project (this deliverable) and will keep it up-to-date throughout their project. Furthermore, the project consortium will: (i) deposit its research data in a suitable research data repository, (ii) make sure third parties can freely access, mine, exploit, reproduce and disseminate its data, (iii) make clear what tools will be needed to use the raw data to validate its research results, or provide the tools itself.

1.3 Origin of the data

During the implementation of the OSOS project the data will be generated only by the users (headmasters, teachers, experts, stakeholders, students) that participate in the project activities and the project partners that will use the services of the portal to support the organization and implementation of these activities. It is mentioned that the students are not considered as regular users of the portal, since no personal information is imported and kept in the portal repositories. The students will use a nickname and a password to access the projects that they will participate. **Figure 12** presents the relations among the various portal entities and content types.
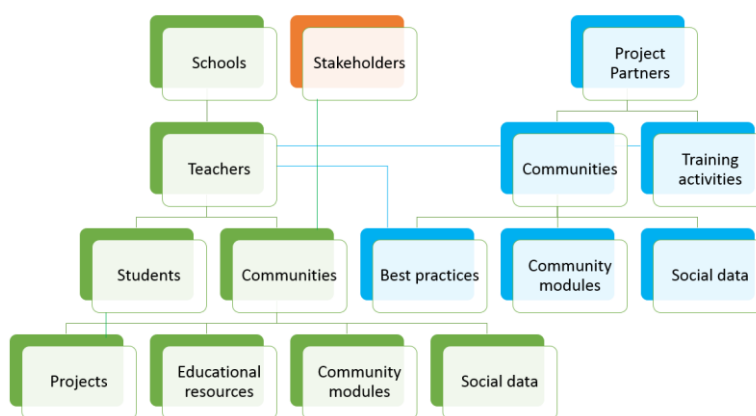

Figure 12: Portal Entities / content types relations

Through **Table 2,** the relation of the main entities of the data is presented and also their contribution in the generation of the different types of content types of the portal.

	Educational resources	Schools	Public communities	Private communities	Modules of public community	Modules of private community	Projects	Accelerators	Analytics	News	eLearning Tools	Training Activities
Administrators of the portal	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full
Teachers	C, M, V, Cp, SP	C, M, V, J	C, M, V, J	C, M, V, J	C, M, V, J (only for members)	C, M, V, J (only for members)	C, M, Cp, V	V		V	V, SP	V, SP
Stakeholders	V	V	C, M, V, J	C, M, V, J	C, M, V, J (only for members)	C, M, V, J (only for members)	V	V		V	V	V
News editors	V	V	V	V	V	V	V	V		V	V	V
Analysts	V	V	V	V	V		V	C, M, Cp, V	C, M, V	V	V	V
National Coordinators	C, M, V, Cp	C, M, V	C, M, V, J	C, M, V, J	C, M, V, J (only for members)	C, M, V, J (only for members)	C, M, Cp, V	V		V	V	V
School managers	C, M, V, Cp, SP	C, M, V, J	C, M, V, J	C, M, V, J	C, M, V, J (only for members)	C, M, V, J (only for members)	C, M, Cp, V	V		V	V	V
Students	V	V	V	V	V		EDIT / PUBLISH	V		V	V	V
eLearning tools providers	V	V	V	V	V		V	V		V	C, M, V	V
News editors	V	V	V	V	V		V	V		C, M, V	V	V
Anonymous / unregistered / not logged-in visitors	V	V	V	V	V		V	V		V	V	V
Community Managers	C, M, V, C	V	C, M, MM, V, J	C, M, MM, V, J	C, M, MM, V, J	C, M, MM, V, J	C, M, V, C	V	C, M, V	V	V	V
Project partners	C, M, V, C	C, M, V, MM	C, M, V	C, M, V		C, M, V, J (only for members)	C, M, V, C	C, M, V, C		V	V	V

Table 2: User Roles & Privileges

Abbreviations used to define the privileges:

Create (C): generate new content,

Manage (M): edit / update, delete. The creators of the content have by default management privileges on the content that they gave created,

View (V): access to view the content of the public communities and the content of the private communities that the user is a member,

Copy (Cp): create new content IF the IPRs from the originator allows it creating a clone of the original content,

Join (J): become a member of the entity,

Manage Membership (MM): manage the members of a community or community module,

Search based on Profile (SP): this option is automatically available to all registered Teachers for personalized searching of content in the portal, based on their preferences in their profile. It is mentioned that a user can have more than one of the roles mentioned in the **Table 2**, based on its participation in the portal and the project and these cases the super set of the privileges are taken into account to define the access and management options of the user in the content of the portal.

1.4 Expected size of data

1.4.1 Expected number of OSOS Users & Projects

OSOS aims to create a network of 1000 pilot schools through the three phases presented in subsection 1.2.1: Stimulation, Incubation, and Acceleration. The aim is to create a pool of cases based on whole-school projects and initiatives from science centres and museums or research centres that promote creative problem solving, discovery, learning by doing, experiential learning, critical thinking and creativity, simulating the real scientific work. These activities include use of data analysis tools, access to unique resources, to animations and simulations of physical processes and experiments, educational games and projects presenting the basic concepts of science, and more. These activities will be implemented for one school year in 100 schools in different countries and locations (both urban and rural) in Europe. The Open Schooling Hubs will then identify at least 9 schools each. In this way, a network of 1000 schools will be created including the 100 Open Schooling Hubs. In each one of these 1000 schools, 2 STEM teachers will be involved and each teacher will evaluate 10 students. This number is based on the average available workstations per school. It is also envisaged that each one of the 1000 schools will create on average 5 projects.

These facts lead to the estimations presented in **Table** 3:

OSOS Schools	STEM Teachers / School	Total Teachers Involved
1.000	2	2.000
	Evaluated Students / Teacher	Total Evaluated Students
	10	20.000
	Projects / School	Total Projects
	5	5.000

Table 3: OSOS expected number of Users & Projects

1.4.2 Expected size of data

As OSOS Infrastructure will be based on the ODS and ISE portal, a safe way to estimate the expected size of data is to examine the relevant information from the actual use of the ISE portal. The ISE portal currently hosts the data created from almost 12.000 Teachers and Experts that participated in the ISE

project activities and used the social and community building services to author and upload their own content. This content includes not only the user generated data, but also the data tracked for statistical purposes and currently counts a size of about 27GB. Based on previous analysis, from this number of users about the 3% of them are uploading their own content in the portal (~3600 Teachers).

Table 4 and **Table 5** incude a comparative presentation of the size for the biggest tables in the database for a period of three (3) years, from 2015 to 2017. Apart from the table that includes caching data and is managed to be kept in low levels, the rest of the tables have increased their size per ~6%. Taking into account that OSOS project will last for three (3) years too, the number of the schools and the teachers that is expected to participate in the project activities and will make use of the services of ISE portal that supports the OSOS Incubators and also the size of the data that is produced in similar authoring tools like the one that is planned to be provided for the creation of new projects from the teachers and the students based on previous experience, it is estimated that the size of the portal repository will increase about 7% up to the end of the project.

Table name	Rows		Data size (bytes}	
	2015	**2017**	**2015**	**2017**
analytics_query_instance_data	95.608,00	144.258,00	2.695.561.216,00	5.033.639.936,00
cache form	17.152,00	1.129,00	2.617.524.224,00	223.363.072,00
u.ser interactions	6.017.588,00	5.869.587,00	595.542.016,00	595.542.016,00
field_revision_field_eo_description	1.743.174,00	1.121.787,00	486.424.576,00	<186424576
field_data_field_eo_description	1.303.370,00	1.618.206,00	486.440.960,00	4.186.440.960,00
field_revision_field_edu_tags	2.194.164,00	2.323.848,00	199.884.800,00	199.868.416,00
taxonomy index	8.194.115,00	7.188.723,00	400.162.816,00	4.103.308.544,00
field_data_field_edu_tags	2.069.767,00	2.088.154,00	198.868.992,00	198.868.992,00
field_revision_body	791.012,00	702.165,00	400.474.112,00	4.122.494.208,00
field data body	355.695,00	769.572,00	400.441.344,00	4.122.445.056,00

Table 4: Biggest ISE tables (1 of 2)

Table name	Index size (bytes}		Total size (MB}		Difference
	2015	**2017**	**2015**	**2017**	**%**
analytics_query _instance_data	0,00	0,00	2.570,69	4.800,45	46,45%
cache form	2.637.824	98.304	2.498,78	213,11	-1072,53%
u.ser interactions	1.049.149.44	1.049.149.440	1.568,50	1.568,50	0,00%
field_revision_field_ eo_description	468.189.184	468.172.800	910,39	910,38	0,00%
field_data_field_eo_description	420.708.352	420.691.968	865,13	865,11	0,00%
field_revision_field_edu_tags	687.489.024	687.489.024	846,27	846,25	0,00%
taxonomy index	411.025.408	415.219.712	773,61	780,61	0,90%
field_data_field_edu_tags	611.745.792	612.794.368	773,06	774,06	0,13%
field_revision_body	200.458.240	200.392.704	573,09	594,03	3,53%
field data body	180.387.84	180.371.456	553,92	574,89	3,65%

Table 5: Biggest ISE tables (2 of 2)

2   FAIR Data

2.1   Making data Findable, including provisions for metadata

2.1.1   Data discoverability – metadata provision and standard identification mechanism

Metadata is, as its name implies, data about data. It describes the properties of a dataset. Metadata can cover various types of information. Descriptive metadata includes elements such as the title, abstract, author and keywords, and is mostly used to discover and identify a dataset. Another type is administrative metadata with elements such as the license, intellectual property rights, when and how the dataset was created, who has access to it, etc.

OSOS content types along with the ISE portal existing contenct types that support the OSOS services are featured by the Open Discovery Space LOM Application profile for their metadata descriptions that is presented in &2.1.5. This standard defined the identification of the data using specific structur of URIs and the metadata schemed provided support the discoverability and fully context description of the content. The content that fully adopts this structure is the educational resources, since it is partially used by the other content types in order to make the discoverability and searching of the content easier.

