DESIGNING STRATEGIES AND ACTIONS TO SUPPORT OPEN SCIENCE: BUILDING CAPACITY IN AN ACADEMIC INSTITUTION

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Abstract

Introduction: The access of information to new learning devices, the ability to interconnect with libraries and repositories without barriers of time or space, and the way in which information is processed and made available highlight the urgency of reflection and access to the production and dissemination of scientific production by its stakeholders. To address these issues, academic institutions, together with their libraries, can devise and develop strategies that enable them to make fuller use of these resources, assisting them to interact with the Open Science movement with greater autonomy and effectiveness. **Aim of the study**: A curricular proposal for a postgraduate course targeted at researchers, science managers, and information professionals is presented, given the gap in higher education offer in this area in Portugal. **Methods**: A literature review was performed and a proposal for a postgraduate course was developed, based on the international FOSTER project. **Results**: The course has been structured in contents that aim to fulfill the objective of disseminating Open Science best practices in the context of higher education, articulated with information literacy. The subjects, distributed by semester, workload. and ECTS, are adaptable to the needs of teaching and dissemination, ensuring the training of researchers, science managers, and information professionals in skills appropriate for navigating this movement. **Conclusions**: The proposed postgraduate course aims to reinforce the importance of building the capacity and best practices' training of stakeholders within Open Science.

Keywords

Open Science; Higher education; Information Literacy; Learning; Post-graduation studies; Skills

Introduction

In May 2016, in the conclusions of the European Council meeting, it was defined that Open Science "has the potential to increase the quality, impact and benefits of science and to accelerate advancement of knowledge by making it more reliable, more efficient and accurate, better understandable by society and responsive to societal challenges. It has the potential to enable growth and innovation through reuse of scientific results by all stakeholders at all levels of society, and ultimately contribute to growth and competitiveness of Europe" (European Council, 2016, p. 3).

Open Science has gained recognition on the national and international scene, as knowledge is conceived as a public good, belonging to all and for all (MCTES, 2016). The promotion of Open Science is a contribution to the valorization and recognition of science. In this sense, the Resolution of the Council of Ministers no. 21/2016, of April 11, approved, as guiding principles for the implementation of a National Open Science Policy: a) open access to publications resulting from research funded by public funds; b) open access to research data resulting from research funded by public funds; and c) the guarantee of the preservation of publications and research data to allow their reuse and continued access.

In this scope, the promotion and implementation of Open Science is a growing concern in research and academic institutions and in society in general, which increasingly seeks to highlight this movement as a way to be and act in favor of science. In universities and academic libraries Open Science constitutes itself as a new and important topic, because it is associated with subjects such as open access, access to research data, data curation, information open sources, open peer reviews, and citizen science (Burgelman et al., 2019) and in which information literacy intervenes in a solid way for full adequacy of the Open Science principles as an empowerment promoter (Antunes et al., 2019, 2020; Lopes, Antunes, & Sanches, 2018, 2019). Understanding the academic production cycle, creating, sharing, and preserving research outputs, as referenced in the studies by Burgelman et al. (2019), Haendel, Vasilevsky, and Wirz (2016), and Koltay, Špiranec, and Karvalics (2016) require, among others, data management and curation skills arising from global changes to the type and variety of data used in research (Figure 1).

