



Challenges to Achieving a More Inclusive and Sustainable Open Education

SPECIAL
COLLECTION: GO-GN

ARTICLE

]u[ubiquity press

FRANCISCO INIESTO 

BERNARDO TABUENCA 

COVADONGA RODRIGO 

EDMUNDO TOVAR 

**Author affiliations can be found in the back matter of this article*

ABSTRACT

This paper showcases relevant initiatives to address inclusive and sustainable development through the objectives of UNESCO's Sustainable Development Goal 4 (SDG4) towards ensuring inclusive and equitable quality education and to promote lifelong learning opportunities for all. These research projects have been possible thanks to initiatives such as the global Open Educational Resources (OER) Graduate Network (GO-GN), a research network that facilitates collaborative research in the area of open education. These types of initiatives empower collaborative research proposals thanks to joint participation in working groups and seminars, which facilitate research collaborations with a clear focus, in this case, on inclusive and sustainable development. In this paper, several challenges on achieving a more inclusive and sustainable Open Education are discussed, such as the need to use accessibility metadata standards to improve the search and sharing of OERs in open repositories, the recommendation to use frameworks like Universal Design for Learning (UDL) to provide inclusive design feedback, and the benefits of action-oriented Massive Open Online Courses (MOOCs) to promote sustainability.

CORRESPONDING AUTHOR:

Francisco Iniesto

The Open University, GB

francisco.iniesto@open.ac.uk

KEYWORDS:

accessibility; inclusion; OER;
MOOC; Open Education; GO-GN;
UDL

TO CITE THIS ARTICLE:

Iniesto, F, Tabuenca, B,
Rodrigo, C and Tovar, E. 2021.
Challenges to Achieving a More
Inclusive and Sustainable Open
Education. *Journal of Interactive
Media in Education*, 2021(1):
28, pp. 1–12. DOI: [https://doi.
org/10.5334/jime.679](https://doi.org/10.5334/jime.679)

INTRODUCTION

Open Educational Resources (OERs) can be beneficial when compared to other online learning opportunities because of their characteristics of openness within a structured learning framework and low cost of learning (Iniesto 2020). Recent literature indicates there is limited research on how accessibility is embedded in the design of OERs (Zhang et al. 2020). Moreover, the need to incorporate greater access has been tackled through significant institutions such as the University of California that stressed the need to make accessible more than 20,000 audio and video files from its online open-access platforms (Jaschik 2016). To avoid the disability law, the University of California decided to remove free access to those contents, requiring learners to sign in with academic credentials to view or listen to them instead of investing in making the content accessible. Therefore, in this case legislation was a driver for inaccessibility.

The importance of accessibility to online educational resources is widely acknowledged (Navarrete & Luján-Mora 2018) but there is limited discussion about the inclusive design of online learning courses (Acosta & Luján-Mora 2016). Providing accessible OERs would increase the flexibility of learning and the benefits to all learners. Law, Perryman and Law (2013) reflected on the need to address accessibility features of platforms and repositories where OERs are deposited, and that institutional repositories should be designed with accessibility in mind. The European Unified Framework for Accessible Lifelong Learning (EU4ALL) was a major collaborative project (McAndrew, Cooper & Farrow 2012) that highlighted the importance of adapting online learning resources for all and stressed the need to make accessible content available. Brahim, Khribi and Jemni (2017) pinpointed the lack of accessibility awareness within the repositories and platforms that host OERs. Technologies used in OER platforms are not necessarily accessible (Rodríguez et al. 2017), which may then block access for a significant number of learners. But barriers to learning in OERs are not necessarily technical, pedagogical designs can affect learners' experiences which might include misuse of cultural references or affect learners' engagement (Iniesto 2020).

The most recent "*Inclusion and Education*" report (UNESCO 2020) assesses the progress towards Sustainable Development Goal 4 (SDG4) which ensures inclusive and equitable quality education and promotes lifelong learning opportunities for all, drawing attention to all those excluded from education because of background or ability, marked by the roadmap of the United Nations 2030 Agenda. A published report on inclusive teaching and learning in higher education in the UK (Department of Education 2017) encourages higher education providers to care and offer support, and to develop an inclusive environment for learners. The lifelong learning paradigm integrates education, work, and personal life in a continuous process and allows learners to be able to access knowledge and develop it both personally and through work (Hanemann 2019). In this respect, if designed to be accessible and inclusive, OERs have the characteristics to widen access to all learners.

This paper integrates different research experiences of alumni and experts of the Global OER Graduate Network (GO-GN) in the area of inclusive and sustainable open education. This network has been the driver in which authors have been in contact and research has been informed jointly. The paper presents different investigations that seek to address SDG4 targets, which have identified different challenges for a more inclusive Open Education.

GO-GN INVOLVEMENT

The Global OER Graduate Network (GO-GN) was founded by Fred Mulder in 2013 with the aim to bring together active researchers on OER in a worldwide network and to promote investigations on OERs towards getting a real impact on society. Almost ten years after the creation of GO-GN and now hosted at the Open University in the United Kingdom (OUUK), it can be concluded with enough perspective that the objectives for which this network was devised have been realised. Equally, it can be said with certainty that the acronyms chosen to define the association were selected with wisdom:

- **Global.** GO-GN is global because during its history it has brought PhD students and educators from all five continents into contact.
- **OER.** In GO-GN, there is a common link between all members: their perspective of education and the promotion of Open Education.

