



Federal Ministry
of Education
and Research

OER Strategy

Open educational resources for the development of digital education



Preface

Modernising Germany's education landscape is a key process for society. In a culture of digitality, modern education is digitally enabled education. Digital literacy and digital skills are essential. They supplement the fundamental skills of reading, writing and arithmetic.

Digital educational spaces are a necessary extension of classrooms, seminar rooms and lecture theatres, which for a long time exclusively shaped our vision of education. Digital tools, media and platforms connect educators, learners and their environment. An increase in communication, dialogue and collaboration – any time and anywhere – is at the heart of digital connectivity. Another key aspect is that it is easier to use, produce and adapt educational materials.

Educational materials are a crucial element, medium and driving force in teaching and learning processes and in skills development for learners and educators

alike. The Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung – BMBF) wants to support the innovative scope offered by digital educational media and materials and to drive forward modernisation and innovation in education.

Open educational resources (OER) offer particular potential for collaboration and cooperation, skills development and the creation of new pedagogical practices to support the development of learners and educators in all educational sectors in the digital living and working environment of the 21st century. With the OER Strategy, the BMBF is building on current developments and creating the framework for an innovation space to explore and harness the potential of open educational resources on a long-term, lasting basis.

The Federal Ministry of Education and Research.

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I. Background, challenges and objectives

Digitalisation is profoundly transforming our society. All areas of personal, professional and public life are facing the challenge of shaping this transformation. The aim of the Federal Ministry of Education and Research (BMBF) is to ensure that digitalisation serves people, society and the conservation of our shared resources. It is essential to constantly find new responses to changes that are made possible or necessary by digital technology. Education needs to equip people with the necessary knowledge and skills. The aim is for people to be able to navigate digital environments confidently and with self-determination, in both their personal and professional lives. In this context, it is essential to incorporate digital technology and digital teaching and learning materials into educational practice in a pedagogically meaningful manner.

The teaching and learning situation during the coronavirus pandemic was an unprecedented test for digital education in Germany. Past failings became apparent. Across educational sectors, the ground that needs to be made up in terms of infrastructure, equipment, content, and educators' and learners' skills is now more evident. Significant disparities have become visible between educational sectors and between education institutions. Higher education institutions were better able to build on existing technical infrastructures and shift very quickly to fully online teaching. Schools, on the other hand, lacked digital infrastructure in many cases. This, together with a lack of strategies for providing individual support to learners, has resulted in learning losses, especially in schools. Existing attainment gaps have been exacerbated, particularly in the case of disadvantaged pupils. To find a lasting solution to the many and diverse problems, significant efforts are still needed in relation to digital learning and teaching. The advances that were also made during the pandemic must now be used in all educational sectors. Developments which enhance equity and ease of transfer in the education system through digital education are more important than ever.

OER for equitable education

Open educational resources (OER) have an important role to play in an equitable transformation in education which encompasses educational goals and practices and increasingly addresses individual learning opportunities. OER include all kinds of educational resources, usually published as materials under a free, open licence, often a Creative Commons (CC) licence.¹ These licences establish clear legal and organisational conditions for using, redistributing and potentially modifying digital materials. The ability to freely use and shape them facilitates and encourages networking, dialogue and cooperation, especially in the digital sphere. At the same time, OER raise fundamental questions about structures and processes relating to the provision of educational resources.

1 For an introduction to Creative Commons: creativecommons.org

Role of the BMBF

With its OER Strategy, as a learning, long-term strategy, the BMBF therefore wants to work with all stakeholders to develop responses and strategies for key issues relating to digital educational materials. At the same time, the BMBF is aiming to provide additional, sustainable impetus in digital education and for a wider change in teaching and learning culture.

The question of what kind of permanent OER structures in Germany are useful and necessary in achieving this will have to be examined in light of the educational media infrastructures that are developing.

A combination of commercial and open educational resources is useful and necessary. How this can be ensured has important implications for the further development of educational media. The BMBF wants to deliberately combine the added value that OER offer in terms of access and the design of education processes with the recognised strengths of commercial educational resources and the approaches of innovative media providers. To this end, cooperation models and payment structures that currently do not exist or have not been tried out in Germany for openly licensed educational materials must also be explored.

The BMBF intends to promote innovation in the establishment of OER. This will be ensured by application-oriented accompanying research projects which help to connect OER stakeholders. In addition, the BMBF will support, through software projects, the targeted development and provision of open educational resources in practice-oriented teaching and learning communities. Building on the results of the OERinfo funding line, the learning OER Strategy is intended to link and further develop the Strategy's areas of action and implement them through funding regulations.

Open educational resources – abbreviations, terms, definition and stakeholders

The common definition of open educational resources (OER) has undergone several shifts since the term was first coined by the United Nations Educational, Scientific and Cultural Organization (UNESCO).

The most recent, internationally accepted definition of OER is enshrined in the 2019 UNESCO Recommendation. This² states:

- “1. Open Educational Resources (OER) are learning, teaching and research materials in any format and medium that reside in the public domain or are under copyright that have been released under an open license, that permit no-cost access, re-use, re-purpose, adaptation and redistribution by others.
2. Open license refers to a license that respects the intellectual property rights of the copyright owner and provides permissions granting the public the rights to access, re-use, re-purpose, adapt and redistribute educational materials.
3. Information and communications technology (ICT) provide great potential for effective, equitable and inclusive access to OER and their use, adaptation and redistribution. They can open possibilities for OER to be accessible anytime and anywhere for everyone, including individuals with disabilities and individuals coming from marginalized or disadvantaged groups. They can help meet the needs of individual learners and effectively promote gender equality and incentivize innovative pedagogical, didactical and methodological approaches.”