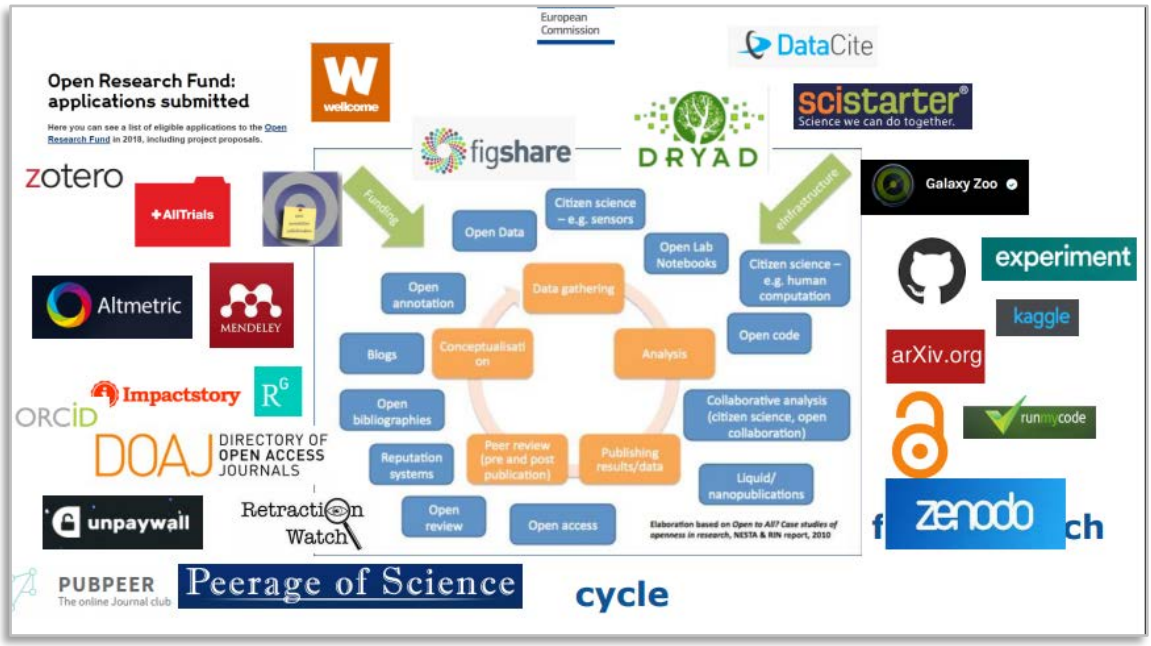

Figure 1. Open Science cycle (Burgelman, 2018).

The lack of knowledge and skills regarding Open Science has been identified as one of the main obstacles to its widespread adoption by the academic and scientific community (FOSTER, 2016; Orth, Pontika, & Ball, 2016). Therefore, the training and empowerment of information professionals, researchers, and science managers, among other stakeholders in research processes, is considered a key component for its success. Recently, the publication of the translation into Portuguese of the OPEN SCIENCE TRAINING HANDBOOK (https://open-science-training-handbook.gitbook.io/book/), initially developed under the initiative and sponsorship of the FOSTER Plus project (https://www.fosteropenscience.eu/), marked a decisive step towards the affirmation of Open Science in Portugal. This document aims to train information professionals and other stakeholders to improve the levels of interaction and application of Open Science and to promote a critical spirit in the use of science. The OPEN SCIENCE TRAINING HANDBOOK offers guidance and resources for trainees and trainers on Open Science, suggesting methods, contents, and presenting examples of exercises that can help trainers to realize their own Open Science training plans. Also, it aims to contribute to Open Science training, promoting professional skills essential for building postgraduate training, effectively supporting practices in this ecosystem, and improving levels of transparency and participation in research practices.

Inspired by this initiative and aware that structured training in this subject remains scarce, the authors of the present study set out to build some training strategies for an academic institution. Initially, autonomous, and free attendance training initiatives were developed, complemented by a strategy of tutorial support to researchers (Table 1).

Table 1. List of stand-alone training sessions for information professionals, researchers, and science managers

Individual and autonomous training sessions
▪ **International guidelines for information literacy** [webinar]
▪ **Information literacy in university contexts I: from research to publication** [webinar]
▪ **Information literacy in university contexts II: contributions to Open Science** [webinar]
▪ **Information literacy in university contexts III: a necessary intervention** [webinar]
▪ **Research resources** [Summer course, since 2015]
▪ **Predatory journals** [webinar]
▪ **New challenges for academic libraries in the face of COVID-19** [webinar]
▪ **Easy and secure remote access to knowledge: OpenAthens** [webinar]
▪ **The PubMed new platform** [webinar]
▪ **New spaces and strategies for learning, digital fluency, and experimentation** [workshop]
▪ **Information literacy for fighting fake news** [workshop]
▪ **Practice communities for trainers and coordinators of literacy programs in academic libraries** [webinar]
▪ **The new information literacy framework: what it is and how to apply it** [webinar]

Then, as a result of this process, they proposed to forward to a structured project aligned with the Open Science principles in articulation with Information Literacy.