2.1.2   Naming Conventions

Since the entire infrastructure of the portal services is based on Drupal (Drupal 7.56) the supported conventions are used for the "machine names" and identities of the data created and hosted, following the core db scheme with the system and the newly custom created tables, related keys and indexes presented in **Figure 13**
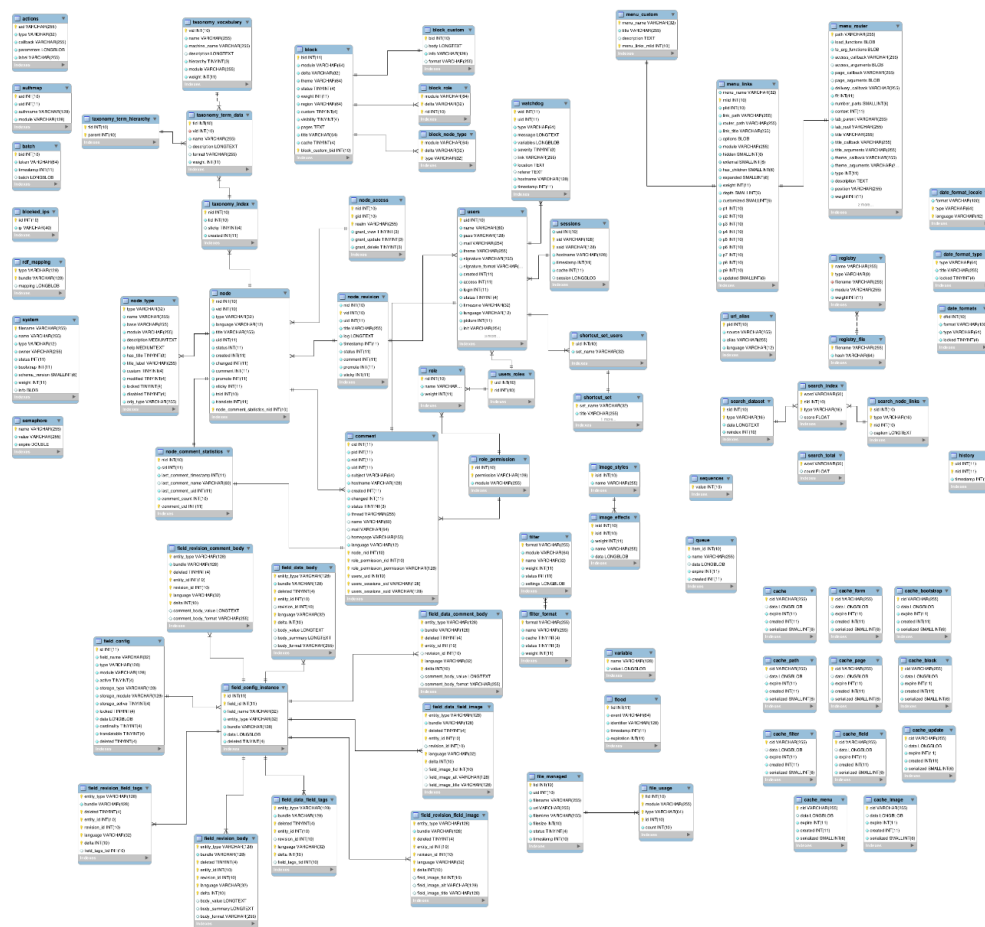
Figure 13: Drupal core db scheme

Especially for the educational resources, an additional mechanism is applied for the identification included in their XML schema structured based on the ODS LOM AP identifying every resource by means of dereferenceable URIs.

2.1.3 Search keywords

As mentioned, the content in the ISE portal follows the classification and vocabularies of the ODS AP. The educational resources are fully aligned with this standardized scheme since other content types partially follow it, in order to be easily searchable, aligned with the educational resources and the profiles of the users. The search mecnanism of the portal for the various content types allows the use of specific facets for narrowing the search and specify exact criteria, but also supports the use of keywords. The ODS AP already includes specific elements for defining keywords that characterize the educational resources and this element, whenever and for the resources that have it filled, it is used for matching the keywords provided by the users during with the ones included in the metadata scheme of the resources. This ensures the effective search of the content and the optimization of the results. During searching, the keyword that is imported by the users is not used only in this specific element but also in the following: Title of the content, Content of the main description and Tags provided either by the editor or other users of the portal

The superset of the ODS AP elements that are used for searvhing content in the portal are presented in **Table 6:**

Name of element	Type	Multilingual	Vocabulary - classification	ODS-AP Path
Title	Text	yes		/lom/general/title
Author Fullname	Text	no		/lom/lifeCycle/contribute/entity
Educational Object Description	Text	yes (todo)		/lom/general/description/string
LO Identifier	Text	no		/lom/general/identifier/entry
ODS general identifier	Text	no		/lom/general/identifier/entry (when catalog = 'ODS')
ODS metadata identifier	Text	no		/lom/metametadata/identifier/entry (when catalog = 'ODS')
ODS file location	Text	no		-
General Language	Term reference	no	ODS AP Languages	/lom/general/language
Language	language selection	no	(from internal vocabulary language)	/lom/general/language
Resource Link	link			/lom/technical/location
Educational TypicalAgeRange	Text	no		/lom/educational/typicalAgeRange/string
Rights Copyright	Term reference	no	ODS AP Rights.Copyright	/lom/rights/copyrightAndOtherRestrictions/value
Rights Cost	Term reference	no	ODS AP Rights.Cost	/lom/rights/cost/value
Classification TaxonPath	Text	yes		/lom/classification/taxonpath/taxon/entry/string
Classification Discipline	Term reference		ODS AP Classification.Discipline	calculated from /lom/classification/taxonpath/taxon/entry/string

Data Provider	Term reference		Repository	-
Educational Context	Term reference		ODS AP Educational.Context	/lom/educational/context/value
Edu Tags	Term reference		Edu Tags	/lom/general/keyword/string
EO Update Date	Date			/lom/lifeCycle/contribute/date/dateTime
Aggregation Level	Term reference	no	ODS AP Aggregation Level	/lom/general/aggregationLevel/value
Media Type	Term reference		ODS AP Technical.Format	/lom/technical/format
Learning Resource Type	Term Reference		ODS AP Educational.Learning ResourceType	/lom/educational/learningResourceType/value

Table 6: Facets used to apply searching in the portal content using ODS AP elements

2.1.4 Clear versioning

Dynamic versioning will be provided for the Projects created by the Teachers and edited by the Students on the metadata description and the actual content. Versioning of information makes a revision of datasets uniquely identifiable and this feature can be used to determine whether and how data has changed over time and to define specifically which version the creators / editors are working with.

Effective data versioning enables understand if a newer version of a dataset is available and which are the changes between the different versions enabling comparisons, and preventing confusion. Providing this possibility for OSOS Projects also the possibility of rolling back in a previous version will be available to ensure that the creators and editors will effectively and easily create their content. For this purpose, a version indicator will be used to identify the separate versions of the Projects. The final method for providing versioning information is yet definite but specific guidelines will be followed:

- A unique version number or date as part of the metadata for the dataset will be used.
- A consistent numbering scheme will be used with a meaningful approach to incrementing digits, such as [SchemaVer][5].
- Since a metadata schema will accompany the Projects a URI will be used that will not change as the versions change, but it will be possible to request a specific version through of it.
- Memento [RFC7089][6] will be used, to express temporal versioning of a dataset and to access the version that was operational at a given datetime. The Memento protocol aligns closely with the approach for assigning URIs to versions that is used for W3C specifications[7].

In this context, the Web Ontology Language [OWL2-QUICK-REFERENCE][8] and the Provenance, Authoring and versioning Ontology [PAV][9] will be considered to provide a number of annotation properties for version information.

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[5] http://schema.org/schemaVersion

[6] https://tools.ietf.org/html/rfc7089

[7] https://www.w3.org/TR/dwbp/

[8] https://www.w3.org/TR/owl2-quick-reference/

[9] https://pav-ontology.github.io/pav/

2.1.5 Metadata creation standards

For the metadata description of the educational content and the classification for the definition of other content type elements in the portal, the ODS Application Profile is applied. The **Open Discovery Space LOM Application Profile** is an IEEE LOM based application profile that enables the classification and retrieval of learning resources based on their learning context of use, capable of supporting the demands put forward from the educational design. The ODS AP does not cover only metadata authored by the designers of the educational content but also user generated metadata such as social tags and user reviews including appropriate social tags categories and evaluative metadata elements.

The main features of the ODS AP are the following:

- The ODS AP includes **all elements** of the IEEE LOM Standard
- The ODS AP includes as **mandatory elements:** (a) the metadata element **1.2 General.Title**, (b) the metadata element **4.3 Technical.Location,** which is used to store the location (e.g URL) of an educational resource and it is a crucial element for accessing an educational resource and (c) the metadata elements **9.1 Classification.Purpose** and **9.2 Classification.Taxon Path,** which are considered as key elements for classifying educational resources, lesson plans and educational scenarios based on learning context of use. These elements are commonly used by the searching mechanisms of existing repositories, collections/federations and in ISE portal too, for the various content types that adopt this classification.
- The ODS AP includes as recommended elements the metadata elements that are used to store the learning context information of educational resources, lesson plans and educational scenarios (except from those considered as mandatory elements) and these are: 1.1 General.Identifier, 1.3 General.Language, 1.5 General.Keyword, 1.8 General.Aggregation Level, 5.6 Educational.Context, 5.7 Educational.Typical Age Range, 5.8 Educational. Difficulty, and 5.9 Educational. Typical Learning Time. Moreover, ODS AP includes as recommended elements additional metadata elements that are frequently used by the searching mechanisms of existing repositories, collections/federations and they have not previously considered for storing learning context information. These additional elements are: 1.4 General.Description, 2.3 LifeCycle.Contribute, 5.2 Educational.Learning Resource Type. Finally, ODS AP includes as recommended elements those elements that are frequently used as mandatory in the examined APs used as basis and these elements are: 3.1 Meta-Metadata.Identifier, 3.2 Meta-Metadata.Contribute, 6.1 Rights.Cost, 6.2 Rights.Copyright and Other Restrictions and 6.3 Rights.Description
- All other IEEE LOM elements are included in the ODS AP as **optional elements.**
- For the classifications, a vocabulary is available at: http://vocbank.opendiscoveryspace.eu/

In **Table 7, Table 8, Table** 9 **and Table 10** the not-standardized elements used in ODS AP are presented since the **Appendix 7.2** presents an example of a valid ODS AP compatible educational resources.