² unesco.org/en/legal-affairs/recommendation-open-educational-resources-oer

This Strategy covers all dimensions of OER. For example, the definition of “open content” includes not only freely accessible content and educational materials, but also software, tools and standards – in short: IT architectures.³

The key stakeholders in the formal, non-formal and informal sectors who are addressed by this OER Strategy are the same as those specified by UNESCO in its Recommendation. The stakeholders include teachers, educators, learners, governmental bodies, educational providers and institutions, education support personnel, teacher trainers, educational policy-makers, cultural institutions (such as libraries, archives and museums) and their users, IT infrastructure providers, researchers, civil society organisations, publishers, the public and private sectors, copyright holders and authors, and the media and broadcasting sector.

Context and role of the Strategy

Open educational resources have been part of the discussion about transformative processes in the context of digital education for more than a decade and a half. From the Cape Town Declaration in 2007 to the UNESCO Recommendation on OER in 2019, many documents make clear that OER can be used for a variety of purposes.

UNESCO Recommendation on OER

The BMBF was involved in drawing up the UNESCO Recommendation on Open Educational Resources (OER), which was adopted in November 2019, building on the United Nations agenda. In it, UNESCO recommends that its Member States should, among other things, build the necessary capacity and nurture the creation of sustainability models for OER.

Germany has positioned itself on the international stage by participating in UNESCO activities and introducing a funding programme that spans different educational sectors. In consultation with the Länder (Germany’s federal states), the BMBF has funded an OER Information Centre. This, together with other funding measures, has raised awareness of OER and driven forward OER skills development.

In some countries, open and freely accessible educational resources are a necessary supplement in ensuring universal basic education. In highly differentiated education systems, such as Germany’s, OER are instead a vital instrument for cultural change in an increasingly digital education system. OER create access to specific and up-to-the-minute teaching and learning materials. They pave the way for an increase in legally secure collaboration and an intensive dialogue among and between educators and learners. Dialogue and collaboration can result in educational resources that can be used flexibly. Individual learning, creativity and innovation are encouraged and a new teaching and learning culture is supported. At the same time, dialogue and collaboration are a tool and an expression of education for democracy.

³ A comparison of the dimensions and forms of OER using narrow and broader definitions of the term was produced as part of the BMBF-funded project MAPPING OER. See mapping-oer.de/mapping-oer.de/2015/08/oer-definiert/index.html

The role of this OER Strategy is:

- to outline how the further development of open educational resources and OER-supportive infrastructures touches on and is integrated into existing BMBF initiatives,
- to define prospects for more intensive OER use, and
- to specify funding priorities.

The Strategy fleshes out the commitment to support effective OER structures that was contained in the coalition agreement for the 20th electoral term. At the same time, the BMBF's OER Strategy is building on important impetus and outcomes of past funding measures implemented as part of the "Education Campaign for the Digital Knowledge Society" strategy, for example. In addition, the Strategy is shining a spotlight on future developments in the field of OER, which also play an important role in the Digital Education Initiative launched in 2021. OER offer concrete means of achieving the Initiative's objective: providing even more comprehensive support for skills development in a digital world.

Digital Education Initiative: digital learning across educational sectors

The Digital Education Initiative, launched in February 2021 by the then Federal Chancellor, Dr Angela Merkel, and the Federal Ministry of Education and Research, aims to support learners' skills development throughout their educational career in a digital world. The Initiative has five areas of action, covering aspects such as the creation of the necessary digital infrastructures, the development of digital learning tools, skills development for educators, and the establishment of modern content and methodologies. The Digital Education Initiative enhances learning, educating, teaching and training in all educational sectors so that all generations can navigate the digital world confidently. In this context, the establishment of a national education platform is a cornerstone of a digital ecosystem for interoperable teaching and learning infrastructures.

Dialogue between stakeholders from all educational sectors on innovative best practices, projects and initiatives in the field of digital education is supported by the Federal Ministry of Education and Research in the framework of the Digital Education Network, which is coordinated by the Education Digitalisation Forum.

Germany's participation in UNESCO activities and the outcomes of the BMBF's past OER funding initiatives are producing results and structures for the expansion of needs-based cross-sectoral developments. However, expanding OER structures and digital education in general cannot mean simply extending analogue educational content and structures. Successful analogue strategies do not do justice to the requirements and opportunities of digital media, the teaching and learning scenarios of the 21st century, or a culture of digitality. The OER Strategy therefore aims to usher in a profound change in our learning culture.

21st century skills

Since the turn of the millennium, educational research and practice have been grappling with the necessary change of strategy and with innovative models and approaches. The focus is on issues relating to the skills required to actively participate in a digital world and the question of how digital media help to better shape teaching and learning. What do learner-centred pedagogical and didactic formats to improve learning processes look like? How can new assessment formats be developed and shaped?

UNESCO, the OECD and the EU define communication, collaboration, creativity and critical thinking skills – summed up as "21st century skills" – as being crucial to enabling each individual to reach their full potential.

OER create additional scope for developing these skills and other crucial competencies for the digital realm. This includes creative forms of collaboration and education, and confidence in dealing with digital data and processes as users. This requires people to be proficient in evaluating and selecting offerings, services and tools for learning and working in the digital sphere.

The United Nations 2030 Agenda

In the ambitious discussion taking place at international level, OER are seen as a building block for greater equity in education and equal opportunities. In this context, the call for a sweeping culture change in education and within society is linked to the aspirations of inclusive education. The broad definition of inclusion that underpins OER is intended to address the challenges of digitalisation and lifelong learning. OER are regarded as having great potential to contribute to quality education, which is Goal 4 of the Sustainable Development Goals (SDG 4) established as part of the United Nations 2030 Agenda.