- **Graduate.** GO-GN was created to support PhD students working on open education-related topics. To date, more than 100 PhD students have graduated with the support of this association (Weller et al. 2020).
- **Network.** GO-GN is a network that has brought together PhD students, educators, and researchers from all over the world, organising face-to-face, online seminars and many other events that promote support and collaboration among its members.

Central to GO-GN open education initiatives are the values of diversity, equity and inclusion as outlined in its DEI project. So far, GO-GN is supporting the DEI project in two phases: In phase 1, GO-GN focused on Africa and provided recommendations to inform the DEI strategy (Bossu et al. 2019); In the current phase, 2, GO-GN focuses on Latin America to improve understanding of what DEI means within that region, and to identify how GO-GN can better support potential members to develop strategies for increasing engagement (Weller, Farrow, & Pitt 2019).

Several authors of this paper joined the first GO-GN seminar, in the city of Cape Town, South Africa in 2013, while others participated in the second and third seminars celebrated during the OpenCourseWare Consortium Global Conference, ‘Open Education for a Multicultural World’ (OE Global Conference), in Ljubljana, Slovenia, and OpenEd14 (Open Education Conference) in Washington DC, USA, both in 2014. The authors of this paper have collaborated with the network throughout these years, which has also made it easier for them to develop their research in the context of Open Education particularly in the area of inclusive and sustainable design. The following sections disclose research performed by the authors to address the SDG4 targets, as indicated in **Table 1** (UNESCO 2020).

RESEARCH INITIATIVES	SDG4 TARGETS ADDRESSED
Innovation Group in the Quality Management of University Centres – Polytechnic University of Madrid (GICAC-UPM) Open Education research initiatives	<ul style="list-style-type: none"> • Target 4.3: Ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university. • Target 4.5: Eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples, and children in vulnerable situations.
Procomun and its OER social community at The National Distance Education University (UNED)	<ul style="list-style-type: none"> • Target 4.5 • Target 4.6: Ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy. The principles, strategies and actions for this target are underpinned by the contemporary understanding of literacy as a continuum of proficiency levels in a given context.
The Marine Litter Massive Open Online Course (MOOC)	<ul style="list-style-type: none"> • Target 4.7: Ensure all learners acquire knowledge and skills needed to promote sustainable development, including among others through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and of culture’s contribution to sustainable development.
YourMOOC4all – MOOC recommender system	<ul style="list-style-type: none"> • Target 4.5

Table 1 Research initiatives performed by the authors.

IMPROVING THE DISCOVERABILITY AND USE OF OERS

This work arises from the fourth author who was an attendee at the first GO-GN seminar as Open Education expert and PhD supervisor. He organised several workshops in collaboration with the Research on OER for Development (ROER4D) team, where he introduced the GICAC-UPM research group formed by researchers from the Polytechnic University of Madrid and the Technical University of Loja. The research from the group aims to improve the access, search, sharing and use of OERs by the use of emerging web technologies to reach a society where OERs are shared and accessible to all using open data (Piedra et al. 2014).

Some of the challenges GICAC-UPM face are the quality and discoverability of OERs. OERs can be made available under an Open License, however, that does not imply that they are easy to find, and then reuse, remix and redistribute. There are several reasons why Open Licenses are not enough, among them, there is an enormous amount of information available and OERs produced by universities; the internal organisation, structure and technological infrastructure

of OER repositories are diverse and respond to the individual vision of the universities. Finally, there is not a standardised way to implement those repositories, heterogeneity leads to barriers of interoperability and sharing of OERs within institutions (Moreno, Tovar & Cabedo 2018). The lack of interoperability shows some disadvantages in the discovery of OER. One way to facilitate interoperability has been addressed through the use of Linked Data to integrate and extract data from repositories, to navigate in OER repositories and to create a basis on which the use, re-use, remix, and adaptation of OERs can be provided more easily. The research group examines the impact of the technology applied to face this issue using Social Network Analysis (SNA) with the following goals: measuring and analysing social structures, to find not evident information within the structures formed by the interaction between end-users and institutions to reduce complex systems to their basic components and their relationships.

An example of the outcomes by this group is Serendipity,¹ a faceted search engine based on Semantic Web Technologies. A faceted search engine is a technique that involves augmenting traditional search techniques with a faceted navigation system, allowing users to narrow down search results by applying multiple filters based on faceted classification of the items. Serendipity applies this type of search to improve OER discoverability including specific filters allowing users to visualise OER repositories from a dataset based on Linked Data technologies. A case study of this engine includes its use through OER repositories in Spain and Latin America (Piedra et al. 2017).

These topics and the tools presented at that very first GO-GN seminar have been applied over the last 10 years in different European projects providing different Open Educational Practices (OEPs):

- For instance, the EntreCom4All² project aimed to improve the accessibility of entrepreneurial education to young and/or female entrepreneurs and entrepreneurial teachers, by developing an online platform that provides access to relevant OERs on entrepreneurship (Tovar, Tabuenca & Piedra 2020).
- Another research coordinated by GO-GN was the project named “*Developing a knowledge-based on MOOCs focusing on Higher Education and Lifelong Learning*” which developed a knowledge base on MOOCs through a continuous and systematic collection of data on existing MOOCs (Tovar et al. 2015). The overall aim of the study was to provide European educational stakeholders (e.g., policymakers, practitioners, education leaders, experts, industry) with a knowledge base for awareness-raising, understanding and strategic decision-making on the existing and potential impact of MOOCs in Europe.