General.Language – 1.3	Educational.Context – 5.6
Value Space	**Value Space**
en	primary education
nl	secondary education
fi	informal context
fr	
de	**Classification.Purpose – 9.1**
it	**Value Space**
el	assessment
pt	discipline

lv	educational objective
et	learning environment
lt	special need
es	teaching approach
hr	
sr	
bg	
da	

General. Aggregation Level – 1.8	
Value Space	**Definition**
1	The smallest level of aggregation, namely, an educational resource
2	A collection of level 1 learning objects, namely, a lesson plan
3	A collection of level 2 learning objects, namely an educational scenario

9.2.1 Classification. TaxonPath.Source
Value Space
ODS Assessment Vocabulary
ODS Arts Vocabulary
ODS Arts Vocabulary
ODS ICT Vocabulary
ODS Language Learning Vocabulary
ODS Mathematics Vocabulary
ODS Science Vocabulary
ODS Social Studies Vocabulary
ODS Learning Outcomes Vocabulary
ODS Learning Environment Vocabulary
ODS Special Needs Vocabulary
ODS Teaching Approaches Vocabulary

Table 7: ODS AP non-standardized elements (1 of 4)

Value Space			
Element	9.1 Classification. Purpose	9.2.1 Classification. TaxonPath.Source	9.2.2.1 Classification. TaxonPathTaxon.Id	9.2.2.2 Classification. TaxonPathTaxon.Entry
Value	assessment	ODS Assessment Vocabulary	ODS-Assess-1	Diagnostic-assessment
			ODS-Assess-2	Peer-assessment
			ODS-Assess-3	Self-assessment
			ODS-Assess-4	Summative assessment
			ODS-Assess-5	Not assessed
"9.1 Classification.Purspose" = "Assessment"				

Value Space			
Element	9.1 Classification. Purpose	9.2.1 Classification. TaxonPath.Source	9.2.2.1 Classification. TaxonPath. Taxon.Id	9.2.2.2 Classification. TaxonPathTaxon.Entry
Value	discipline	ODS Arts Vocabulary	ODS Curriculum – Based Vocabularies	
"9.1 Classification.Purpose" = "Discipline: Arts"				

	Value Space			
Element	9.1 Classification. Purpose	9.2.1 Classification. TaxonPath.Source	9.2.2.1 Classification. TaxonPath. Taxon.Id	9.2.2.2 Classification. TaxonPathTaxon.Entry
Value	discipline	ODS ICT Vocabulary	ODS Curriculum – Based Vocabularies	
"9.1 Classification.Purpsose" = "Discipline: ICT"				
	Value Space			
Element	9.1 Classification. Purpose	9.2.1 Classification. TaxonPath.Source	9.2.2.1 Classification. TaxonPath. Taxon.Id	9.2.2.2 Classification. TaxonPath.Taxon.Entry
Value	discipline	ODS Language Learning Vocabulary	ODS Curriculum – Based Vocabularies	
"9.1 Classification.Purpsose = "Discipline: Language Learning"				
	Value Space			
Element	9.1 Classification. Purpose	9.2.1 Classification. TaxonPath.Source	9.2.2.1 Classification. TaxonPathTaxon.Id	9.2.2.2 Classification. TaxonPathTaxon.Entry
Value	discipline	ODS Mathematics Vocabulary	ODS Curriculum – Based Vocabularies	
"9.1 Classification.Purpsose" = "Discipline: Mathematics"				
	Value Space			
Element	9.1 Classification. Purpose	9.2.1 Classification. TaxonPath.Source	9.2.2.1 Classification. TaxonPathTaxon.Id	9.2.2.2 Classification. TaxonPathTaxon.Entry
Value	discipline	ODS Science Vocabulary	ODS Curriculum – Based Vocabularies	
"9.1 Classification.Purpsose" = "Discipline: Science"				

Table 8: ODS AP non-standardized elements (2 of 4)

	Value Space			
Element	9.1 Classification. Purpose	9.2.1 Classification. TaxonPath.Source	9.2.2.1 Classification. TaxonPath. Taxon.Id	9.2.2.2 Classification. TaxonPath.Taxon.Entry
Value	discipline	ODS Social Studies Vocabulary	ODS Curriculum – Based Vocabularies	
"9.1 Classification.Purpsose" = "Discipline: Social Studies"				

	Value Space				
Element	9.1 Classification. Purpose	9.2.1 Classification. TaxonPath.Source	9.2.1 Classification.TaxoPath. Taxon	9.2.2.1 Classification. TaxonPathTaxon.Id	9.2.2.2 Classification. TaxonPathTaxon.Entry
Value	educational objective	ODS Learning Outcomes Vocabulary	-	**ODS-EO-01**	**Cognitive**
				ODS-EO-01-01	Knowledge
				ODS-EO-01-01-01	Factual
				ODS-EO-01-01-02	Conceptual
				ODS-EO-01-01-03	Procedural
				ODS-EO-01-01-04	Meta – cognitive
				ODS-EO-01-02	**Process**

				ODS-EO-01-02-01	To remember
				ODS-EO-01-02-02	To understand
				ODS-EO-01-02-03	To apply
				ODS-EO-01-02-04	To think critically and creatively
				ODS-EO-02	**Affective**
				ODS-EO-02-01	To pay attention
				ODS-EO-02-02	To respond and participate
				ODS-EO-02-03	To organize values
				ODS-EO-02-04	To form and follow a system of values
				ODS-EO-03	**Psychomotor**
				ODS-EO-03-01	To imitate and try
				ODS-EO-03-02	To perform confidentially following instructions
				ODS-EO-03-03	To perform independently, skillfully and precisely
				ODS-EO-03-04	To adapt and perform creatively
element "9.1 Classification.Purpsose" = "Educational Objective"					

Table 9: ODS AP non-standardized elements (3 of 4)

Value Space				
Element	9.1 Classification. Purpose	9.2.1 Classification. TaxonPath.Source	9.2.2.1 Classification. TaxonPathTaxon.Id	9.2.2.2 Classification. TaxonPathTaxon.Entry
Value	learning environment	ODS Learning Environment Vocabulary	ODS-LE-1	Audio-based
			ODS-LE-2	Computer-based
			ODS-LE-3	Field-based
			ODS-LE-4	Lab-based
			ODS-LE-5	Lecture-based
			ODS-LE-6	Simulator
			ODS-LE-7	Video
			ODS-LE-8	Work-based
"9.1 Classification.Purpsose" = "Learning Environment"				
Value Space				
Element	9.1 Classification. Purpose	9.2.1 Classification. TaxonPath.Source	9.2.2.1 Classification. TaxonPathTaxon.Id	9.2.2.2 Classification. TaxonPathTaxon.Entry
Value	special need	ODS Special Needs Vocabulary	ODS-SP-1	Visual
			ODS-SP-2	Auditive
			ODS-SP-3	Psychomotor
			ODS-SP-4	Behavioural
"9.1 Classification.Purpsose" = "Special Need"				

Value Space				
Element	9.1 Classification. Purpose	9.2.1 Classification. TaxonPath.Source	9.2.2.1 Classification. TaxonPathTaxon.Id	9.2.2.2 Classification. TaxonPathTaxon.Entry
Value	teaching approach	ODS Teaching Approaches Vocabulary	ODS-TA-01	Behaviourist
			ODS-TA-01-01	Programmed instruction
			ODS-TA-01-02	Drill and practise
			ODS-TA-02	Cognitivist
			ODS-TA-02-01	Direct instruction
			ODS-TA-02-02	Collaborative learning
			ODS-TA-02-03	Inquiry learning
			ODS-TA-02-04	Problem – based
			ODS-TA-02-05	Reciprocal teaching
			ODS-TA-03	Constructivist
			ODS-TA-03-01	Cognitive apprenticeship
			ODS-TA-03-02	Socratic instruction
			ODS-TA-03-03	Experiential learning
			ODS-TA-03-04	Action research
			ODS-TA-03-05	Communities of practice
			ODS-TA-03-06	Design-based learning
"9.1 Classification.Purpsose" = "Teaching Approach"				

Table 10: ODS AP non-standardized elements (4 of 4)

Definitions related to the ODS AP

Metadata Model: A **metadata model** is a structure description about the characteristics and properties of any given information resource, and allows the creation of catalogs and indexes for information resources, along with searching information on the basis of these characteristics. The metadata specification used widely for the description of digital resources is Dublin Core (DC) (Greenberg, 2001).

Educational Metadata: In the case of LOs, generic metadata models for digital resources (such as the Dublin Core model) are not sufficient, because they do not include information about the educational characteristics of a given LO. Consequently, specialized models that lay emphasis on the educational metadata of digital resources have been developed. **Educational metadata** represent the educational characteristics of a LO, such as the target groups it involves, or the educational context it addresses. The metadata model widely used for the description of LOs is the IEEE Learning Object Metadata (LOM) (IEEE LOM, 2005).

Application Profile: An Application Profile (AP) is a metadata scheme, which consists of metadata elements selected from one or more standard metadata schemes and it is created for allowing a given application to meet its functional requirements (Heery and Patel, 2000). The European Committee for Standardization (CEN/ISSS) defines an Application Profile (AP) as: "an assemblage of metadata elements selected from one or more metadata schemas and combined in a compound schema. Application profiles provide the means to express principles of modularity and extensibility. The purpose of an Application Profile is to adapt or combine existing schemas into a package that is tailored to the functional requirements of a particular application, while retaining interoperability with the original base schemas" (Duval et al., 2006).