Objectives of the OER Strategy

In light of this, the BMBF has established the following specific objectives:

1. The BMBF intends to create and expand systems to incentivise the production and use of OER, and aims to enhance the existing technical, pedagogical and organisational framework.
2. The BMBF is strengthening a culture of openness, cooperation and sharing, and is encouraging the necessary mindset changes for educators and learners that this requires, as well as modern technical solutions, adaptable and widely used standards, and suitable community management formats.
3. In this context, the BMBF intends to strengthen change management more generally in education institutions by promoting not only strategic development processes, but also core technologies and open educational practices in the field of OER.

The aim is for education institutions, edtech companies and start-ups to increasingly see themselves as part of a participatory network, and to open themselves up to new requirements that go beyond the conventional dichotomy between “providers” and “users”. The BMBF’s funding measures based on this Strategy are seeking to create a sustainable OER-supportive ecosystem of technologies, services and networking opportunities. This ecosystem is intended to initiate, support and connect projects nationwide in the field of digital education that relate to the production and use of open educational resources on key future issues for society and educational content. Establishing open educational content and practices as integral components of digital education at all levels of the education system is at the heart of the BMBF’s funding measures.

Embedding in the stakeholder landscape

In Germany’s federal education system, Federal Government initiatives are always positioned in a complex web of competences and intersections. The *Länder* are also taking action on OER, for example increasingly through joint, cross-*Länder* projects in the framework of the Digital Pact for Schools. In parallel with this, the Conference of Ministers of Education and Cultural Affairs (KMK) published its supplementary recommendation on “Teaching and learning in the digital world” in 2021 as an addendum to its “Education in the Digital World” strategy. Among other things, the supplementary recommendation prioritises cooperation and networking in connection with open teaching and learning materials, citing lessons learned during the coronavirus pandemic. At the same time, it is clear that the *Länder* are also focusing more on European developments.

The EU's Digital Education Action Plan

In the Digital Education Action Plan (2021–2027)⁴, the European Commission sets out its vision for high-quality, inclusive and accessible digital education in Europe. The EU wants to develop a high-performing digital education ecosystem and is seeking to improve the provision of digital skills in education and training. In this context, OER use, networking, dialogue and compatibility are increasingly becoming a priority at European level as well, and this is feeding into national developments. This can be seen in DigCompEdu⁵ and SELFIE⁶, for example. They are both tools which enable schools, teachers and instructors to discover and specifically develop potential for digital teaching and learning. Individual and collaborative self-reflection to identify needs is the starting point for further developing skills, digital materials and infrastructures in schools and other education institutions. Open educational resources are taken into consideration in this context. The Länder are making growing use of both DigCompEdu and SELFIE in Germany. DigCompEdu was adopted by the Länder as a joint basis for developing Land-specific competence frameworks, and is seen as a guarantor of national and international compatibility, especially in the framework of the European Digital Education Action Plan.⁷

Overall, OER initiatives are creating a newly defined and developing space for action in which top-down and bottom-up approaches are driving forward the establishment of OER in Germany's education landscape. The Federation welcomes the additional impetus that has already been provided by the Länder. Our shared objective must be to reinforce the evolution that is under way. The BMBF intends to provide flanking support in this context.

The quality of the developments will also be measured by how well they address equity and inclusion and improve participation and involvement in the education of the 21st century.

The BMBF's OER Strategy outlines the role of open educational resources and processes for modern digital education in various areas of action. These areas of action were identified and fleshed out by considering and bringing together numerous suggestions and contributions that were put forward during a broad consultation process with educational stakeholders⁸ and OER experts. This Strategy draws on these suggestions and contributions⁹ and defines key development prospects and future funding areas for the further establishment of OER.

⁴ See education.ec.europa.eu/focus-topics/digital-education/action-plan

⁵ See ec.europa.eu/jrc/en/digcompedu

⁶ See education.ec.europa.eu/selfie-for-teachers

⁷ See Conference of Ministers of Education and Cultural Affairs (KMK), "Lehrern und Lernen in der digitalen Welt" (Teaching and learning in the digital world) – recommendation supplementing the KMK's "Education in the Digital World" strategy, 9 December 2021

⁸ The educational stakeholders that the BMBF is addressing with this Strategy are outlined on page 4 in the box headed "Open educational resources – abbreviations, terms, definition and stakeholders"

⁹ This was essentially a two-stage process which ran from February to the end of April 2021. A total of 80 written submissions were received and three additional focused discussion and consultation events were held online; the necessary analysis phases took place in March and from May 2021. A list of the civil society and commercial stakeholders can be found at: dserver.bundestag.de/btd/19/314/1931438.pdf

II. Areas of action

1. Anchoring and developing educators' OER skills

Selecting, using and evaluating teaching and learning materials has always been part of the training, daily work and continuing training of teachers, instructors and educators in the various sectors of the education and training system.

For these educators, the advantage of OER by comparison with conventional educational resources is the legal clarity regarding their use and the design freedom they allow. Materials can and are allowed to be adapted, redesigned and modified for specific educational purposes, for specific target groups or due to specific regional factors. A creative, innovative approach to learning materials, and supplementing and differentiating them for the educator's own group of learners, are thus key requirements in professionalised teaching and lesson preparation, which can be specifically enhanced by using OER.

OER are both an outcome of and a tool in digital transformation. Joint, co-creative development processes, supported in particular by digital educational and collaborative tools, have led to a huge increase in freely accessible digital teaching and learning resources in Germany. In other words, the use of freely accessible materials that can be adapted for specific pedagogical contexts encourages their production and availability, and thus boosts their potential in terms of learning effectiveness.

