Education and the access to it are a public good.
Following the UN Human Rights Charta and achieving the
UNESCO Sustainable Development Goals.

Enabling universal access to education was entrenched as a [human right in 1948](). Additionally, international organisations such as [UNESCO]() also work to support increasing the access to education through various initiatives and programs. Among these initiatives was the formulation of the Sustainable Development Goals (SDGs), specifically [Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all](). But even before there were calls for making teaching and learning materials freely available through [Open Educational Resources (OER)](), the [Berlin Declaration on Open Access]() and the [Budapest Open Access initiatives]() propagated for increased accessibility for scientific research. Most recently, the [UNESCO Recommendation on Open Science]() captured all of these concepts within Open Science, focusing on open and sustainable infrastructures and enabling a wider societal participation in knowledge creation. Discussions around the access to education have their basis in the concept of Open Education, most notably OER. As can be seen in these developments, science and education has been gradually opening up its structures and processes, going from closed institutions to free and public access and finally to open participation. Actively creating and working with educational materials is not only relevant for teachers and lecturers, but also for learners.

Democratisation and Co-Creation of Teaching and
Learning Materials.

Especially over the last few years, the necessity for self-paced online learning environments and learning opportunities have been rapidly growing. Although the previously mentioned initiatives and programs moved philosophical ideas

and concepts about education forward, the broader landscape of (self-paced) teaching and learning environments has indeed not become more accessible. It can be argued that EdTech and course providers in general have simply shifted the authority for teaching and learning, as well as content expertise from traditional educational institutions, such as schools and universities, to faceless corporations with a bottom line. Comparatively, public education and universities are built on democratic structures and, as previously mentioned, embrace Open Access, Open Education and Open Science. Simultaneously EdTech companies and course providers operate closed learning environments offering no external feedback options or challenges to their content-authority. Although some EdTech companies have indeed done an IPO, the stakeholders of these companies possess no more power to influence and provide feedback into their educational processes than before. And even if they would, because of the inherently market-driven approach of these companies, where educational processes, such as teaching and learning, have moved thoroughly into the background, the stakeholders can be potentially removed from these supposedly leveraged positions. As can be seen in the case of [Kahoot](#) and their private equity offer.

The increased influence of EdTech companies and course providers have shifted education away from democratic processes within teaching and learning. Arguably, education can be considered as foundational democratic process, wherein teaching and learning is a constant dialogue between teacher and learner with each side providing appropriate feedback in their shared process. The teacher as an expert in the subject and pedagogy can offer instruction and guidance to the learner, while the learner can provide feedback during the learning process if certain ideas and concepts are unclear and need more explanation, while shaping the goals they want to reach.

This [concept of co-creation](#) has been used more and more in schools and universities. Mostly in the realm of curriculum development and teaching and learning structures and projects. But this concept can offer something valuable in more aspects than just the structural and conceptual development of teaching and learning. By incorporating this concept into more and different phases and aspects of the educational process, it can not only empower learners to take part in better understanding and shaping their own education, but it can help teachers with structuring and supporting their learners more specifically.

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Creating Open Content, Open Educational Resources and
incentivising their usage.
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With the rise of connected networks, i.e. the internet, came an increased focus on digital education and digital teaching and learning materials. More specifically, the "open" aspect of digital teaching and learning materials, which was formulated by [David Wiley](#), shined a light on the enormous potential for collaboration and co-creation. The 5Rs come with inherent methodological issues when looking at the practical application of all "open" aspects when using educational materials. Nonetheless, the idea and concept of OER has spread across the education landscape with increased funding (see [federal funding in Germany](#)), formulations of policy (also on a national level, see [Ljubljana OER Action Plan](#)), various international organisations working on spreading and communicating the concept ([OE Global](#)) and many advocates in all sectors of education. But it can be argued that the OER community has been facing various hurdles that continue to hinder the full-scale adoption of the concept on a mechanical and technical level.

First, licensing issues have been plaguing not only creators of teaching and learning materials, but digital creators in general. Although the creation and

sharing of digital content on the internet has become a lot easier, this near universal possibility brought with it the downside of more diluted documentation of meta-data and tracking of the creations across the net. With inconclusive meta-data and multiple iterations of digital content that is downloaded and remixed, the original authors with their intentions and ideas can become lost. To try to counteract these developments, Open Education and other advocates introduced the use of open licensing to the education space. While [Lawrence Lessig](#) first conceived of and mainly thought for it to be used by the digital art community, [Creative Commons licenses](#) proved to be very useful in education nonetheless. This enabled educators to start creating and sharing their teaching and learning materials with the public, while using various educational repositories to enhance understanding of their ideas and concepts behind the material. Additionally within the meta-data of these educational materials educators could provide users (be it other educators or learners themselves) a general overview of how and where the materials could be used. With the help of open licensing and the use of Creative Commons, one part of the sharing and remixing seemed to be solved, as educators could create their materials with the help of licensing that documented how and what has been changed in their original material.

Since the inception of OER one of the main questions that remains is the sustainable, wide-scale implementation of their use in education. One of most cited barriers seems to be the incentive structure, as [teachers](#) and [faculty members](#) at [universities](#) are widely reluctant to make of the openness, despite [initiatives](#) also trying to tackle this issue more thoroughly.

How can OER be sustainably incorporated in educational processes? Using blockchain technology for the 5R activities.

Retain: The factor of retaining and thereby owning and control a copy of created materials is further enhanced by the following affordances in this list.

Revise: Because of the immutable nature of the Blockchain, different versions of educational material can be preserved, thereby ensuring a transparent and unchangeable record of revisions made by various contributors supporting the use of Creative Commons licensing through technological means.

Remix: Smart contracts can facilitate the combination of different pieces of content by enforcing rules for attribution and usage, allowing for the creation of new works while respecting the rights of not only the original creators, but also all creators partaking in the feedback and editing process.

Reuse: Usage rights and permissions can be tracked more easily and reliably with the help of Blockchain technology, thereby enabling creators to specify how their work can be reused by others. Smart contracts on a blockchain can enforce these permissions automatically.

Redistribute: Blockchain-based systems can enable transparent and fair distribution of material by tracking usage and ensuring appropriate compensation to anyone involved in the creation and remix-process through mechanisms like micropayments or royalty distribution in a decentralised manner, incentivising the active engagement in the creation process.

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