Social Tagging: The act of adding keywords, also known as tags, to any type of digital resource by users (rather than resources' authors) (Bonino, 2009) is referred to as Social Tagging. The term of Social Tagging has emerged for those applications that encourage groups of individuals to openly share their private descriptions (or tags) of digital resources with other users, either by using a collection of tags created by the individuals for their personal use (referred to as folksonomy) (Anderson, 2007).

2.2 Making data openly Accessible

2.2.1 Openly available and Closed Data

A pilot deployment of the Open Learning Content Infrastructure of the OSOS Infastrucute allows all future educational content resources to be linked to portal learning metadata and hosts a subset of the educational content and metadata repositories at a virtual e-Infrastructure. To this aim, a virtual e-infrastructure is provided and a full set of portal metadata (around 600,000 e-learning resources) which all were structured according to the ODS AP schema, are exposed as Linked Open Data.

The full RDF dump of portal includes about 594K metadata records exposed as Linked Data with about 14M triples. The format of the RDF (see **Figure 14**) exposed is available to be downloaded at the following links: http://data.opendiscoveryspace.eu/ODS_LOM2LD/ODS_SecondDraft.html. The linked data exposure is available at http://data.opendiscoveryspace.eu. The SPARQL endpoint is also available at http://data.opendiscoveryspace.eu/sparql.tpl.

```
Turtle Example

    @prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
    @prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
    @prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
    @prefix dcterms: <http://purl.org/dc/terms/> .
    @prefix xdt: <http://www.w3.org/2005/xpath-datatypes> .
    @prefix cc: <http://creativecommons.org/ns#> .
    @prefix vcard: <http://www.w3.org/2001/vcard-rdf/3.0#>.
    @prefix lom:<http://ltsc.ieee.org/rdf/lomv1p0/lom#>.
    @prefix lomvoc: <http://ltsc.ieee.org/rdf/lomv1p0/vocabulary#>.
    @prefix lomterms: <http://ltsc.ieee.org/rdf/lomv1p0/terms#>.
    @prefix foaf: <http://xmlns.com/foaf/0.1/> .
```

Figure 14: Namespaces of Turtle format to represent RDF

Apart from this way of making the educational resources openly available, also specific APIs are provided and fully described in **subsection 2.2.2**

2.2.2 Data availability ways

2.2.2.1 Open APIs of the OSOS Infrastrucure

For accessing the data of OSOS Infrastructure, a number of open APIs are available to support further integration and collaboration of the portal with external tools that are properly authorized to use these services and access the data.

The first step for a "tool" or third-party application to het access on the integration services is to be registered and authenticated by the administrators of the portal.

These APIs enable all educational data produced in the OSOS Infrastructure to be shared with other projects/initiatives/entities. The APIS along with their features and attributes are presented in **Tables 11-19.**

- **User Management Services**

Method:		getUser
Description		Retrieves data of specific user participating in the external tools' community
Method Input:		

Parameter Name	Parameter Type	Description
Community_id	String	The id of the external tools' community node.
User_id	String	The id of the user

Method Output:	

Parameter Type	Description
JSON	The user data are provided in the following format {"username":"","mail":"","gender":"","full_name":"","organization":""}

Fault:	

Exception Name	Description
DBOperationException	Thrown in case the operation fails to be executed

<p align="center">**Table 11: User Management Services Open API (1 of 4)**</p>

Method:		notify
Description		Used for notification when a user account is deleted
Method Input:		

Parameter Name	Parameter Type	Description
User_id	String	The id of the user account deleted.

Method Output: N/A	

Fault:	

Exception Name	Description
DBOperationException	Thrown in case the operation fails to be executed

<p align="center">**Table 12: User Management Services Open API (2 of 4)**</p>

Method:		getUsersOfCommunity
Description		Retrieves all available users participated in the external tools' community.
Method Input:		

Parameter Name	Parameter Type	Description
Community_id	String	The id of the community node.

Method Output:	

Parameter Type	Description

JSONArray	The retrieved data are provided in the following format [{"uid":"","name":"","mail":"","full_name":"","gender":"","organization":""}]

Fault:

Exception Name	Description
DBOperationException	Thrown in case the operation fails to be executed

Table 13: User Management Services Open API (3 of 4)

Method:	createUser
Description	Creates a user under the external tools' community. If the username provided already exists then it is considered that the user exists and the data of the user are updated.

Method Input:

Parameter Name	Parameter Type	Description
Community_id	String	The id of the external tools' community node.
User_data	JSON	The format of the user data are as follow {"password":"","username":"","mail":"","gender":"","full_name":"","organization":""}

Method Output: N/A

Fault:

Exception Name	Description
DBOperationException	Thrown in case the operation fails to be executed

Table 14: User Management Services Open API (4 of 4)

- **Group Management Services**

Method:	createGroup
Description	Redirects user to the OSOS group creation page under the tools' community.

Method Input:

Parameter Name	Parameter Type	Description
Community_id	String	The id of the community node under which the group will be created.

Method Output: N/A

Fault:

Exception Name	Description
DBOperationException	Thrown in case the operation fails to be executed

Table 15: Group Management Services Open API (1 of 4)

Method:		getGroup
Description		Retrieves data of the specified group.

Method Input:

Parameter Name	Parameter Type	Description
Group_id	String	The id of the group node.

Method Output:

Parameter Type	Description
JSON	The user data are provided in the following format {"language":"","title":"","createdDate":"","number_ofParticipanrs":""}

Fault:

Exception Name	Description
DBOperationException	Thrown in case the operation fails to be executed

Table 16: Group Management Services Open API (2 of 4)

Method:		getUsersOfGroup
Description		Retrieves all available users participating in a specific group.

Method Input:

Parameter Name	Parameter Type	Description
Group_id	String	The id of the group node.

Method Output:

Parameter Type	Description
JSONArray	The retrieved data are provided in the following format [{"uid":"","name":"","mail":"","full_name":"","gender":"","organization":""}]

Fault:

Exception Name	Description
DBOperationException	Thrown in case the operation fails to be executed

Table 17: Group Management Services Open API (3 of 4)

Method:		addUser
Description		Adds a user in a Group under the external tools' community.
Method Input:		

Parameter Name	Parameter Type	Description
Group_id	String	The id of the external tools' community group.
User_id	String	The id of the user.

Method Output: N/A	
Fault:	

Exception Name	Description
DBOperationException	Thrown in case the operation fails to be executed

Table 18: Group Management Services Open API (4 of 4)

- **Resource sharing Services**

Method:		postScenario
Description		Post scenario as a reference in the community page.
Method Input:		

Parameter Name	Parameter Type	Description
Community_id	String	The id of the external tools' community node.
Scenario_data	JSON	The format of the scenario data are as follow {"scenario_id":"…", "title":"…" , "description":"…", "url":"…"}

Method Output: N/A	
Fault:	

Exception Name	Description
DBOperationException	Thrown in case the operation fails to be executed

Table 19: Resource Sharing Services Open API

2.2.2.2 Search OSOS Infrastructure educational resources

To facilitate the external tools basic-alignment, a JavaScript component is also availabe that offers functionality to search the ISE repository using the SOLR search engine operating on top of it. The SOLR search engine provides powerful searching mechanisms including full-text search and faceted search through REST-like HTTP/XML and JSON APIs that make it easy to use from virtually any programming language.

Figure 15 **and Figure 16** depict the use of this special JavaScript-based component.

Figure 15 depicts the case where the component has not any search parameters defined yet. In the left hand column, the user is able to specify various search parameters such as a search string, the educational context, the repository from which the desired resources should come from or the date related to the resource. Note that these parameters are indicative and the component can be configured to include many more.

Figure 15: Initial state of the Search page

Figure 16 depicts a situation where a number of search parameters have already been specified:

- "newton law" search string
- "en" language (this stands for English)
- "Cosmos" repository

The result set shown in the right-hand side corresponds to metadata records that refer to English resources residing at the Cosmos repository that are describing Newton's law in physics. The user can further refine the search by adding new parameters or delete any of the above three parameters to make the search more general.

Figure 16: The search page after specifying a number of search criteria

In **Appendix 7.3** more technical details about the use of the Search API are provided

2.2.3 Methods, software tools and documentation to access OSOS data

The methods software and tools that can be used for the different ways of accessing the portal data are presented under the Training Academies of the portal including documentation, descriptive and supporting material. The following activities have beed made available online:

2.2.3.1 Title: ODS Moodle plugin

Description: he main target of the current activity is to make an introduction and give all the necessary guidelines for the Moodle Blocks that have been developed to enable the alignment of Moodle installations with the portal. The objective behind these modules is to facilitate the inclusion of stakeholders that use Moodle installations in ODS, since there are several schools that use Moodle to organize their content and support their learning activities. In this context, two Moodle Blocks were implemented. The first one provides access to the ODS repository search services and uses a generic JavaScript-based component. The second Moodle block provides the necessary functionality to enable harvesting of Moodle courses from the ODS harvester, thus offering the capability to the users of a Moodle installations that uses this block to publish their educational content in the ODS repository. The first block essentially provides basic-level alignment while the second block provides a systematic way of entry-level alignment of Moodle installations.

URL:http://portal.opendiscoveryspace.eu/en/tr-activity/developing-ods-moodle-plugin-introduction-future-developers-834760

2.2.3.2 Title: Metadata Ingestion

Description: In this learning module the content providers will be presented with the basics of metadata harvesting. The most common protocols and technologies will be explored and foundations on how a harvesting-based population federation works will be given. Special attention will be paid to the concept of harvesting, the role of harvesting and OAI-PMH in ODS, and to the implementation of learning objects collections through an OAI-PMH endpoint.