Yet although OER are becoming increasingly widespread, their adaptability is not covered in depth in established structures for initial and continuing training for educators. As a result, the potential of OER often goes unharnessed. This also means that OER-driven individualisation of teaching and learning processes cannot be adequately implemented. In short, the quality, effectiveness and efficiency of adaptable OER are not yet sufficiently reflected in the preparation and implementation of teaching and learning processes.

To expand the use of OER, the BMBF therefore wants to better support and prepare educators for their role in the use of OER in educational practice. The BMBF will take steps to integrate the production, use and distribution of OER into general and specialised didactic training for teachers, educational media consultants, higher education teaching personnel who deliver (specialised) didactic training and teacher training, and early childhood education stakeholders.

Developing effective teaching and learning approaches which use OER and incorporate them into curricula and assessment regulations is an important foundation for the structural establishment of OER. The BMBF wants to identify and evaluate existing approaches nationwide, and support the transfer of the results into educational practice. To promote widespread use of OER by educators, it will also be necessary to encourage continuing education and training on the subject of OER.

At the same time, continuing education and training on the subject of 21st century skills and practices more generally is also needed to support trainee and active educators in their work with OER, and to enable them to experience self-directed, lifelong learning and teaching. With regard to this issue, the BMBF wants to make it possible to build on existing services and tools, for example in the case of digitally enabled techniques for collaboration and creativity. The aim is to make their impact more widespread, for example through disseminator models.

Start-ups that address the initial and continuing training of less digitally savvy educators and educational stakeholders are to receive support from the BMBF – including with a view to cooperation across educational sectors – in injecting new momentum and making additional contributions with regard to this topic.

In many education institutions, dialogue and cooperation in the production and use of teaching and learning materials is common practice. This practice is often informal, not least due to problems with licensing materials in a way that offers legal certainty. The BMBF therefore intends to promote legal certainty for producing and sharing OER, identify reservations and obstacles regarding the sharing of self-produced content, and help to alleviate concerns by issuing technical guidelines or legal briefings.

The aim is to ensure legal certainty for sharing based on functional licensing models. To this end, the BMBF will identify what legal advisory and assistance services should be addressed and supported in their engagement for the further development of Creative Commons licences and in providing advice to educators.

Areas for funding

- Production and distribution of OER in initial and continuing didactic training
- Inclusion of OER in curricula for general and specialised didactic training and continuing training
- Continuing education and training on the use of OER and on 21st century skills and practices
- Cooperation across educational sectors on OER
- Advice and support on sharing OER with legal certainty

2. Developing new partnerships: from OER to Open Educational Practices (OEP)

Viewing education and research as common goods leads to a key conclusion: the outcomes of publicly funded projects and initiatives should be made available as public goods. The BMBF's Open Access Strategy is already creating the framework for implementing this in science and research. Scientific findings are being made available to interested parties and society. This creates new opportunities for others to access the findings and participate in the process.

Open Access Strategy

With its Open Access Strategy, the Federal Ministry of Education and Research is seeking to ensure free and open access to scientific information, and funding innovative projects that support open online access to scientific publications. By incorporating an open access clause in its project funding, the BMBF has already taken an important step towards scientific openness within its area of responsibility. The BMBF's Open Access Strategy is to be dynamically developed into a national Open Access Strategy, with the involvement of the *Länder*, the scientific community and other stakeholders.

The OER Strategy also embraces an open access approach. Regarding the education system, it upholds the principle that “public money creates public goods”. This is intended to ensure that educators and learners in education institutions are given access to high-quality materials and innovative approaches and methods – from research, public service broadcasters, publishers or teaching practice.

In principle, open access makes digital educational materials available in unlimited quantities. With due regard for certain parameters, copyright law¹⁰ already permits and enables all types of content to be used for educational purposes with legal certainty. That said, it imposes clear limits on adapting these materials.

By contrast, the benefits of OER are amplified by the minimal restrictions on their adaptation, which is facilitated and encouraged by rights of use granted by the creator. Creators independently and contractually determine the options for re-use of their works. Easy-to-use licences thus make it simple for communities of practice¹¹ to emerge.

Open licensing of digital OER paves the way for low-threshold dialogue – across education institutions and educational stakeholders. Experience gained and lessons learned in this dialogue and in adapting specific OER can support and advance skills development for all involved.

The BMBF therefore expressly intends to support and further develop joint development processes and usage strategies that are based on open access and availability within a culture of sharing and dialogue. In other words, the BMBF aims to expand OER development to build an active community that includes a wide range of stakeholders and promotes cooperation between them.

Open Educational Practices (OEP) and open pedagogy are guiding principles in this context. They bring together all actions and measures by educators, learners and educational stakeholders who are striving to improve educational practice through openness.

Open Educational Practice(s)

The MAPPING OER project, funded by the BMBF, also explored the link between OER and Open Educational Practices (OEP) that underpins this Strategy. It found that OEP expand the core aspects of OER – materials and infrastructure – to include practices relating to OER. In this text, OEP refers to collaborative scenarios, models, formats and frameworks in which educational stakeholders use, produce and adapt OER and subsequently make what has been produced available to others.