Aim of the study

The aim of this study is to create postgraduate training for information professionals, researchers, and science managers in the principles and best practices of Open Science in the current information ecosystem. The study also seeks to answer the following questions:

1. How can researchers be empowered for Open Science?
2. How to articulate information literacy within the Open Science ecosystem?

3. What are the roles of the relationship between information professionals, researchers, and science managers for the development of Open Science best practices in higher education?
4. The design of a postgraduate proposal about Open Science.

Methods

In a first step, we conducted a literature review to identify studies that documented the implementation, development, and evaluation of Open Science training courses based on their principles and best practices.

In the second phase, a training strategy was designed at ISPA - Instituto Universitário, structured in a postgraduate course format, with the aim of developing and updating skills regarding the Open Science standards. In this stage, we sought to involve the APPsyCI research center (Applied Psychology Research Center Capabilities & Inclusion), in a collaborative process, with different agents involved in the research process: those responsible for the research center, researchers, and librarians. The inclusion of librarians in APPsyCI increases their area of expertise and allows them to offer what the research center expected of them: expertise in the association between Open Science and research innovation; civic engagement and educational development; and increasing information literacy in higher education (Antunes, Lopes, & Sanches, 2021). The APPsyCI decided to incorporate, in all its areas of activity, an Open Science research line articulated with information literacy. In this understanding, the assumptions of Open Science were implemented through several actions: repository management, training of teachers and researchers, support in the choice of journals in which to publish, dissemination, and promotion of scientific knowledge under the FAIR principles. The social and academic impact of the research line provides some light on the national landscape for innovation in research and broadens horizons by combining information literacy with Open Science. Thus, the creation of this research line within the research center shows that the association of Open Science with information literacy can be considered as the path and object of applied research (Antunes, Lopes, & Sanches, 2021).

In the conception of this post-graduate course, we sought to identify similar training offers, their relevance, feasibility, and adequacy to the market, determine objectives, audience, competencies to be acquired, detail programmatic contents, workloads, and ECTS attribution.

Results

The creation of a postgraduate course on Open Science articulated with the knowledge and methodologies of scientific information literacy intends to train, develop and deepen the knowledge of information professionals, researchers, and science managers.

1. Designation

Postgraduate Diploma in **Open Science Skills Training**.

2. Rationale

Open Science includes the regular application of practices associated with open access to scientific information, research data, and scientific publications, but above all in the opening of the scientific process to the community, reinforcing scientific social responsibility. It is the translation movement of scientific knowledge to society, thus enhancing transparency in practices, methodologies, observation, and data collection, fostering the public availability and reuse of research data, public access, and transparency in scientific communication, and reinforcing the use of web-based tools to facilitate scientific collaboration.

These transformations have been fostered by greater transparency and accessibility of data and greater speed of information, together with an increasing decentralization of policy, now increasingly networked.

The challenges to be addressed are listed in both the National Open Science Policy (https://www.ciencia-aberta.pt/pnca) and in Horizon Europe, as well as in the Portugal InCode 2030 program, strategic documents for national public policies for the next decade, whose focus is the development of transversal skills and lifelong learning, in key areas for the empowerment of active citizenship and employability.

This proposal for the creation of a post-graduation course in Open Science is characterized as innovative and unique: by the combination of contents, it proposes and the practical component it associates; by the monitoring methodologies adopted; by the timeliness and diversity of the practical/experiential training it incorporates, namely the breadth of associated entities and of the subjects/themes addressed. The course brings together the collaboration of teachers and experts from various institutions and scientific areas. It also involves the collaboration and association of several entities that integrate or relate to the science and technology system.

3. Objectives

i) To train, develop and deepen the knowledge of information professionals, researchers, and science managers in the strategic domain of Open Science articulated with information literacy;

ii) To respond to practical issues within the new science paradigm: scientific publications, availability of research data (FAIR principles), open peer review, open and alternative metrics, ethics and data protection, licensing, among others.

4. Curricular structure

Based on a holistic vision of learning, information, and the production and dissemination of knowledge in different media, the study plan has an interdisciplinary character, benefiting from concepts, models, theories, and techniques from complementary scientific domains. In parallel, the course emphasizes experiential, active, and open learning in the collaborative, participatory, and relational space.

Table 2 shows the curricular structure, organized in two semesters, with a workload of 108 hours and 30 ECTS.