DEVELOPMENT OF A SOCIAL COMMUNITY FOR INCLUSIVE OERS

The current learning context for many learners is a blended one, comprising the use of online educational resources, such as digital books, presentations, videos, podcasts, etc. The study carried out by the OUUK’s Open Research Hub (de Los Arcos et al. 2015) showed the high degree of use of OERs for blended educational purposes. The distribution of the percentages of educators who have ever used OERs highlighted the high incidence in the use of videos, images, and open textbooks. But for OER use, two aspects of special relevance need to be considered: if these resources are adequate for all learners (including those with accessibility needs) and if their reuse and redistribution comply with the use of Open Licenses. A broader knowledge of the existence of open repositories and specific norms to evaluate their quality, together with some basic notions of computing, would allow educators to create or reuse OERs with the assurance of Open Licences and adapted to the varied needs of their learners (Rodrigo & Tabuenca 2020).

Procomun³ is one of these open repositories. It stores more than 95,000 OERs along with educators’ experiences, constituting an intelligent, social and distributed network. The repository is designed mainly for educational purposes but is open to a wider audience. Anyone can search, consult and download OERs in different formats. A semantic layer has been built

1 Serendipity, <http://serendipity.utpl.edu.ec/>.

2 EntreCom4All, <http://gicac.ls.fi.upm.es/entrecom4all/#>.

3 Procomun, <http://procomun.educalab.es/>.

on top of the existing platform and the services offered have been expanded by including the use of Linked Data. The incorporation of a faceted search engine allows educators to find educational objects by restricting the global set of results through multiple criteria based on their reasoning.

The other fundamental element of the Procomun space is the social network closely linked to educational resources built by educators themselves, enriched with a social labelling system, which includes user votes, recommendations for use and links to specific learning communities. Since its inception, Procomun has been designed with the technology of the semantic web to harvest the links to other resources available in external repositories and be able to make their content visible.

Research carried out by the third author includes the use of Procomun since 2017, creating a social community of practice amongst learners at UNED (see [Figure 1](#)). The objective of this community is to explore the extent to which educators enrolled in UNED's Higher Education teaching qualification in Computer Science ("Master in Secondary Education, Professional Training and Language Teaching") achieve the skills to design OERs. The main objectives are as follows:

1. Provide learners with knowledge about Procomun.
2. Provide a practical activity to underpin the concepts of the Shareable Content Object Reference Model (SCORM)⁴ standard, repository's semantic layer and specific open tools for OER authoring.
3. Foster the development of OERs in the Computer Science area.
4. Enhance the design of OERs aligned with SDG4 targets.



Figure 1 Social community linked to the Procomun repository.

At the time of writing, in 2021, the social community comprises more than 120 members and hosts 43 new OERs. These were created by Computer Science educators using the eXelearning⁵ authoring tool connected to Procomun, thus allowing publishing, metadata filling and specification of licences. Some of the more recently developed OERs are:

- A practical guide for educators that contributes to the dissemination of techniques for the creation and reuse of OERs for learners with hearing impairment.
- A case study for the use of Computer Vision techniques to improve the accessibility of OERs for learners with visual impairment.
- Three OERs based on inquiry-based learning to empower the presence of women in the field of Computer Science. The resources have been built around the biographies of three well-recognised professionals: Hedy Lamarr, Joan Clarke and Evelyn Berezin.
- Two OERs built on project-based learning devoted to raising awareness among learners of the importance of equality in gender.

⁴ SCORM, <https://adlnet.gov/projects/scorm/#scorm-2004-4th-edition>.

⁵ Exelearning, <https://exelearning.net/descargas/>.

For quality assessment, the social community uses the Quality for Digital Learning Resources standard (UNE 2020). Learners are trained within the teaching qualification programme to assess their OERs following this standard that covers indicators of technological, pedagogical and accessibility compliance (Moreno et al. 2019).

A MOOC TO IDENTIFY AND PROMOTE SOLUTIONS TO REDUCE MARINE LITTER

Research carried out by the second author highlights the potential of MOOCs towards environmental activism (Tabuenca, Kalz, & Löhr 2019) and to sustain the quality education goal (Tovar et al. 2019). With this regard, marine litter is a global problem that affects every ocean of the world. Litter is an environmental, human health and socio-economic problem that is a symptom of a highly disposable society. With worldwide growth in the amount of solid litter thrown away every day and slow rates of degradation, the amount of litter present in the marine environment is increasing.

The UN Environment Programme and the Open University of the Netherlands (OUNL) has created a MOOC on Marine Litter as a key activity of the Global Partnership on Marine Litter.⁶ The MOOC on marine litter strives to teach learners through action-oriented learning how they can apply successful and inspiring activities to their local context, regardless of their profession or location. The course presents different options and tools to combat marine pollution such as the use of effective and legitimate tools like the Honolulu Strategy (Shevealy, Courtney, & Parks 2012). The course provides examples and case studies that aim to inspire leadership at all levels, thereby increasing awareness of and stimulating creative solutions to marine litter problems. Moreover, this course aims to benefit policymakers, practitioners, and managers who wish to connect with other professionals to enhance their knowledge of marine litter issues.

The MOOC on Marine litter was first held in 2015 in English. The increasing number of participants and success in its successive editions have made it possible to progressively translate it so that it is now available in 10 different languages (i.e., English, Spanish, Russian, Vietnamese, French, Indonesian, Russian, Portuguese, Chinese, and Thai). The last edition of the course finished in January 2021 with nearly 10,000 participants from 182 different countries. The course is offered in two different tracks:

- **Leadership Track.** The two-week leadership track introduces marine litter concepts and various strategies for preventing and reducing marine litter. It presents a general overview of marine litter and provides the essential knowledge, insights, and skills needed to play a leading role in the transition to a marine litter-free society. The track presents inspiring examples of organisations and people from varying backgrounds that take responsibility and play a leading role in tackling marine litter, e.g., as a policymaker, a researcher, an artist or a CEO of a large company.
- **Expert Track.** After finishing the Leadership Track, participants can continue for 6 additional weeks. This track provides more in-depth information on marine litter and is intended for people who want to work actively on marine litter issues, e.g., policymakers, researchers, environmental professionals, teachers, NGO representatives, learners or citizens with a particular interest in the topic. This track prepares participants for an active role in addressing marine litter with useful tools and instruments and connecting participants to marine litter networks around the globe.