OEP thus shine more of a spotlight on the processual nature and quality development of freely accessible and open educational content and resources. Joint, iterative production, remixing, revision, adaptation, differentiation, individualisation and perfecting of educational resources is both the basis for and a key factor in ensuring OER are used beneficially in education – and can achieve new, additional impacts in education. In addition, OEP emphasise an innovative learning and teaching practice guided by the principle of lifelong learning – with learners shaping their learning processes in a more autonomous and self-directed way, together with others (peer learning).¹²

Defined in this way, OEP can be, firstly, an important instrument for skills development by all educational stakeholders, educators and learners in all educational sectors and education institutions – and, secondly, it can be a guarantor of high-quality OER. In other words, OEP offer an opportunity to foster continuous updates, renewal and innovation in the education system. The overarching goal of all educational stakeholders – implementing modern and high-quality education at all times – can thus be supported with OEP.

¹⁰ See sections 60a and 60b of the Copyright Act (*Urheberrechtsgesetz*)

¹¹ Communities of practice are characterised in particular by shared values, practices, artefacts (e. g. teaching materials) and a shared discourse

¹² See mapping-oer.de/mapping-oer.de/2015/08/oer-definiert/index.html

In concrete terms, the BMBF is seeking to develop and establish frameworks, practices and approaches to encourage the use of OER and OEP. At the same time, this process aims to trial and support innovative pedagogical and didactic models and open teaching and learning practices. Interactions between OER and OEP are to be harnessed for innovation in education.

The BMBF's OER funding projects will therefore support a culture of OEP in which educators see themselves as lifelong learners. Educators who are opening up existing education formats to include OER are using and developing OER as learners in communities of practice and professional learning communities¹³ for their own ongoing skills development.

The funding also aims to use OER and OEP to harness additional potential for lifelong learning. This is another area where approaches and results rooted in participatory and creative design and learning will play a growing role in the development of necessary skills.

Higher education institutions are to play an important part in this. As research and education institutions, they can, firstly, incorporate innovations in the field of OER into their own OEP for higher education teaching. Secondly, they establish OEP-related practices in the initial and continuing training for future teachers and their pedagogical practice.

Particularly in OEP, there are further requirements for the production and incorporation of open, trustworthy and high-quality learning materials. An awareness of the risks of deliberate data manipulation and the ability to evaluate information and data sources are vital in this context. The production of digital media therefore requires media literacy, while at the same time it must aim to increase the media literacy of those involved.

Society is increasingly being shaped by a digital attention economy. Effective instruments are therefore needed for developing and reflecting on media literacy. OER development and their use in OEP requires engagement with the goals of their development and with licensing, and allows media literacy and education for democracy to be enhanced in the process of creating them.

An understanding of teaching and learning that embraces collaborative development and distribution of materials needs to be supported by making the transition from OER, in the sense of the "pure production of materials", to OEP, in the sense of a "usage strategy to shape new forms of teaching and design processes" for OER.

To achieve this, it is important to raise the profile of innovative teaching and learning scenarios and ensure they can be built on. Examples of best practice from support provided under the OER Strategy will encourage and simplify widespread use of OER and OEP. Use cases that have been tested in practice and are suited for transfer must remain available for this purpose after the end of the project.

The BMBF regards OEP, in its broader sense, as including the trialling and establishment of new kinds of partnerships. The aim is for strategic partnerships between key stakeholders to stimulate and support the joint production of open learning materials in new models of cooperation. The BMBF includes public institutions and education institutions, media education professionals, publishers and innovative ed-techs in this, for example.

The aim is to develop the links between various OER stakeholders in order to support new formats for OER skills development and dialogue (e.g. in the form of peer coaching) and examine potential new business models to determine their viability.

¹³ Professional learning communities are characterised by their de-privatisation of practice (e.g. lessons), a shared focus (e.g. pupils), cooperation, reflective inquiry, and collective values and standards.

Areas for funding

- Establishing and developing an OER community based on the OEP principle
- Innovative didactic methods using OER in OEP
- Trialling new partnerships and models of cooperation
- Developing educators' and learners' individual ability to evaluate the quality of information, its origin and its risks

3. Establishing technical foundations and structures for OER and OEP

OER will only be sustainably established once dealing with resources is simple from a technical perspective as well. For OER to be widely used, it needs to be easy to remix various types of media, adapt materials to suit different target groups, and update them in light of new developments.

The BMBF's aim is to create synergies so that resources can be managed easily and continuously adapted, and so that their quality can be ensured. Existing obstacles to the availability and user-friendliness of OER and OER-based educational offerings need to be dismantled. It is vital to avoid duplication or the development of parallel structures, for example for searching for OER content; existing options should be brought together.

Today, the ubiquity of individualisable digital media that can be used on mobile devices allows changes to be made at ever shorter intervals. Up-to-the-minute videos can enrich lessons using OER. In the case of changeable OER content, it is therefore essential for the technical infrastructure to support collaborative revision so that the quality of the resources can be maintained and they can be kept up to date.

Authoring environment for OER

The BMBF will, in particular, support the development of flexible components that maximise usability, using a plug-in approach. The aim is for there to be seamless workspaces and authoring environments for the development, depositing and distribution of OER using CC licences; they must be usable in various teaching and learning architectures. Suitable technical means will thus be used to ensure easy technical interoperability, including and especially with evolving teaching and learning management systems.

In addition, adaptability, accessibility and inclusion are binding development criteria for such technical workspaces and authoring environments. This is the only way for OER to reach its full potential in terms of increasing equity in education.

Existing "search and find" mechanisms need to be improved. To this end, we are seeking to ensure that existing solutions are intuitive to use, and that, as part of the concept of an OER workspace, collections can be curated and jointly produced materials can be finalised. The OER workspace will support measures to integrate OER in conjunction with the future national education platform, in order to connect offerings from various educational stakeholders and educational sectors in the field of open resources.