URL: http://portal.opendiscoveryspace.eu/en/tr-activity/metadata-ingestion-ods-401764

2.2.3.3 Title: Building with ODS API

Description: This Training Activity focuses on the training of Technology Developers on building authoring tools compatible with the ODS system. It most particularly takes into consideration the development framework of ODS in order to allow people to either develop their own authoring tools or extend the existing metadata and scenario authoring tools.

URL: http://portal.opendiscoveryspace.eu/en/tr-activity/building-authoring-tools-compatible-ods-system-building-ods-api-668547

For the Search API of the portal relevant documentation for the basic architecture and features is uploaded here: https://github.com/evolvingweb/ajax-solr/wiki/Architectural-overview.

2.2.4 Data, metadata, code and documentations repositories

The data, metadata, code and documentation repositories are all rely on the same infrastructure and they are hosted as virtual machines in the GRNET ViMa[10] VPS service. The full list of the repositories is presented: (i) **Application server (**Hosts the Drupal installation (version 7.22) over a typical Apache HTTPd/PHP stack using the prefork multi-processing module[11]. Accepts HTTP connections only from the reverse proxy. Also hosts all the static content of the ODS portal (documents, presentations, images etc.), (ii) **Database server (**Holds ODS portal's data in a MySQL database (version 5.5.37) using InnoDB as storage engine. Current database size reaches 27 GB spanning in 982 tables.), (iii) **Web server (Responsible** for serving all HTTP user requests. Uses an Apache HTTPd in reverse proxy mode).

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[10] https://vima.grnet.gr/about/info/en/

[11] https://httpd.apache.org/docs/2.2/mod/prefork.html

For the new features of OSOS Incubators, a separate virtual machine will be engaged in the same infrastructure, and especially for the Project Authoring tool, for several reasons:

- It is expected that a siginificant amount of data will be produced during the creation and edit of the projects from the Teachers and the Students since also a versioning feature will be supported. So, the mass of the produced data wil be high
- The use of the tools from the students requires the concurrent use of the portal services and the tools and it is expected that the load of traffic will be significantly increased
- It will ease the better management of the load and the more effective support of the service since this division will positively affect the performance of the entire system
- Hosting the data of the Projects in a separate repository will ease and fasten the analysis to procude the proper statistics for the assessment framework of the project

It is mentioned that the provider of the infrastructure already supports the portal services for openness of data, supporting and providing the respective services of the portal and will continue the support for the OSOS project lifetime and features too.

2.2.5   Restrictions

The project actions and results are aligned with similar international initiatives and its various phases are developed taking into account input from key external players (educational authorities, international outreach groups, scientific organizations).

The consortium will make an exact plan so the results of the project to be presented in numerous conferences and workshops in Europe and beyond (e.g. EPS, GIREP, ESERA, EHTA biennial conferences, etc.). Upon the delivery of the first project results, papers will be submitted to scientific journals and magazines focusing on education, innovation education, STEM education. The papers produced by OSOS will be open access so that they can be immediately and freely available to the wide public (using more precisely the gold open access model). Furthermore, according to the OSOS Grant Agreement[12,] each OSOS partner must ensure open access (free of charge online access for any user) to all peer-reviewed scientific publications relating to its results.

In particular, it must:

- as soon as possible and at the latest on publication, deposit a machine-readable electronic copy of the published version or final peer-reviewed manuscript accepted for publication in a repository for scientific publications; Moreover, the beneficiary must aim to deposit at the same time the research data needed to validate the results presented in the deposited scientific publications.
- ensure open access to the deposited publication — via the repository — at the latest on publication, if an electronic version is available for free via the publisher, or within six months of publication
- ensure open access — via the repository — to the bibliographic metadata that identify the deposited publication.

Regarding the digital research data generated in the action ('data'), the beneficiaries must:

- deposit in a research data repository and take measures to make it possible for third parties to access, mine, exploit, reproduce and disseminate — free of charge for any user — the following: (i) the data, including associated metadata, needed to validate the results presented in, (ii) scientific publications as soon as possible, (iii) other data, including associated metadata, as specified and within the deadlines laid down

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[12] Grant Agreement number: 741572 — OSOS — H2020-SwafS-2016-17/H2020-SwafS-2016-1, Article 29

- provide information — via the repository — about tools and instruments at the disposal of the beneficiaries and necessary for validating the results (and — where possible — provide the tools and instruments themselves).

Regarding the sensitive student related data generated and collected through questionnaires, projects and activities throughout the project, each school's responsible OSOS manager is able to decide if and when these data can be shared or used.

At this case, a Creative Commons License will be used. (see **subsection 2.4.1**).

2.3   Making data Interoperable

All methods, tools and standards decribed in the previous sections ensure the interoperability aspect of the data generated in the ISE portal and the services of the portal as well. All standards that cover this aspect are listed:

- **ODS LOM AP:** Metadata description of educational resources and related content
- **UNESCO ICT Competency Framework for Teachers[13]:** For the Teachers' profiles, to be able to match teachers' competences with educational resources descriptions (through IEEE LOM related metadata)
- **IEEE LOM[14]:** Standard's vocabularies are used for the classification of the ODS AP elements
- **OAI-PMH:** For metadata publishing and harvesting

2.4   Increase data re-use

2.4.1   License schemes of OSOS Data to permit the widest use possible

The licencing scheme that is applied in the portal for the educational content follows and applies the framework and standard restrictions specified by the Creative Commons License. (https://creativecommons.org). The originators of the content define the level of use and accessibility when creating new content and the selected option is applied for all users and visitors of the portal.

For the educational content that the originator declares that is fully open to access and use the rules applied by the privacy levels of the community are enforced. The selected options are recorded and defined by specific elements in the metadata description of the educational content and thus is ensured that all future uses and presentation of the content will follow them in case of aggregation of the portal repository by a third, external repository.

2.4.2   Re-use of Data

All the four types of Data collected and generated during the project's lifetime and after its termination, will be re-usable by the massive community of OSOS stakeholders. OSOS will deploy an open learning content infrastructure that aggregates existing repositories and tools into a critical mass of e-learning contents, covering around 1,000,000 e-learning resources from 75 educational repositories across the globe. Moreover, OSOS adopts social networking tools and offers the opportunity for the development of lightweight school-based portals to support the development of school-generated content, the assessment of the school's openness level and its cultural change. Addtitionaly, the consortium will include a key player in the field of digital education in Australia in order to inform the proposed OSOS framework and the resulting services with findings and initiatives taking place in different places of the world where school openness and innovation is at the highest level of the educational policy agenda. More specifically the consortium includes as partner the Curtin University of Technology (CURTIN).

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[13]   http://www.unesco.org/new/en/unesco/themes/icts/teacher-education/unesco-ict-competency-framework- for-teachers/

[14]   https://standards.ieee.org/findstds/standard/1484.12.1-2002.html

Curtin University of Technology (CURTIN) has considerable research expertise in key areas of this proposal namely, (a) in modelling schools as organizations as well as specific school actors such as teachers (b) digital systems for open access to education. In this framework CURTIN will contribute to WP2 and WP6.

Furthermore, the OSOS consortium set up a collaborative scheme with the Office for Digital Learning of the Massachusetts Institute of Technology (MIT). MIT ODL team are the initiators of the edX platform. MIT focusing on the recent Initiative for Learning and Teaching (TILT) that aims to bring the essence of the MIT learning approach beyond the borders of the campus to K-12 learners and teachers around the world. TILT looks to fill a growing need in science education by initiating new research, design, and outreach programs that will transform both how students learn and how we understand how students learn. TILT is following similar approaches with OSOS and offers a unique opportunity to follow its developments and to cooperate systematically with the MIT team in the OSOS Strategies (WP2) and to the Open Schooling Best Practices and Initial Pilots (WP4).

This collaboration scheme is based on the implementation of the "Arrangement between the European Commission and the Government of the United States of America for cooperation between researchers funded separately by the European Union's and the United States Framework Programmes on Research and innovation (signed on 17/10/2016)". Thus, the OSOS coordinating entity, EA, signed an agreement related to the Project with MIT ODL so to a) offer specific services to the project and b) reach a common understanding in respect of intellectual property rights, data access, and data dissemination and other matters considered essential to collaboration and to lay that understanding down in a Memorandum of Understanding among themselves. The Horizon 2020 OSOS coordinating entity (EA) ensures that any understanding reached is compatible with the obligations under the Horizon 2020 project and the US partner (MIT) likewise ensures it is compatible with the obligations under its funding mechanism (e.g. National Science Foundation of USA (http://www.nsf.gov/).

3   Allocation of resources

3.1   Costs of making OSOS data FAIR

OSOS' infrastructure will be based on the existing ODS and ISE portal and their huge community and precious content. The costs for setting up this infrastructure is analysed in **Table 20**

Cost Item	Total Investment
Development of the Open Discovery Space (http://opendiscoveryspace.eu/) portal (50% co-funded)	10.000.000 €
Development of Inspring Science Education (www.inspiringscience.eu) content (50% co-funded)	8.000.000 €
OSOS Authoring Tool for student projects	200.000 €
Total	**18.200.000 €**

Table 20: OSOS needed infrastructure cost

3.2   Data management responsibilities in the OSOS Infrastructure

For the effective, secure and proper creation and management of the content, the portal includes specific roles, properly assigned with access and administration privileges

Administrators: they have full access in the portal content and services. Only a few people are assigned with this role that are responsible for the administration of the portal and support of users.

Registered users: these are users that participate in the implementation of the project from the schools' and stakeholders' side and might be teachers or experts. This role is defined by the user during his/her registration or by the administrator of the portal.

National coordinators: The National Coordinators are mainly responsible for the registration and management of the Schools. This role is assigned by the administrator of the portal.

School manager: this role is assigned by the National Coordinators to teachers that are responsible to manage the profile of the Schools under of which they are registered.

Community Managers: this role is automatically assigned to the registered user that creates a new community in the portal and have access to the administration of the content of the community and also the members of it. The Community Manager initializes among other descriptive elements, the school under of which this community belongs to (if he/she is a Teacher) and if a community is public or private.