Throughout these years the impact of this course on society has been evidenced with the achievement of different outcomes:

- **Solutions for global marine litter.** At the end of the Leadership Track and Expert Track, participants must analyse a specific marine litter case using the Driver Pressure State Impact Response (DPSIR) framework. The DPSIR framework was developed by the Organisation of Economic Co-operation and Development (OECD 2003) as a means of structuring and organising indicators in a way that is meaningful to decision-makers. DPSIR is mostly used to show the cause-effect relationships between environmental

⁶ Marine litter MOOC, <https://www.ou.nl/-/unenvironment-mooc-marine-litter>.

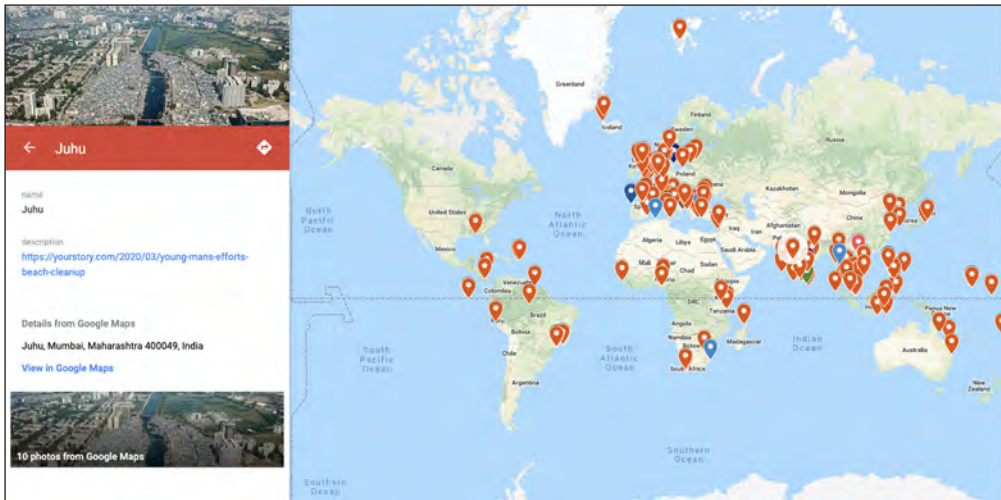


Figure 2 Denounce marine litter in your local environment.

and human systems (Tscherning et al. 2012). Over the years, learners have identified and characterised relevant stakeholders involved and reflected upon strategies used to implement particular measures or solutions to marine litter (Löhr et al. 2017).

- **Marine litter map.** The MOOC includes a map to denounce trash in your local environment. Through this multimedia map of the figure, any learner can report their story including photographs, videos, texts and links to blogs where misbehaviours concerning marine litter in their local environment are described (e.g., Frantz (2020) seen in *Figure 2* above). This map aims to give visibility to these local denunciations at the worldwide level, with the objective that they are not repeated, and they can be solved.
- **Wish tree.** Wish tree to eradicate marine litter in the world. In different editions of the course, a collaborative tree has been implemented through which any learner could share their best wishes to eradicate garbage in the world (Tabuenca 2018).
- **Get in contact and keep active.** The course has a Twitter channel and a Facebook channel so that participants can exchange their contacts and thus continue their activist work in the context of marine litter.

The need to care for the marine environment is universal. This MOOC instructs on the implementation of solutions so that citizens of the world can manage waste locally and thus prevent it from ending up at sea. Multi language MOOCs facilitate access to information worldwide so that the proposed solutions can be taught and put into practice throughout the world.

A MOOC RECOMMENDER SYSTEM BASED ON UNIVERSAL DESIGN

Recommender systems, applied in many domains, have been used in the educational context (Dwivedi & Roshni 2017) by advising learners to enrol in specific courses depending on learners' performance in previous courses, their grades, and similarity of content. The curriculum recommendation mechanism has not gone unnoticed by MOOC providers for whom trying to offer courses of interest for their learners is a priority in their sustainable development and business model (Tan & Wu 2018).

During the Open Education Global Conference in 2015 in Banff, Canada, a presentation given by a GO-GN member about the use of feedback in MOOC recommender systems (Floratos, Guasch & Espasa 2015) was the seed of the YourMOOC4all project by the first and third authors. YourMOOC4all⁷ is an ongoing joint research project between OUUK and UNED. It is like any other MOOC search engines where learners can add feedback about the MOOCs they are participating in and receive recommendations considering learners' preferences. On top of that, YourMOOC4all also supports the review of various pedagogical aspects of the MOOCs through ratings, free text comments, and posted opinions about the content of the MOOC, the provider, or the instructor. YourMOOC4all project is designed with the following aims (Iniesto & Rodrigo 2018):

⁷ YourMOOC4All, <http://yourmooc4all.lsi.uned.es/>.

1. Provide information to MOOC developers and recommendations to learners seeking accessible MOOCs.
2. Support learner evaluation of inclusive instructional design aspects of MOOCs using the Universal Design for Learning (UDL) framework and retrieve recommendations, helping learners to locate MOOCs that fit their needs.