Data standards and discoverability

Developing uniform metadata standards is a prerequisite for functional interfaces between existing and new OER offerings. Metadata describes educational content. Ensuring technical and semantic standardisation of metadata descriptions and the future-proof interoperability of various metadata standards is the only way to improve OER discoverability and the dynamic expansion of the OER ecosystem. We want to provide targeted incentives for this.

Metadata standardisation must combine educational practice, bibliographic and information science perspectives. Future development projects will focus on cooperation with relevant initiatives, institutions and working groups. They will also build on past pioneering work in this area.¹⁴

Suitable identification mechanisms or “identifiers”, as an address for digital educational content, are a prerequisite for the permanent discoverability of OER. The BMBF has previously engaged with persistent identifiers as a potential basis for ensuring the permanent discoverability of conventional media. Such identifiers need to be reimagined and developed further for OER.

Quality mechanisms

The quality of the OER materials available is a major factor in how intensively OER are used. The freedoms offered by open licensing are also a key challenge and opportunity in terms of quality development and assurance for OER. Tools therefore need to be developed which support the collaborative creation, management and curation of OER.

The aim, in this context, is to establish reliable quality development and assurance, based in particular on peer-to-peer processes. Other directions for future development include the creation of practice-oriented evaluation systems to identify and highlight particularly good OER, and the establishment of evaluation bodies which can review OER on behalf of authors, using transparent processes and criteria that are still to be defined.

However, evaluation systems alone are not enough. Support will therefore also be provided for functions and services which assist educators in producing and adapting high-quality OER materials and incorporating them into teaching and learning approaches.

Future-ready infrastructures

In general, the BMBF wants to promote the development of OER infrastructures that are open and adaptable to future innovations, potential uses and use cases. In this context, open source software offers an optimal framework for providing such open infrastructures while meeting high standards in terms of security and usability. Open source code is thus an important criterion for sustainable OER infrastructures which prevent lock-in effects and ensure widespread availability of OER. Interfaces – between, for example, the infrastructures of the Länder and the infrastructures of various educational sectors – will play an important role in this.

Areas for funding

- Developing technical solutions (plug-ins, converters) for the collaborative production, depositing and distribution of OER using Creative Commons licences
- Developing tools for reliable quality development and assurance and for the evaluation and identification of high-quality OER
- Improving existing services in terms of content search and discovery and intuitive user interfaces
- Developing uniform common standards for metadata and interoperable interfaces, including connections with established learning management systems
- Researching and developing digital solutions for the permanent identification of digital educational materials
- Developing open, secure and sustainable digital programme structures and infrastructures

¹⁴ One example of this is the Deutsche Initiative für Netzwerk-information (German Initiative for Networked Information, DINI)

4. Supporting innovation and cross-setting education with OER

Innovativeness and understanding are grounded, crucially, not only in knowledge, but also in experimentation and development. Education must incorporate more experimentation and development as learning activities for learners and educators alike. Additional opportunities are therefore also needed in order to support a cultural shift towards greater innovativeness in formal education. Experimentation, failure as a productive learning process, and encouragement of innovative thinking and corresponding attitudes (open mindset) are therefore also to be facilitated with OER in additional spaces for action and experimentation.

The BMBF will promote initiatives in which open educational resources are produced collaboratively, in iterative processes and in as-yet less established constellations of various educational stakeholders, including across settings and institutions. The aim is to support the creativity and the willingness and capacity to innovate of learners and educators.

To more strongly emphasise these aspects, OER are also to be made more widespread in the context of non-formal education, and they are to be established in additional experiential spaces for action. Particularly at local level, diverse forms of non-school, non-formal educational services are suited to OER use and production, for example in libraries, adult education centres and other areas. Trialling use and production processes based on a division of labour in specific OER learning opportunities offers a wide range of opportunities to incorporate and utilise the different perspectives and skills of the stakeholders involved.

Additional spaces for experimentation which thus emerge for and in connection with OER also offer educators at formal education institutions further opportunities to trial and support OER processes and skills across settings. Teachers who experiment with and develop OER with their pupils at thematic intersections between school, work and higher education are creating new teaching and learning experiences that can be expanded further.

For example, all stakeholders in the field of career orientation are facing additional challenges due to growing demand for skilled workers and the transition to an increasingly complex and digital world of work. Making career orientation timely, relevant and digital, and learning during this process, represents both an opportunity to be seized and a challenge to be faced. Teachers, pupils at general and vocational schools, counselling services for vocational training, regional economic development organisations, companies providing training and instructors all have a part to play in this. The BMBF is providing wide-ranging support – for example with the app to help young people in the process of choosing their career (berufswahlapp)¹⁵, the vocational orientation programme, and the pilot projects in the context of the Federation-Länder “Education Chains” initiative – for measures and new forms of career orientation, including digital formats. OER can make an additional contribution in this context, both nationally and at local level.

In vocational education and training, partnerships between educational settings represent another space for experimentation and action in relation to OER. This includes the intersections between education institutions in the dual vocational training system – i. e. between companies providing training, vocational schools, and institutions for inter-company vocational training. For decades, the BMBF has been providing funding for inter-company vocational training centres and their development into centres of excellence. There is also a special programme to equip inter-company vocational training centres with projects to develop and trial digital learning approaches and materials.

One of the hallmarks of vocational education and training is the high level of diversity in training occupations, and thus content, by comparison with general education. Moreover, specialisation and the pressure to innovate mean that learning materials need to be updated more often. OER can have particularly significant impacts in vocational education and training and in cooperation between educational settings.

¹⁵ See berufswahlapp.de

Based on the standardised national curricular requirements for in-company vocational training and vocational school lessons, OER can provide targeted support for cooperation between teachers and instructors. OER offer a low-threshold, legally certain way to meet the demand for up-to-date, tailored materials for vocational training that can be updated and revised easily by all involved.