Students: these are not regular users of the portal. They access the projects that they participate using only a nickname and password that are related only to the project, the url of which is shared by their teacher. No further information or personal data is imported and kept in the portal.

eLearning tools managers: this role is assigned to users that are responsible for the management of the eLearning tools in the portal. This role is assigned by the administrator of the portal.

Training activity contributors: the users assigned with this role are responsible for the management of the Training Activities. This role is assigned by the administrator of the portal.

Tool providers: this role is assigned to users that are responsible for the registering eLearning tools in the portal. This role is assigned by the administrator of the portal.

News editor: the users assigned with this role are responsible for the management of the News in the portal. This role is assigned by the administrator of the portal.

Analyst: the users with this role can create queries on the analytics and view the results in the form or reports or download them as excel files. This role is assigned by the administrator of the portal.

3.3 Costs and value of long term preservation

The annual administrative costs of the OSOS Portal are estimated around 40.760 euros, while the annual maintenance costs are estimated at 13.920 euros. The Total Annual Costs for running the Osos Portal & Support Mechanisms is estimated at 54.680 euros and is analysed in **Table 21.**

PORTAL ADMINISTRATION	Calculated on monthly basis						
	# / month	time (min)	total time (min)	total time (hours)	days	Cost / month	YEARLY
Administration Support							
User registrations	60	2	120	2	0,25	80,00 €	960,00 €
Community requests	25	3	75	1,25	0,16	50,00 €	600,00 €
Users' communication	10	70	700	11,67	1,46	466,67 €	5.600,00 €
Community statistics	1	480	480	8	1	320,00 €	3.840,00 €
Portal statistics	0,33	2400	800	13,33	1,67	533,33 €	6.400,00 €
ISE tools statistics	0,33	300	100	1,67	0,21	66,67 €	800,00 €
Maintaine of statistics file	1	120	120	2,00	0,25	80,00 €	960,00 €
Dissemination Support							
e-mail communication	2	960	1920	32	4	1.280 €	15.360 €
News admin	3	20	60	1	0,13	40,00 €	480,00 €
Development Support							
New GUI of supported communities / engaged projects	0,5	1440	720	12	1,5	480,00 €	5.760,00 €
TOTAL ADMINISTRATION COSTS (€)			4375	72,92	9,11	3.396,67	40.760,00
PORTAL MAINTENANCE	# / month	time (min)	total time (min)	total time (hours)	days	Cost / month	YEARLY
Technical support (bug fixing, cashing and clearance steps, upgrade if necessary, restart)	3	240	720	12	1,5	480,00 €	5.760,00 €
Infrastructure maintainance	3	240	720	12	1,5	480,00 €	5.760,00 €
TOTAL (€)			1440	24	3	960,00 €	11.520,00
Hosting						200,00 €	2.400,00 €
TOTAL MAINTENANCE COSTS (€)							13.920,00
TOTAL ANNUAL COSTS FOR RUNNING THE OSOS PORTAL & SUPPORT MECHANISMS (€)							54.680,00

Table 21: OSOS Annual Administration & Maintenance Costs

4 Data security

The security & privacy for the interacting users of the platform including all relevant stakeholders are covered from various aspects and levels throughout all levels of portal's infrastructure and platform:

- **Platform:** This level targets on the seamless access of the users in the individual components of the portal services, supporting end enhancing the service in an advanced and secure manner.
- **Service / sub-system:** This level of security regards the distributed authorization and auditing processes by the individual sub-systems of the platform and allows the controlled access and guidance of the users on the available services
- **Entities organization:** This level provides the controlled access and follows the privacy mechanisms on the Schools, teachers and communities /groups data that are ensured by the organization of the relations among these entities. These levels of organization are totally respected by the implementation and provision of the relevant services and navigation of the users throughout the portal.
- **Community-based:** Due to the collaborative nature of the services provided through the grow of extended community networks, privacy settings are supported also at community level, in order to protect the privacy settings, set by the community managers on the users' activities and content developed under the communities. The "open" and "private" modes are established as options and respected in all levels of presentation and access of the communities' content.
- **Users' profile-based:** The users / entities that are registered and profiled to the portal manage the partially access on their personal / public data based on their preferences and self-defined restrictions
- **Content contextual description & IPRs:** Access on the individual educational resources, tools and other content provided in the portal follow and cover the IPRs set by their authors/creators, as these are set using the contextual descriptions of them.

Regarding the privacy policy that is followed in the portal and its special conditions are presented in the relevant policy statement in **Appendix 7.1** and it will be online provided for the acknowledgement to the users.

5   Ethical aspects & Other Issues

5.1   Ethical Aspects

The OSOS project will comply with data protection acts, directives, and opinions, both at European and at National level. These include: (i) Directive 95/46/EC of the European Parliament and the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data, (ii) The Charter of Fundamental Rights of the EU, specifically the article concerning the protection of personal data, (iii) UK Data protection act 1998, reviewing the rights of UK citizens to access personal information, (iv) The opinions of the European Group on Ethics in Science and New Technologies in their report "Citizen Rights and New Technologies: A European Challenge" on the Charter on Fundamental Rights related to technological innovation. In particular, recommendations related to ICT concerning data protection and individuals' freedom and autonomy will be taken into account. The Project Coordinator will ensure compliance with such legislation. The Consortium notes that the proposed research and activities of the project involve one area highlighted of the Ethical Issues Table: i.e. the involvement of children.

Furthermore, OSOS will engage young people, aged 10-18, in science education activities. Parental consent will be required for the children to participate in the project. A series of procedures will therefore be set in motion to secure privacy, security and ethical conduct in all our field and evaluation studies. Specifically:

- All researchers and mentors involved in school-based activities, or working directly with children outside school, will be required to follow all national procedures for verifying fitness to access school premises.
- All researchers will be required to have school-verified identification and a school liaison person available at all times during school visits.
- All researchers will be aware of essential health and safety issues concerning students on school premises.
- Parental consent will be obtained for each step in the activity (e.g. children's involvement in evaluation studies, videos, photographs).

5.2   Other data management procedures

Handling of user personal data: The project consortium will devise mechanisms that comply with the rules relating to the protection of personal data, as described in Directive 95/46/EC. This Directive regulates the processing of personal data and stipulates, among other things, the following:

- The data subject has the right to be informed when his/her personal data are being processed
- Data may be processed only under the following circumstances (Art 7):
  - When the data subject has unambiguously given his/her consent.
  - When the processing is necessary for the performance of or the entering into a contract.
  - When processing is necessary for compliance with a legal obligation.
  - When processing is necessary in order to protect the vital interests of the data subject.
  - When processing is necessary for the performance of a task carried out in the public interest or in the exercise of official authority vested in the controller or in a third party to whom the data are disclosed.
  - When processing is necessary for the purposes of the legitimate interests pursued by the controller or by the third party or parties to whom the data is disclosed, except where such interests are overridden by the interests for fundamental rights and freedoms of the data subject.

In summary, in all cases the project undertakes to ensure that all data used within it will be:

- fairly and lawfully processed
- processed for limited purposes
- adequate, relevant and not excessive
- accurate
- not kept longer than necessary
- processed in accordance with the data subject's rights, both locally and within EU legislation
- secure
- not transferred to countries without adequate protection.

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7 Appendix

7.1 Privacy Policy

OSOS is committed to protect your privacy and will collect, process and use all data in accordance with the Data Protection Directives and all other applicable data protection laws in the European Union.

By accepting this privacy policy you give your consent that OSOS collects, processes and uses data you provide when you register as a user, along with any information that you submit or enter during your visits on OSOS according to this privacy policy. If you do not agree to the regulations as set out in this privacy policy, press the "No" Button to exit registration.

You may, at any time, in whole or in part revoke your consent.

The use of your data according to this privacy policy is one of the basic requirements to properly use the OSOS service. If you revoke your consent, OSOS will terminate the agreement allowing the use of OSOS service and delete your profile.

In particular, but not limited to, you agree to the following:

You agree, that cookies are used on OSOS (see item 6. for further information).

You agree, that your name and address (provided in your registration) will be given to any third party substantially claiming an infringement of their rights, if that third party addresses OSOS with a written warning containing sufficient prove for the infringement of their rights, and after you were given the opportunity to object to the claim. You agree, that we will take the relevant material offline and that you will be notified via email to your email address and / or regular mail to your address provided in your registration and be given a time limit for objection of two (2) weeks.

OSOS will gather, process and use data about you and your computer system in order to provide and improve the service and features of the service. Some of the data will be provided by you as part of your registration and actions on the platform, and some will be collected automatically. In particular:

1. Responsible organization

INTRASOFT International S.A. (Rue Nicolas Bove 2b, Luxembourg) is responsible for the collection, processing and usage of your data regarding the use of OSOS. Should you have any queries concerning the privacy protection in OSOS, or should you wish to exercise your rights in connection with your personal data, please send an email to Lamprini Kolovou (Lamprini.Kolovou@intrasoft-intl.com).

2. Collection, processing and usage of personal data, and purpose

Personal data will be collected, processed and used, if you provide such personal data to us using the OSOS service. OSOS collects personal data that you voluntarily provide to become a registered user of the service, and when you use certain aspects of the service, such as writing comments, declaring areas of interests, tagging resources, messaging community members, etc.In the registration process, you will be asked to provide the following personal data: name, address, email address.In the course of registration you will be asked to choose a user name. As part of the service, to provide an educational social portal, it is necessary that a minimum amount of personal data such as user name or profile picture is visible to other registered users. The name shown to other users on the platform will be your user name, allowing you to use the portal anonymously.

OSOS may combine the personal data collected from you with other data collected from you – as described in item 3. below – and other users' data to provide you with a better experience of our service, i.e. to provide certain features of our service to you, such as to display information and suggestions based on users similar to you.