YourMOOC4all contains more than 700 MOOCs in Spanish from UNED Abierta, MiriadaX and Coursera and it is based on the premise that learners' experiences on OER repositories offer useful information for others to use to fulfil their interests and to inform accessibility needs. For instance, if a learner is looking for a course in machine learning and it is especially accessible using the screen reader, that information is of great interest to another learner in a similar situation. YourMOOC4all helps learners to find MOOCs of their professional development interest and that fit their accessibility needs.

YourMOOC4all faceted search engine allows searching by free text, letting the learner refine the search by the title of the course, theme or information included in its specification. It is possible to order the results by title, institution that imparts it, platform where it is hosted, or the score obtained. The enriched user profile model proposed for YourMOOC4all (see *Figure 3*) follows an adaptive model architecture (Iniesto & Rodrigo 2016). The model of educational services proposed is useful to find MOOCs whose platforms and content are inclusive considering learners' needs and continuing professional development preferences. The profile has two differentiated components: accessibility and professional development preferences (Iniesto, Rodrigo & Hillaire, 2019):

1. The recommender system establishes a relationship within the level of accessibility required and considers the assistive technologies and adaptations preferred by the learner, having the ability to find the MOOCs that are more accessible regarding those needs.
2. It also prioritises the preferences regarding professional development linking those with the subject of the MOOCs.

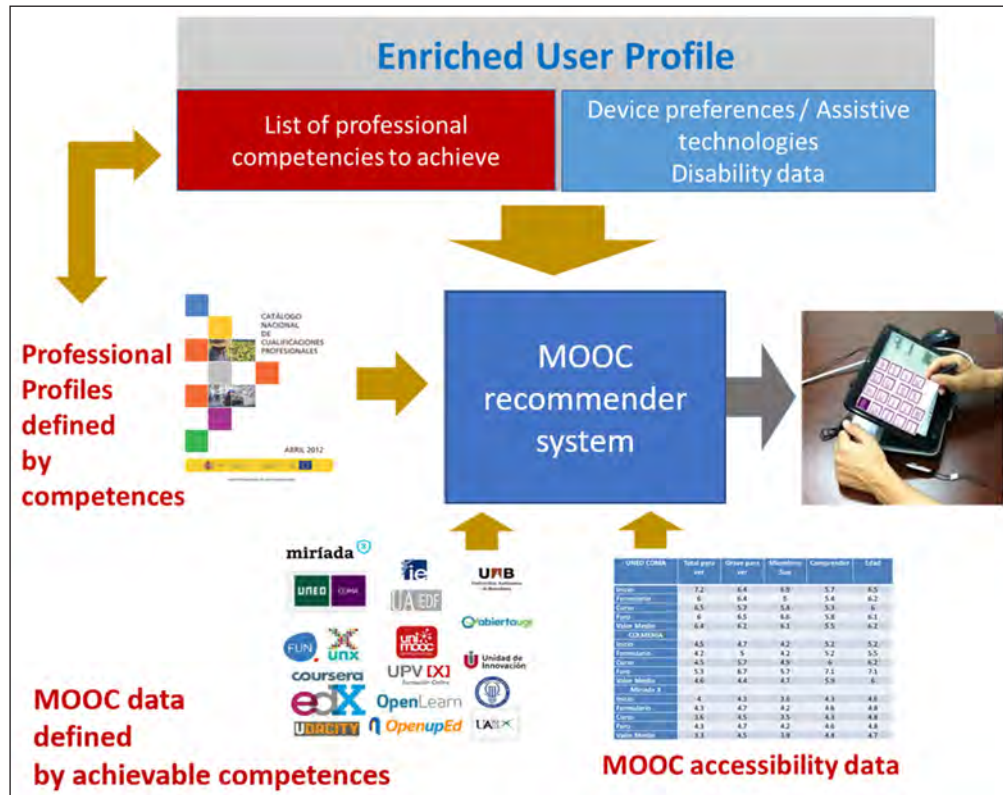


Figure 3 YourMOOC4all enriched user profile model.

UDL offers a framework that considers how to design learning environments to develop expert learners, defined in this framework as resourceful and knowledgeable, strategic and goal-directed, purposeful and motivated (CAST 2017). UDL is based on three principles:

- 1. Provide multiple means of engagement.** Learners differ in how they may feel involved and motivated to learn. Therefore, it is necessary to offer options that reflect the interests of learners, strategies to face new tasks, choices for self-evaluation and reflection on their expectations.
- 2. Provide multiple means of representation.** Learners vary in the way they perceive and understand the educational content. Therefore, it is necessary to offer different options to approach materials through various channels of perception, be it auditory, visual, or motor, providing the information in a format that allows as much adjustment as possible by the learner.
- 3. Provide multiple means for action and expression.** Learners differ in how they can work during learning and express what they know. It is necessary to offer varied options for action through materials with which all learners can interact, facilitate fluent opinions, and seek to stimulate effort and motivation towards a goal.

The UDL approach is to present the information in ways that fit learners' needs, rather than requiring learners to adapt to the information (Meyer, Rose & Gordon 2014). At the same time, UDL supports every learner to choose the best path for their learning. This approach is relevant to understand learners who may like the curriculum to adjust to their needs. As reported above, one of the objectives of UDL is not simply the mastery of content knowledge or new technologies, it is the mastery of the learning process where education should help turn novice learners into expert learners (CAST 2017), which aligns itself with the pedagogical perspective of MOOCs where learners are expected to be self-directed in their learning (Loizzo et al. 2017).