Table 2. Curricular units of the postgraduate course

CURRICULAR UNITS
1st semester (total of ECTS: 15.5)
▪ **Inaugural Conference** (1h/0.5 ECTS)
▪ **Open Science: concept, policies, and projects** (12h/4 ECTS)
▪ **Open Data: data management plan and research data curation** (9h/2.5 ECTS)
▪ **Open Educational Resources** (8h/2 ECTS)
▪ **Open Access and Citizen Science** (8h/2 ECTS)
▪ **Open Science Research Resources** (9h/2.5 ECTS)
▪ **Open Publishing: open editions and open sources** (8h/2 ECTS)
2nd semester (total of ECTS: 14.5)
▪ **Digital Competences** (10h/3 ECTS)
▪ **Media and Information Literacy: models, strategies and intervention** (9h/2.5 ECTS)
▪ **Academic and Scientific Writing** (10h/3 ECTS)
▪ **Creativity and Innovation** (8h/2 ECTS)
▪ **Thematic Seminars** (8h/2 ECTS)
▪ **Project Supervision Seminars** (8h/2 ECTS)

5. Audience

Information professionals, researchers, teachers, science managers, and other professionals with training in other domains of specialization (bachelor or master).

6. Skills to be acquired

In a global process of valorization of scientific information, the course aims to provide skills to:

a) acquire knowledge about the theory and practice of Open Science: open access, open sources of information, open research data, data curation, and open peer review;

b) Understand the relevance of information literacy to the achievement of Open Science;

c) Implement training in Open Science and its literacy in the academic and scientific environment;

d) Critically use scientific and scholarly information in print, digital and multimedia environments;

e) Develop critical thinking towards the ethical and legal issues surrounding the use and sharing of scientific and scholarly information in the Open Science environment;

f) Identify relevant information sources and methodologies to carry out research work in the scope of Open Science;

g) Integrate the policies issued by national and international science organizations.

In summary, this postgraduate course in **Open Science Skills Training** presents a comprehensive training program, using several approaches: e-learning (self-learning), moderated/tutored or blended learning materials and courses, as well as several face-to-face actions and courses, in partnership with the OpenAIRE, the FIT4RRI or the OpenMinted guidelines.

Discussion and Conclusions

The present study sought to demonstrate that Open Science has contents that can be converted into learning strategies in several contexts and formats, either through specific modular training, or through a curricular unit, or even a postgraduate degree in which Open Science is transversely applied. Despite focusing on one case, the authors believe that this exercise can inspire other higher education decision-makers to teach Open Science skills. This should be a grounded practice that ultimately is not limited to meeting the movement requirements, but stimulates transversal learning processes (Burgelman et al., 2019; Lopes, Antunes, & Sanches, 2019).

Therefore, training and empowerment of information professionals, researchers, and other stakeholders in research processes are considered a key component for the Open Science success, and several training initiatives have been promoted and supported both at the local and European level (FOSTER, 2018; Orth, Pontika, & Ball, 2016; Steinerová, 2016).

The formal proposal of a postgraduate course aims to provide a training response to a comprehensive need, aligned with an understanding of the diversity of existing solutions for the development of Open Science in Portugal articulated with information literacy, providing those interested with a set of skills, knowledge, instruments and theoretical-practical tools for application and adaptation to specific situations in multiple environments – professional, academic, scientific, but also social.

Building a postgraduate course based on Open Science articulated with information literacy with the support of the research center APPsyCI is not a completely new idea, but its application continues to be a renewed challenge (Antunes, Lopes, & Sanches, 2021; Burgelman et al, 2019; Lopes, Antunes, & Sanches, 2018). The pedagogical aspects focused on the motivation and involvement of professionals, should be stimulated through guided research and reflection, adapted to each curricular unit. The increasing importance of the participants' experiences should

be highlighted, as they become more autonomous and responsible in the access and use of scientific and academic information.

In summary, this postgraduate course aims to train and empower Open Science. It translates the evolution from simple awareness and knowledge to the need to incorporate Open Science best practices in the current digital ecosystem of information and science.

For future studies in this domain, it is suggested an evaluative approach of the postgraduation, as well as the collection of suggestions and comments for improvement, thus seeking to determine what are the impacts and in what circumstances one can adequately respond to the challenges of Open Science.

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