OSOS is a community project. To provide this service to you, a consortium of organizations is cooperating. You will find a list of the cooperating organizations by following this link: www.opendiscoveryspace.eu. Within the distributed consortium service architecture, your personal data will only be exchanged, if this is necessary to provide you with OSOS's service. This, method will be used, for example, to measure popularity of learning resources by gathering ratings, tags, bookmarks, views, etc. from yourself and other users. Data will also be exchanged for services like combined tag clouds for yourself and/or the communities you sign up to.

Other than that, personal data will only be exchanged with state authorities and government departments, if required by mandatory law, or if any third party substantially claims an infringement of their rights, if the third-party addresses OSOS with a written warning containing sufficient prove for the infringement of their rights, and after you were given the opportunity to object to the claim made by the third party, as agreed above in this agreement.

Other than that, personal data that you supply will not be given or otherwise disclosed to any third party without your prior consent.

As a rule, your personal data is not accessible through search engines.

All our employees, as well as all our cooperating partners within the consortium are obliged by us to keep all data and information confidential and to comply with this privacy policy as well as with mandatory law when processing and using your data.

Users should also be aware that information disclosed during sessions on OSOS (e.g. comments, tags, voting) is public information and may be displayed to other users.

3. Collection, processing and usage of other data

OSOS also uses technological tools like Web logs and cookies – please also see item 6. of this privacy policy – when you browse or use OSOS's service to collect certain information in a server log. The server log includes your Internet Protocol Address (by which the computer that is used can be identified), the remote host (name of the computer and IP address of your online access which requests the site), time of your request, status, volume of transferred data and the website from which you visited the requested site (referrer) as well as product and version information of your browser. OSOS anonymises the protocol data (logs) without identification or references to the user to use it for statistical analyses, particularly for server load predictions.

An anonymised unique user ID will be used in the ways how OSOS associates and stores the automatically generated information with personally identifiable information to provide you with a better experience of our service, i.e. to provide certain features of our service to you, such as to display information and suggestions based on users similar to you.

4. Security

OSOS uses technological and organizational security measures to protect your collected data from manipulation, loss, destruction, and against access through third parties. All security measures will be improved according to the development of standard security measures.

Identity theft and the practice currently known as "phishing" are of great concern to us. Safeguarding information to help protect you from identity theft is a top priority. We do not and will not, at any time, request your credit card information, your account ID, login password, or national identification numbers in a non-secure or unsolicited e-mail or telephone communication.

5. User's rights

When requested in writing, OSOS will provide you with information on your personal data which is saved at OSOS. OSOS will correct all data, should any data be false or out of date, and requested by you in writing. Moreover, you have the right to ask OSOS for suspension and / or deletion of your personal data.

If you would like us to delete, suspend, correct your data or if you would like to receive information on your saved data, please contact us with a request that we delete your information from our database. We will use economically justifiable efforts to honour your request. We may retain an archived copy of your records if required by mandatory law.

6. Cookies

Cookies are bits of electronic information that can be transferred to a user's hard drive to customize a person's usage of a product or website, keep records of a user's access to a website or product, or store information needed by the user on a regular basis. The use of cookies is typically associated with websites. OSOS uses cookies. For example, when you sign in, OSOS stores your user ID and a combination of your IP address and time of login as a cookie on your hard drive. This cookie allows you to move from page to page without having to sign in again on each page. Similarly, if you enter information during your session, such as search keywords, this will be stored as a cookie and you will not have to re-enter such information during that session.

If you do not want cookies to be used, you may make certain changes to the preferences of your browser. You may use OSOS's service with certain limitations, in particular regarding the features of the service, the display of information and suggestions based on your history or users similar to you.

INTRASOFT International S.A.