Therefore, for the evaluation of the courses and their platforms in YourMOOC4all, an evaluation matrix was created following the UDL guidelines (CAST 2018), with a total of 31 questions directly related to the checklists. Learners apply this matrix to quantitatively rate any of the optional indicators using a Likert scale (0 to 5). All the indicators offer a small tip to help learners understand each question with an example. In the evaluation process, learners can answer open-ended questions at principle and MOOC level, enriching the qualitative content of the feedback, offering valuable information to other learners and, for research purposes, to provide more information for triangulation and to potentially report accessibility barriers to MOOC developers.

DISCUSSION AND CONCLUSIONS

In almost a decade, the GO-GN community has put researchers from different areas in contact around a common goal: Open Education. This paper shows four different initiatives in which GO-GN alumni and experts in the field of education have contributed to promoting inclusive education in accordance with the sustainable development goals of the UNESCO 2030 agenda. From these initiatives, we can reflect on four challenges to provide a more inclusive Open Education which still need to be addressed:

- 1.** There exists a potential in the use of Linked Data in open repositories to integrate and extract resources from those repositories. If correctly labelled through metadata, OER can be found by educators and learners using faceted search engines (i.e., including OER specific filters) (Piedra et al. 2017). Unfortunately, OER repositories such as Procomun are not using accessibility metadata standards for labelling their resources, decreasing the potential of the amount of OERs hosted to be reused in educational contexts to address accessibility needs (Rodrigo & Tabuenca 2020).
- 2.** The profiling used in OER repositories and recommender systems, such as YourMOOC4all, could benefit from the application of accessibility metadata standards to allow personalisation in the recommendation of OERs which match the varied needs of learners (Iniesto & Rodrigo 2018).
- 3.** The use of frameworks such as UDL to evaluate OERs' inclusive design can be used to provide feedback to those designing the resources, therefore feedback can be produced directly based on the interaction of educators and learners in those systems (Iniesto, Rodrigo & Hillaire 2019).
- 4.** The production of action oriented OERs such as the Marine Litter course is aligned with that perspective of providing feedback to build a more sustainable and inclusive future (Tabuenca, Kalz & Löhr 2019). Therefore, more initiatives like this course should be supported.

This paper aimed to showcase real initiatives that address inclusive and sustainable development through the objectives of UNESCO's SG4. These pieces of research have been possible thanks to GO-GN, a research network that facilitates collaborative research in Open Education. GO-GN empowers collaborative research proposals thanks to joint participation in working groups and seminars, which facilitate research collaborations with a clear focus, in this case, on inclusive and sustainable development (Weller et al. 2020).

Examples from our cooperation and research based on GO-GN support have showcased the work on the acquisition of skills relevant to the labour market and discoverability of OERs with the work supported by GICAC-UPM. While Procomun and its social community potentiate the creation and reuse of inclusive OERs. The Marine Litter MOOC ensures that all learners acquire the knowledge and skills needed to promote sustainable development and global citizenship education. Finally, YourMOOC4all facilitates the inclusive evaluation and personalisation of MOOC offerings. These initiatives demonstrate the range of approaches to meeting SG4 (i.e., targets 4.3, 4.5, 4.6 and 4.7), and the benefit of communities such as GO-GN which promotes global interaction among its members, experts, and friends.

ACKNOWLEDGEMENTS

The authors would like to thank the Global OER Graduate Network (GO-GN) which is supported by the William and Flora Hewlett Foundation.

COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR AFFILIATIONS

Francisco Iniesto  orcid.org/0000-0003-3946-3056

The Open University, GB

Bernardo Tabuenca  orcid.org/0000-0002-1093-4187

Universidad Politécnica de Madrid, ES

Covadonga Rodrigo  orcid.org/0000-0001-8135-3163

UNED, ES

Edmundo Tovar  orcid.org/0000-0003-2929-659X

Universidad Politécnica de Madrid, ES

REFERENCES

- Acosta, T** and **Luján-Mora, S.** 2016. Comparison from the levels of accessibility on LMS platforms that supports the online learning system. In: Gómez Chova, L, López Martínez, A and Candel Torres, I (eds.), *Proceedings of the 8th Annual International Conference on Education and New Learning Technologies (Edulearn 2016)*, 4–6 July 2016 Barcelona, 2704–2711. IATED Academy.
- Bossu, C, Pete, J, Prinsloo, P** and **Agbu, JF.** 2019. How to tame a dragon: Scoping diversity, inclusion and equity in the context of an OER project. *Pan-Commonwealth Forum 9 (PCF)*, 9–11 September Edinburgh. Burnaby: Commonwealth of Learning.
- Brahim, HB, Khribi, MK** and **Jemni, M.** 2017. Towards accessible open educational resources: Overview and challenges. *2017 6th International Conference on Information and Communication Technology and Accessibility (ICTA)*, 19–21 December 2017 Muscat, 1–6. Piscataway, NJ: IEEE.
- CAST.** 2017. Top 5 UDL tips for fostering expert learners. *Learning Designed* [online]. Available at <https://www.learningdesigned.org/resource/top-5-udl-tips-fostering-expert-learners>.
- CAST.** 2018. *Universal design for learning guidelines version 2.2*. Wakefield, MA. Available at <http://udlguidelines.cast.org>.
- de Los Arcos, B, Farrow, R, Pitt, R, Perryman, LA, Weller, M** and **McAndrew, P.** 2015. *OER research hub data 2013–2015: Educators*. Open Education Research Hub.
- Department of Education.** 2017. *Inclusive teaching and learning in higher education. Access to higher education and higher education participation* (Independent Report). UK Government. <https://www.gov.uk/government/publications/inclusive-teaching-and-learning-in-higher-education>.
- Dwivedi, S** and **Roshni, VK.** 2017. Recommender system for big data in education. In: *2017 5th National Conference on E-Learning & E-Learning Technologies (ELELTECH)*, 3–4 August 2017 Hyderabad, 1–4. IEEE. DOI: <https://doi.org/10.1109/ELELTECH.2017.8074993>