Areas for funding

- Creativity and innovativeness in connection with OER in spaces for experimentation
- Local, non-formal spaces for dialogue and experimentation to encourage widespread use of OER
- Cross-setting spaces for OER experimentation at the intersections between formal and non-formal education
- Joint and collaborative production and use of OER by educational settings in job-related and vocational education and training

5. Supporting OER with user-centred, application-oriented and collaborative research

Educational research has been slow to engage with the topic of OER. The further development of existing OER structures is therefore to be supported by a research agenda to address current research gaps.

In this way, the BMBF intends to ensure that the discourse on the topic of OER is underpinned by research and takes place on a broader scale. Research is to be conducted into the potential offered by OER, going beyond solely using a cost-benefit analysis, and the results are to be implemented in an application-oriented manner. Unlike in the case of higher education, there are only isolated findings on OER's impacts on pedagogical approaches and changes to established educational practices.¹⁶

The BMBF will therefore increase its funding for accompanying research and evaluation of OER use and use cases in practice-focused projects, in order to optimise the impact in the education system and advance the user-centred transfer of research outcomes into practice. Practitioners are to be involved from an early stage in the research, which is to examine a culture of sharing and change management in education institutions.

The research agenda will initially focus on the formal education system. Alongside the learning and teaching behaviour of educators, it will examine the behaviour of learners in the use of open digital teaching and learning media in schools and higher education. Key aspects in this context include both expectations and the quality of results of the collaborative use and editing of OER, and pedagogical and didactic aspects of OER and OEP in terms of learning effectiveness and their contribution to equity in education. The OER community will be involved in the accompanying research on OER and OEP and the conditions for their success.

¹⁶ See Otto, D., Schröder, N., Diekmann, D. et al. Offen gemacht: Der Stand der internationalen evidenzbasierten Forschung zu Open Educational Resources (OER) (Made open: The state of international evidence-based research on Open Educational Resources (OER)). *Z Erziehungswiss* 24, 1061–1085 (2021). doi.org/10.1007/s11618-021-01043-2 and link.springer.com/article/10.1007/s11618-021-01043-2

With this OER Strategy, the BMBF wants to encourage the production, availability, redistribution and didactically sound use of openly licensed, freely accessible teaching and learning materials, and to establish appropriate quality assurance. The work and output of the present and future OER community are therefore to be fed into funding projects and the accompanying research, for example through BarCamps, peer learning approaches and moderated workshop formats. Cooperative formats and networking opportunities, with their positive experiences and impacts for institutions, educators and learners, have proved their worth in past BMBF funding initiatives. Firstly, they reflect the principles and the essence of OER; secondly, they provide the basis for identifying and shaping new development priorities for digital education and for directly connecting educational practice and educational research.

Areas for funding

- Research projects about the teaching and learning behaviour of educators in dealing with OER and expectations relating to OER
- Accompanying research into the use of OER in initial and continuing (specialised) didactic training
- Research into the use of OER by learners and learning effectiveness
- Implementing dialogue and development formats by and for the OER community

6. Implementation: bringing together initiatives and stakeholders in digitally enabled OER practice

Experts from all educational sectors and both commercial and non-commercial educational stakeholders took part in the preceding consultation process on the BMBF's OER Strategy. The key guidelines identified for future OER support are summarised by the Strategy, taking a cross-sectoral approach. This makes clear that the BMBF's OER Strategy is seeking to ensure that OER are embedded in education more broadly, comprehensively and consistently, and in a more structured manner, as a cross-cutting issue.

In combination with other BMBF initiatives, the aim is also for OER to generate further innovative impetus for education in the digital condition. Providing additional support for capacity building, skills development and ease of transfer in education with high-quality OER that is accessible at all times is the core objective in this context.

However, it is no less important to the BMBF to use OER to give rise to new partnerships, in order to make educational processes fit for the future more generally. The pivotal factors in this will be, firstly, the integration of research and practice, and secondly, the development, use and re-use of digital educational materials and infrastructures. To this end, the BMBF will build on existing links.

The BMBF is providing substantial funding for the infrastructure for digital education through the Digital Pact for Schools (*DigitalPakt Schule*). Local, regional, *Land*-wide and cross-Länder projects are improving schools' digital equipment and compatibility in a digital education ecosystem.

Digital Pact for Schools – infrastructure as a driving force for modern school education

With the Digital Pact for Schools, the Federation is making 5 billion euros in financial assistance available to the Länder for investment in digital teaching and learning infrastructures. The aim is to develop a digital infrastructure which is a driving force for high-performing digital educational environments in schools.

Alongside digital infrastructure in schools, the Digital Pact is also facilitating regional, Land-wide and cross-Länder projects. In the latter category, OER are so far being covered by the following projects: SODIX/Mundo, the website for vocational education and training (Portal für Berufliche Bildung), and EDUCHECK Digital.

In 2020 and 2021, school closures and teaching models brought about by the pandemic made clear the need to take a close look at upgrading, operationalising and maintaining infrastructure as a driving force for digital education in the pandemic – and beyond. The Federation and the Länder therefore augmented the Digital Pact for Schools with three supplementary agreements.

To ensure that all school pupils could take part in remote learning, the Federation made 500 million euros available through an immediate action programme to purchase devices that could be borrowed by learners who did not have access to a device. The second supplementary agreement provided another 500 million euros for the creation of professional IT administration structures in schools. Finally, a further 500 million euros was made available to equip teachers with tablets and laptops to support and implement digital forms of teaching in and outside of classrooms. In total, 6.5 billion euros is now available for the Digital Pact for Schools.