Name of representative : **Lamprini Kolovou**

Address : **Rue Nicolas Bove 2b**

Phone number : **+ 30 310 6876482**

Fax number : **+ 30 210 6876478**

E-mail : contact_ods@intrasoft-intl.com

7.2   OSOS XML Schema Sample

```
<?xml version="1.0" encoding="UTF-8"?>

<lom        xmlns:lom="http://ltsc.ieee.org/xsd/LOM"        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://ltsc.ieee.org/xsd/LOM lomODS.xsd">

 <!-- 1. General Category -->

 <general>

  <identifier>

   <catalog>ODS</catalog>

   <entry>2345.lo</entry>

  </identifier>

  <title>

   <string language="en">DNA duplication and mutations</string>

  </title>

  <language>el</language>

  <description>

   <string language="en">Information on DNA structure, replication, transcription, translation and mutations</string>

  </description>

  <keyword>

   <string language="en">DNA</string>
```

```xml
    <string language="en">functions of DNA</string>
    <string language="en">DNA structure</string>
  </keyword>
  <structure>
    <source>LOMODSv1.0</source>
    <value>atomic</value>
  </structure>
  <aggregationLevel>
    <source>LOMODSv1.0</source>
    <value>1</value>
  </aggregationLevel>
</general>
<!-- 2. LifeCycle Category -->
<lifeCycle>
  <version>
    <string>1.0</string>
  </version>
  <status>
    <source>LOMODSv1.0</source>
    <value>final</value>
  </status>
  <contribute>
    <role>
      <source>LOMODSv1.0</source>
      <value>author</value>
    </role>
    <entity><![CDATA[BEGIN:VCARD
FN:Youtube
ORG:Youtube
N:Youtube
VERSION:3.0
END:VCARD]]></entity>
    <date>
      <dateTime>2007-07-19T01:42:32.00Z</dateTime>
      <description />
    </date>
  </contribute>
</lifeCycle>
<!-- 3. Meta-Metadata Category -->
<metaMetadata>
  <identifier>
```

```xml
      <catalog />
      <entry />
    </identifier>
    <contribute>
      <role>
        <source>LOMODSv1.0</source>
        <value>creator</value>
      </role>
      <entity><![CDATA[BEGIN:VCARD
FN:Panagiotis Zervas
EMAIL;TYPE=INTERNET:pzervas@iti.gr
ORG:CERTH
N:Zervas;Panagiotis
VERSION:3.0
END:VCARD]]></entity>
        <date>
          <dateTime>2011-04-02T20:18:50.50Z</dateTime>
          <description />
        </date>
    </contribute>
    <contribute>
      <role>
        <source>LOMODSv1.0</source>
        <value>validator</value>
      </role>
      <entity><![CDATA[BEGIN:VCARD
FN:Panagiotis Zervas
EMAIL;TYPE=INTERNET:pzervas@iti.gr
ORG:CERTH
N:Zervas;Panagiotis
VERSION:3.0
END:VCARD]]></entity>
        <date>
          <dateTime>2011-04-02T20:18:50.50Z</dateTime>
          <description />
        </date>
    </contribute>
    <metadataSchema>LOMv1.0</metadataSchema>
    <language>en</language>
  </metaMetadata>
  <!-- 4. Technical Category -->
```

```xml
<technical>
 <format>video/mpeg</format>
 <size>5000</size>
 <location>http://www.youtube.com/watch?v=l0TC9Lt7IGU</location>
 <requirement>
  <orComposite>
   <type>
    <source>LOMODSv1.0</source>
    <value>operating system</value>
   </type>
   <name>
    <source>LOMODSv1.0</source>
    <value>any</value>
   </name>
   <minimumVersion />
   <maximumVersion />
  </orComposite>
 </requirement>
 <duration>
  <duration>PT8M18S</duration>
  <description />
 </duration>
</technical>
<!-- 5. Educational Category -->
<educational>
 <interactivityType>
  <source>LOMODSv1.0</source>
  <value>expositive</value>
 </interactivityType>
 <learningResourceType>
  <source>LOMODSv1.0</source>
  <value>video</value>
 </learningResourceType>
 <interactivityLevel>
  <source>LOMODSv1.0</source>
  <value>very low</value>
 </interactivityLevel>
 <semanticDensity>
  <source>LOMODSv1.0</source>
  <value>medium</value>
 </semanticDensity>
```

```xml
<intendedEndUserRole>
  <source>LOMODSv1.0</source>
  <value>teacher</value>
</intendedEndUserRole>
<intendedEndUserRole>
  <source>LOMODSv1.0</source>
  <value>learner</value>
</intendedEndUserRole>
<context>
  <source>LOMODSv1.0</source>
  <value>secondary education</value>
</context>
<typicalAgeRange>
  <string language="en">13-U</string>
</typicalAgeRange>
<difficulty>
  <source>LOMODSv1.0</source>
  <value>medium</value>
</difficulty>
<typicalLearningTime>
  <duration>PT10M</duration>
  <description />
</typicalLearningTime>
<description>
  <string language="en" />
</description>
<language>en</language>
</educational>
<!-- 6. Rights Category -->
<rights>
 <cost>
  <source>LOMODSv1.0</source>
  <value>no</value>
 </cost>
 <copyrightAndOtherRestrictions>
  <source>LOMODSv1.0</source>
  <value>yes</value>
 </copyrightAndOtherRestrictions>
 <description>
  <string language="en">http://creativecommons.org/licenses/by-nc-nd/3.0</string>
 </description>
```

```
  </rights>
  <!-- 8. Annotation Category -->
  <annotation>
    <entity><![CDATA[BEGIN:VCARD
FN:Panagiotis Zervas
EMAIL;TYPE=INTERNET:pzervas@iti.gr
ORG:CERTH
N:Zervas;Panagiotis
VERSION:3.0
END:VCARD]]></entity>
    <date>
      <dateTime>2011-04-02T20:18:50.50Z</dateTime>
      <description />
    </date>
    <description>
      <string language="en">Quality certified</string>
    </description>
  </annotation>
  <!-- 9. Classification Category -->
  <classification>
    <purpose>
      <source>LOMODSv1.0</source>
      <value>discipline</value>
    </purpose>
    <taxonPath>
      <source>
        <string language="en">ODS Science Vocabulary</string>
      </source>
      <taxon>
        <id />
        <entry>
          <string language="en">Life processes</string>
        </entry>
      </taxon>
      <taxon>
        <id />
        <entry>
          <string language="en">Cell processes - generally</string>
        </entry>
      </taxon>
    </taxonPath>
```

```xml
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  <source>
    <string language="en">ODS Science Vocabulary</string>
  </source>
  <taxon>
    <id />
    <entry>
      <string language="en">Atoms and molecules</string>
    </entry>
  </taxon>
  <taxon>
    <id />
    <entry>
      <string language="en">Molecules   generally</string>
    </entry>
  </taxon>
</taxonPath>
</classification>
<classification>
  <purpose>
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    <value>special need</value>
  </purpose>
  <taxonPath>
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      <string language="en">ODS Special Needs Vocabulary</string>
    </source>
    <taxon>
      <id>ODS-SP-1</id>
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      </entry>
    </taxon>
  </taxonPath>
</classification>
<classification>
  <purpose>
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    <value>learning environment</value>
  </purpose>
  <taxonPath>
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    </source>
    <taxon>
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        <string language="en">Computer   based</string>
      </entry>
    </taxon>
    <taxon>
      <id>ODS-LE-5</id>
      <entry>
        <string language="en">Lecture-based</string>
      </entry>
    </taxon>
  </taxonPath>
 </classification>
</lom>
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7.3   Technical details of Search API

Returning parameters: "id", "site", "hash" ,"entity_id", "entity_type", "bundle", "bundle_name", "ss_language", "path" , "url", "path_alias", "label", "spell", "content", "teaser", "ss_name", "tos_name", "ss_name_formatted", "tos_name_formatted", "is_uid", "bs_status", "bs_sticky","bs_promote", "is_tnid", "bs_translate", "ds_created", "ds_changed", "ds_last_comment_or_change", "im_field_edu_tags", "tid", "im_vid_11", "sm_vid_Edu_Tags", "tm_vid_11_names", "bm_field_ods_object", "bs_field_ods_object", "dm_field_eo_update_date", "im_field_aggregation_level", "im_vid_21", "sm_vid_ODS_AP_Aggregation_Level", "tm_vid_21_names", "im_field_data_provider", "im_vid_44", "sm_vid_Repository", "tm_vid_44_names", "im_field_general_language", "im_vid_32", "sm_vid_ODS_AP_Languages", , "tm_vid_32_names", "im_field_rights_copyright", "im_vid_38", "sm_vid_ODS_AP_Rights_Copyright", "tm_vid_38_names", "loid", "timestamp", "author"

Sample of response:

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name="label"><str>Microsoft PowerPoint- 00-MARK SOCIAL-ALUMNOS.ppt [Modo de compatibilidad]</str></arr><arr
name="spell"><str>Microsoft PowerPoint- 00-MARK SOCIAL-ALUMNOS.ppt [Modo de compatibilidad]</str></arr><str
name="teaser">MARKETING SOCIAL
MARKETING SOCIALMARKETING SOCIALMARKETING SOCIALMARKETING SOCIAL
1Jaime Rivera Camino
MARKETING SOCIAL
OBJETIVOS DE APRENDIZAJE
•COMPRENDER LA IMPORTANCIA DEL MARKETING PARA L...</str><str name="tos_name">social updater</str><str
name="tos_name_formatted">social updater</str><long name="is_uid">46</long><bool
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name="is_tnid">0</long><bool name="bs_translate">false</bool><date name="ds_created">2013-09-
25T16:21:35Z</date><date name="ds_changed">2013-09-28T06:29:51Z</date><date
name="ds_last_comment_or_change">2013-09-28T06:29:51Z</date><arr
name="bm_field_ods_object"><bool>false</bool></arr><bool name="bs_field_ods_object">false</bool><arr
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MARKETING SOCIALMARKETING SOCIALMARKETING SOCIALMARKETING SOCIAL
1Jaime Rivera Camino
MARKETING SOCIAL
OBJETIVOS DE APRENDIZAJE
•COMPRENDER LA IMPORTANCIA DEL MARKETING PARA L...</str><str>Spanish</str></arr><arr name="twm_content_es"><str>MARKETING SOCIAL
MARKETING SOCIALMARKETING SOCIALMARKETING SOCIALMARKETING SOCIAL
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MARKETING SOCIALMARKETING SOCIALMARKETING SOCIALMARKETING SOCIAL
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Barreto, Emerson Paes Samedi, Septembre 28, 2013- 02:00 Educational Object Promover o debate sobre o uso dos agrotóxicos na</str><str name="tos_name">social updater</str><str name="tos_name_formatted">social updater</str><long name="is_uid">46</long><bool name="bs_status">true</bool><bool name="bs_sticky">false</bool><bool name="bs_promote">false</bool><long name="is_tnid">0</long><bool name="bs_translate">false</bool><date name="ds_created">2013-09-25T16:21:35Z</date><date name="ds_changed">2013-09-28T06:29:51Z</date><date name="ds_last_comment_or_change">2013-09-28T06:29:51Z</date><arr name="bm_field_ods_object"><bool>false</bool></arr><bool name="bs_field_ods_object">false</bool><arr name="dm_field_eo_update_date"><date>2013-09-28T00:00:00Z</date></arr><date name="updated">2013-09-28T00:00:00Z</date><arr name="im_field_aggregation_level"><long>14312</long></arr><arr name="tid"><long>14312</long><long>14460</long><long>14391</long></arr><arr name="im_vid_21"><long>14312</long></arr><arr name="tm_vid_21_names"><str>Educational Object</str></arr><arr name="im_field_data_provider"><long>14460</long></arr><arr name="im_vid_44"><long>14460</long></arr><arr name="tm_vid_44_names"><str>La Flor</str></arr><arr name="im_field_rights_copyright"><long>14391</long></arr><arr name="im_vid_38"><long>14391</long></arr><arr name="tm_vid_38_names"><str>Yes</str></arr><str name="i18n_label_en">TV Escola – Sala de Professor – Programa Frutas e Legumes – Parte 05</str><str name="author">Pamplona, Gilberto; 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View Resource Pamplona, Gilberto; Barreto, Emerson Paes Samedi, Septembre 28, 2013- 02:00 Educational Object
Promover o debate sobre o uso dos agrotóxicos na agricultura, subsidiando com argumentos e conceitos La Flor Yes TV
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name="tm_vid_44_names"><str>La Flor</str></arr><arr
name="im_field_general_language"><long>14345</long></arr><arr name="im_vid_32"><long>14345</long></arr><arr
name="tm_vid_32_names"><str>Spanish</str></arr><arr
name="im_field_rights_copyright"><long>14391</long></arr><arr name="im_vid_38"><long>14391</long></arr><arr
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Through Creativity and Community

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7.4 Portal content types

OSOS features will be support from the infrastructure side by a number of content types hosted and managed in the ISE portal. these are following described:

Educational resources: this is learning content created mainly by the project partners as best practices and also from the teachers that are registered in the portal. The learning resources can be either simple educational objects or more complex lesson plans or learning scenarios. This type of content is a complex type that include (1) the metadata scheme that describe the educational resource with specific structure and vocabulary followed based on the applied ODS LOM AP and (2) the main body, where the actual educational content is included (simple text or multimedia content).

Demonstrators: this is a specific type of learning content with similar structure of the educational resources that are advanced learning scenarios or lesson plans that make use of eLeanring tools and are provided as best practices from the portal. They follow the same structure as the rest of educational resources. The metadata description of the demonstrators follow the ODS LOM AP. This type of content is provided by the project partners.

Schools: this content type include all the information that describe the schools that are registered in the portal as specific entities. Their structure does not follow an standardized scheme. The schools are registered and managed in the portal by the project partners.

eLearning Tools: this type describe the eLeraning tools that are provided to the users of the portal to be used in their educational resources. Part of the structure followed the definition of elements and vocabulary of the ODS LOM AP to ease the interrelations with the rest of the content in the portal and make searching mechanism more effective. This type of content is mainly created by the project partners and tools' providers registered as experts in the portal.

Training Activities: these are training material provided to the teachers, experts and parents that visit the portal and follow specific structure. They might contain simple text or multimedia content and urls to better support their training objectives. Partially they follow the vocabulary of ODS LOM AP in order to ease the interrelations with the rest of the content in the portal and make searching mechanism more effective. The training activities are mainly provided by the project partners.

Communities: this is one of the core content created in the portal and follows a specific structure. Several relations among various communities and other content in the portal are created. The communities are user generated content and can be created by any registered user in the portal. The communities created by the Teachers are automatically related also with the School where these Teachers "belong" to. The level of access of the Communities define the also the level of their content. The "public" communities are accessible to all visitors of the portal and the content follows the restrictions that their creator enforce. The "private" communities allow access to the content only to their members and as a next level the restrictions of the creators of the content are applied.

Community modules: each community might contain several modules that serves the organization and promotion of its members activities. These modules are Croups, Events, Discussions, Activities, Blogs and Polls), they follow specific structure in the portal and they are created by the members of the communities.

Multimedia content: this is content that might be added in all previous complex content types to better support the presentation of the content.

Social data: social data are structured elements of data that accompany the complex content types described above. They are mainly provided by the members of the communities and can be tags, rates,

shares, votes, bookmarks, comments, follows. Especially for the educational tags that are provided by the registered users on the learning resources the ODS LOM AP vocabulary is followed.

Analytics: these data are created with an anonymous way in the portal, monitoring and following the users' actions in the portal in each portal page. They are not available to all visitors in the portal and to access them, specific queries should be created by the properly privileged users, the analysts.

News: the news is a simple content type in the portal that it is provided be privileged users and they present the most recent activities of the project. No metadata description is added but they might contain textual ore multimedia content to better present the activity described.

Projects: this content type is mainly created by the teachers and enhanced by the students that participate in the implementation of the project. Similar to the educational resources, they include (1) the metadata scheme that describe them and partially follows the structure and vocabulary of the ODS LOM AP and (2) the main body, where the actual content is included (simple text or multimedia content).

Accelerators: these are projects provided by the project partners to be used as best practices in the portal and they fully apply the structure of the projects.

It is mentioned that in the portal there is no row / unstructured data collected and imported in the system.