- Floratos, N, Guasch, T and Espasa, A.** 2015. Recommendations on formative assessment and feedback practices for stronger engagement in MOOCs. *Open Praxis*, 7(2): 141–152. DOI: <https://doi.org/10.5944/openpraxis.7.2.194>
- Frantz, R.** 12 April, 2020. How one young man's efforts resulted in the world's largest beach cleanup project. *Your Story* [online]. Available at: <https://yourstory.com/2020/03/young-mans-efforts-beach-cleanup>.
- Hanemann, U.** 2019. Examining the application of the lifelong learning principle to the literacy target in the fourth Sustainable Development Goal (SDG 4). *International Review of Education*, 65(2): 251–275. DOI: <https://doi.org/10.1007/s11159-019-09771-8>
- Iniesto, F.** 2020. *An investigation into the accessibility of Massive Open Online Courses (MOOCs)*. Thesis (PhD). The Open University. <http://oro.open.ac.uk/70010/>.
- Iniesto, F and Rodrigo, C.** 2016. A preliminary study for developing accessible MOOC Services. *Journal of Accessibility and Design For All*, 6(2): 126–150.
- Iniesto, F and Rodrigo, C.** 2018. YourMOOC4all: A MOOCs inclusive design and useful feedback research project. In: *2018 Learning With MOOCs (LWMOOCs)*, 26–28 September 2018 Madrid, 147–150. IEEE. DOI: <https://doi.org/10.1109/LWMOOCs.2018.8534644>
- Iniesto, F, Rodrigo, C and Hillaire, G.** 2019. Applying UDL principles in an inclusive design project based on MOOCs reviews. In: Gronseth, S and Dalton, E (eds.), *Universal access through inclusive instructional design: International perspectives on UDL*, 197–207. New York: Routledge. DOI: <https://doi.org/10.4324/9780429435515-25>
- Jaschik, S.** 20 September, 2016. University may remove online content to avoid disability law. *Inside Higher Ed* [online]. <https://www.insidehighered.com/news/2016/09/20/berkeley-may-remove-free-online-content-rather-complying-disability-law>.
- Law, P, Perryman, L-A and Law, A.** 2013. Open educational resources for all? Comparing user motivations and characteristics across The Open University's iTunes U channel and OpenLearn platform. In: *Open and Flexible Higher Education Conference*, 23–25 October 2013 Paris, 204–219. European Association of Distance Teaching Universities.
- Löhr, A, Savelli, H, Beunen, R, Kalz, M, Ragas, A and Van Belleghem, F.** 2017. Solutions for global marine litter pollution. *Current Opinion in Environmental Sustainability*, 28: 90–99. DOI: <https://doi.org/10.1016/j.cosust.2017.08.009>
- Loizzo, J, Ertmer, PA, Watson, WR and Watson, SL.** 2017. Adult MOOC learners as self-directed: Perceptions of motivation, success, and completion. *Online Learning*, 21(2): n2. DOI: <https://doi.org/10.24059/olj.v21i2.889>
- McAndrew, P, Cooper, M and Farrow, R.** 2012. Adapting online learning resources for all: Planning for professionalism in accessibility. *Research in Learning Technology*, 20: 345–361. DOI: <https://doi.org/10.3402/rlt.v20i0.18699>
- Meyer, A, Rose, DH and Gordon, DT.** 2014. *Universal design for learning: Theory and practice*. Wakefield, MA: CAST Professional Publishing.
- Moreno, L, Alarcon, R, Segura-Bedmar, I and Martínez, P.** 2019. Lexical simplification approach to support the accessibility guidelines. In: *Proceedings of the XX International Conference on Human Computer Interaction (Interacción 2019)*, 25–28 June 2019 Donostia Gipuzkoa, Spain, 1–4. New York: ACM. DOI: <https://doi.org/10.1145/3335595.3335651>
- Moreno, N, Tovar, E and Cabedo, R.** 2018. Systematic review: OER and disability. In: *2018 IEEE 5th International Congress on Information Science and Technology (CIST)*, 21–27 October 2018 Marrakech, 428–431. IEEE. DOI: <https://doi.org/10.1109/CIST.2018.8596659>
- Navarrete, R and Luján-Mora, S.** 2018. Bridging the accessibility gap in open educational resources. *Universal Access in the Information Society*, 17(4): 755–774. DOI: <https://doi.org/10.1007/s10209-017-0529-9>
- OECD.** 2003. *Environmental indicators – development, measurement and use*. Reference Paper. Organisation of Economic Co-operation and Development. Available at <https://www.oecd.org/env/indicators-modelling-outlooks/24993546.pdf>.
- Piedra, N, Chicaiza, J, Atenas, J, Lopez-Vargas, J and Tovar, E.** 2017. Using linked data to blended educational materials with OER—A general context of synergy: Linked data for describe, discovery and retrieve OER and human beings knowledge to provide context. In: Jemni, M, Khribi, K and Koutheair, M (eds.), *Open Education: from OERs to MOOCs*, 283–313. Berlin, Heidelberg: Springer. DOI: https://doi.org/10.1007/978-3-662-52925-6_15
- Piedra, N, López, J, Chicaiza, J and Tovar, E.** 2014. Serendipity a platform to discover and visualize Open OER Data from OpenCourseWare repositories. In: *Proceedings of OpenCourseWare Consortium Global Conference: Open Education for a Multicultural World (OCWC)*, 23–25 April 2014 Ljubljana.
- Rodrigo, C and Tabuenca, B.** 2020. Ecologías de aprendizaje en estudiantes online con discapacidades. *Comunicar: Revista Científica de Comunicación y Educación*, 28(62): 53–65. DOI: <https://doi.org/10.3916/C62-2020-05>