The implementation of the Digital Pact for Schools also includes steps by the Länder to strengthen continuing training for teachers with regard to digital teaching and learning, and thus advance professionalisation in the use of digital teaching and learning environments. Producing and adapting digital teaching and learning content is a core element of this kind of professionalisation. OER are a key component in this.

The coalition agreement for the 20th electoral term provides for a Digital Pact 2.0 covering the period to 2030. The Federation will work with the Länder to analyse and map the digital education needs that are to be addressed in this context.

The cross-Länder projects, in particular, have set in motion the process of looking at a sustainable nationwide digital education infrastructure. Cross-Länder access and provision of educational media, and collaboration between teachers, Länder institutes and other educational stakeholders, constitute innovative development approaches in these projects. The Länder projects also identify and frame the digital availability and quality of open educational resources as both a challenge and an objective for embedding OER.

Digital higher education

The Federal Ministry of Education and Research believes that higher education institutions offer great potential for embedding OER in the education landscape, and it is promoting openness within the “digital higher education” funding priority. In the framework of the four funding lines for research into digital higher education, the BMBF is supporting the development of innovative digital teaching and learning formats, and to achieve this it is requiring open access and appropriate rights of use for third parties (open source or Creative Commons licences).

The Federation-Länder initiative to support artificial intelligence (AI) in higher education also ensures that its results can be re-used and strives for interoperability with existing solutions.

The AI Campus is a BMBF-funded project which works with a wide range of partners from various educational sectors to develop OER learning opportunities about AI and data literacy. With fully open licensing of its self-developed learning materials, this collaborative project is playing a pioneering role in higher education.

In the context of the BMBF's "digital higher education" funding lines, analogue and digital education are in the process of changing and evolving while benefiting from greater support in future – from both schools and higher education institutions. To date, digitally enabled teaching and learning has seemed to be found mainly in higher education institutions, and to be influencing other educational sectors from there. Fully digitally equipped schools and effective strategies, approaches and capacities for digital teaching and learning in schools are expected to result in stronger impetus coming from this sector as well. This is also creating new and improved conditions for OER, in which change in schools can also support change and innovation in other educational sectors.

National programme to improve the quality of teacher training

Since 2015, the BMBF has been actively supporting the Länder in developing teachers' skills by funding the national programme to improve the quality of teacher training (*Qualitätsoffensive Lehrerbildung – QLB*); it is providing up to 500 million euros for this by the end of 2023. The priority of "digital education" has been further highlighted by an additional funding line. As a result, alongside the projects that have already received funding, an additional 30 projects have been approved that focus on issues of digital education and quality improvement in teacher training courses. In total, the QLB is currently funding 91 projects, involving 72 higher education institutions that offer teacher training programmes.

The BMBF has already been supporting change in schools since 2015 with the national programme to improve the quality of teacher training, based on a Federation-Länder agreement and a joint programme. Educational research has been driven forward within the digitalisation research priority since 2018.

Educational research – "digitalisation" research priority

Since 2018, as part of the "digitalisation in education" research priority, the BMBF has been funding more than 100 projects which are helping to identify the challenges for learning and teaching that are associated with digitalisation and to develop potential solutions, in order to seize newly emerging opportunities and thus contribute to the evolution of the education system. In 2022, further projects are being launched under a third funding line, with the aim of reaching findings about successful skills development for a digital world. Open educational resources and open educational practices have not yet been specifically addressed in this context.

Alongside past OER funding initiatives, the BMBF took additional steps during the coronavirus pandemic to support teachers and embed OER. The OER website WirLernenOnline succeeded in very quickly addressing the sharp rise in demand for digital educational materials by bringing together existing OER. At the same time, important results were produced and experiences were gained about how OER, starting with schools, can be integrated into existing teaching and learning infrastructures and made more accessible and easier to produce, with quality assurance being ensured by specialised editorial teams. WirLernenOnline is thus one of the projects which have driven forward evidence-based engagement with future OER architectures at all levels and by a very wide range of educational stakeholders. The importance and the impacts of OER infrastructure projects of this kind, which also include the cross-Länder project SODIX/Mundo, were particularly visible during the coronavirus pandemic.

Especially recently – a trend that was reinforced by the coronavirus pandemic – all of the digital education initiatives and measures have produced a wide range of additional potential solutions to improve educational practice.

Likewise, with regard to the production and use of OER, there has been an even greater focus on issues that are representative of the need for improvement and innovation in the entire digitally enabled education system: forward-looking skills development, changes that are needed to frameworks and practices, and necessary digital tools and infrastructures.

Diversity will continue to be a hallmark of all developments in Germany's differentiated, federal and innovative education system. In the course of this, the BMBF intends, with further funding measures in the field of OER and OEP, to make a major contribution to enhancing the performance and equity of the education system across the country, in cooperation with all relevant stakeholders and at all levels.

For it is also clear that one thing has not yet been achieved by all past measures at federal and Land level relating to OER: bringing together key digital OER functions and services for educators and learners, in as comprehensive a manner as possible, and in compliance with data protection requirements. This should, in future, be an integral element in an individual digital “cockpit” for teaching and learning in every educational situation. A consolidation and focusing of existing OER infrastructures will be necessary as part of this. This will provide a more reliable means for standards-compliant and interoperable discovery, production and depositing of open educational resources in OER libraries.

The idea of native and compatible elements and infrastructures for OER therefore serves as a model for further developments through which the BMBF wants to embed OER in educational practice to an even greater extent. Future funding initiatives will draw on and use this model and the areas of action outlined in this Strategy in order to further consolidate the developments to date.

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