- Rodríguez, G, Pérez, J, Cueva, S and Torres, R.** 2017. A framework for improving web accessibility and usability of Open Course Ware sites. *Computers & Education*, 109: 197–215. DOI: <https://doi.org/10.1016/j.compedu.2017.02.013>
- Sheevely, S, Courtney, K and Parks, JE.** 2012. *The Honolulu strategy: A global framework for prevention and management of marine debris*. United Nations Environment Programme, National Oceanic and Atmospheric Administration. Available at https://marinedebris.noaa.gov/sites/default/files/publications-files/Honolulu_Strategy.pdf.
- Tabuenca, B.** 2018. *Spirobranchus giganteus: Árbol de deseos para erradicar la basura marina en el mundo* [online]. Available at: <https://padlet.com/btabuenca/spirobranchus2018>.
- Tabuenca, B, Kalz, M and Löhr, A.** 2019. Massive open online education for environmental activism: The worldwide problem of marine litter. *Sustainability*, 11(10): 2860. DOI: <https://doi.org/10.3390/su11102860>
- Tan, M and Wu, M.** 2018. An association rule model of course recommendation in MOOCs: Based on edX platform. *European Scientific Journal, ESJ*, 14(25): 284–292. DOI: <https://doi.org/10.19044/esj.2018.v14n25p284>
- Tovar, E, Cabedo, R, Kalz, M, Walhout, J, Kreijns, K and Niellisen, G.** 2015. Who is taking European MOOCs and why? A large-scale, cross provider data collection about participants of European Open Online Courses. In: *Proceedings of the 2015 Open Education Global Conference (Entrepreneurship and Innovation)*, 22–24 April 2015 Banff.
- Tovar, E, Tabuenca, B, Alzaghouh, A, Kloos, CD, Sluss, J, López-Rey, Á, ... and Piedra, N.** 2019. Do MOOCs sustain the UNESCO's quality education goal? In: *Proceedings of the 2019 IEEE Global Engineering Education Conference (EDUCON2019)*, 9–11 April 2019 Dubai, 1499–1503. IEEE. DOI: <https://doi.org/10.1109/EDUCON.2019.8725203>
- Tovar, E, Tabuenca, B and Piedra, N.** 2020. EntreCom4ALL MODEL to sustain the entrepreneurship competence needs. In: *Proceedings of the 2020 IEEE Global Engineering Education Conference (EDUCON2020)*, 27–30 April 2020 Online, 1937–1940. IEEE. DOI: <https://doi.org/10.1109/EDUCON45650.2020.9125352>
- Tscherning, K, Helming, K, Krippner, B, Sieber, S and Paloma, SG.** 2012. Does research applying the DPSIR framework support decision making? *Land Use Policy*, 29(1): 102–110. DOI: <https://doi.org/10.1016/j.landusepol.2011.05.009>
- UNE.** 2020. Calidad de los materiales educativos digitales. España: Asociación Española de Normalización, (UNE 71362). Available at <https://www.une.org/encuentra-tu-norma/busca-tu-norma/norma/?Tipo=N&c=N0063263>.
- UNESCO.** 2020. *Global education monitoring report 2020: Inclusion and education: All means all*. Global Education Monitoring Report Team [766]. Available at <https://unesdoc.unesco.org/ark:/48223/pf0000373718>.
- Weller, M, Farrow, R and Pitt, B.** 2019. GO-GN: Lessons in building an open research community. *Pan-Commonwealth Forum 9 (PCF)*, 9–11 September Edinburgh. Commonwealth of Learning. Available at <http://oasis.col.org/handle/11599/3336>.
- Weller, M, Pitt, R, Iniesto, F and Farrow, R.** 2020. *GO-GN annual review 2020*. Global OER Graduate Network (GO-GN). Available at <http://oro.open.ac.uk/74428/1/74428.pdf>.
- Zhang, X, Tlili, A, Nascimbeni, F, Burgos, D, Huang, R, Chang, TW, Jemni, M and Khribi, MK.** 2020. Accessibility within open educational resources and practices for disabled learners: A systematic literature review. *Smart Learning Environments*, 7(1): 1–19. DOI: <https://doi.org/10.1186/s40561-019-0113-2>

TO CITE THIS ARTICLE:

Iniesto, F, Tabuenca, B, Rodrigo, C and Tovar, E. 2021. Challenges to Achieving a More Inclusive and Sustainable Open Education. *Journal of Interactive Media in Education*, 2021(1): 28, pp. 1–12. DOI: <https://doi.org/10.5334/jime.679>

Submitted: 13 April 2021

Accepted: 07 September 2021

Published: 13 December 2021

COPYRIGHT:

© 2021 The Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC-BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. See <http://creativecommons.org/licenses/by/4.0/>.

Journal of Interactive Media in Education is a peer-reviewed open access journal published by Ubiquity Press.