

An inconvenient truth? The (un-) importance of e-learning as a tool for sustainable education in Germany

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Anne Sagafe¹ and Thomas Wendeborn²

Keywords

E-learning, digitalisation, sustainability, teacher training programmes, higher education

Abstract

In the context of digitalisation, digital media, tools and technologies are becoming an integral part of everyday life. These digital tools are changing social communication as well as the living and working environment. With regards to these environments, the education system plays an important role: Society must be strengthened in terms of digital everyday life and qualified for the future job market. As part of a document analysis based on Mayring (2014), 207 research projects - funded by the German Federal Ministry of Education and Research (BMBWF) between 2000 and 2018 - were examined with regards to sustainability and outcomes. An in-depth qualitative analysis of the project reports and websites was conducted for 27 projects whose funding lasted from 2013 until 2018. The results of the analysis indicated that higher education was the funding priority. However, this prioritisation did not apply to teacher training programmes at universities. The results of the analysis showed that research projects with a focus on Open Educational Resources (OER) were particularly frequently funded. Common project outcomes were a collection of different materials and the creation of project websites. Despite numerous projects related to e-learning, a systematic research into the importance of e-learning tools in teacher training programmes was not identified. The dominance of research projects related to the OER topic promotes the enormous potential in

¹ Anne Safage is professor of educational sciences at the Faculty of Human Sciences, University of Potsdam, Potsdam, Germany.

² Thomas Wendeborn is professor at the Faculty of Sports Science, University of Leipzig, Germany.

terms of sustainability and digitalisation. However, the project results obviously remain unused in the context of higher education and teacher training programmes.

1 Research topic

The advancing digitalisation is turning digital media, tools and technologies into an integral part of everyday life and changes social communication in a fundamental way. In this context, the education system plays a critical role. It is responsible for strengthening society for digital everyday life. Furthermore, it has the task to qualify the society for the labor market (BMBF, 2017, Dunkel, Wohlfart & Wendeborn, 2018). This responsibility implies new demands for school and teachers in order to design education in such ways that the social challenges of the 21st century can be mastered. Moreover, ICT (Information & Communication Technology) needs to be integrated efficiently in instructions to promote learning processes (Fraillon et al., 2020).

This development takes place at national and supranational level. The European Digital Education Action Plan focuses, among other things, „on [the] implementation and the need to stimulate, support and scale up purposeful use of digital and innovative education practices“ (European Commission, 2018, p. 4). At the same time, the Action Plan states that the effectiveness and sustainability of these innovative efforts are highest among well-trained teachers and clear learning objectives (e.g. Hilmayr et al., 2020). These efforts are also highlighted by the Digital Education Action Plan 2021-2027 (European Commission, 2020). This plan reflects in Priority 1 that "[d]igital education content and training in digital skills - including digital teaching methods - will be essential for staff" (ibid., p. 11). In the context of this debate, education and research policies play a central role at the German national level (BMBF, 2017). Since the beginning of e-learning developments in the 1990s, the topics of digitalisation and e-learning in the educational context have been supported by various funding programmes and initiatives. Furthermore, these topics are regularly addressed in strategic papers of the BMBF and The Standing Conference of the Ministers of Education and Cultural Affairs in Germany (KMK). These documents address a variety of measures and technologies relevant to teaching and learning under the conditions of digitisation. Since the beginning of the various funding programmes, it was repeatedly emphasised that the use of e-learning has fallen short of expectations (Huber et al., 2020). In this regard, the various

funding measures have led to an "unmanageable quantity of e-learning offers" (Mehl, 2011, p. 44). However, the quality of these currently available offers is "ambivalent to negative" (ibid.). The development of content relevant to teaching and learning has progressed less than that of technical developments (ibid.). Despite all the e-learning initiatives and more than 20 years of public funding for universities and schools in Germany, massive shortcomings in the German education system became apparent when the corona pandemic broke out. Especially under pandemic conditions, the structural mismatch of education and digitization in Germany became apparent (Cone et al., 2022). And if private-sector companies hadn't already developed videoconferencing software, even those wouldn't have been available.

This finding in the context of e-learning projects as a financial funding priority also raises the question of sustainability with regards to previous funding activities. As a central aspect of future-oriented social development, sustainability plays an increasingly important role in terms of worldwide digitalisation. Moreover, sustainability represents a major challenge of the current era. Originally developed in forestry in the mid-19th century, the concept of sustainability has become a guiding principle of the 21st century. Sustainability is accordingly taken into account in a wide range of subject areas. Regarding to this wide ranging applications, the 2030 Agenda for Sustainable Development of the United Nations (2015) formulates 17 global Sustainable Development Goals (SDGs) at the economical, social and ecological level which are to be implemented by 2030. The education sector is also taken into account. The aim of SDG 4 (Education) is to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (UN, 2015, p. 14). Furthermore, education is seen as essential in order to be able to achieve the SDGs. Consequently, the aim is to integrate education into sustainable developments and vice versa (ibid.).

The demand for high-quality education as a central concern of the SDGs includes the aspect of digitalisation in education as a sub-goal. By reaching this goal the number of youths and adults who possess relevant information and communications technology (ICT) skills for employment, decent jobs and entrepreneurship can be increased.

Based on the initial situation, this empirical study deals with the question of sustainable benefits that previous e-learning funding measures offer for school and university practice in

Germany. For this purpose, the examination examines which e-learning funding projects have existed to date and to what extent, and whether the results of these studies could or can offer sustainable added value for school and university practice. In particular, this value will be considered with regards to teacher education which concerns both of the educational areas mentioned.

2 Theoretical framework

2.1 Digitalisation in school and higher education

The development towards the digital information age, also referred to as the digital transformation, has an increasing impact on the education sector. The increasing dissemination and use of digital technology in everyday life results in an indispensable and adequate teaching of these tools in the education sector. The use of digital technologies for teaching and learning must always be seen as complementary to existing (analogue) educational structures (Kerres, 2018). Humans do not learn or work digitally without any tools. They learn and work by using the internet, apps or other software on digital devices. However, they "always learn and work as people, humanly, physically, psychologically and socially [Author's translation]" (Lankau, 2017, p. 24). Considering technical aspects in this context is, therefore, necessary, but not sufficient. Accordingly, the goal of education should be to link both analogue and digital media sensibly for use in teaching and learning processes.

The term e-learning has been established as a generic term for teaching and learning with digital media. E-learning enables new possibilities for education in schools and universities, but always raises the question of the pedagogical benefit and the didactic integration. In the current debate on digitalisation in education, however, the focus is often on technology instead of teaching and learning processes (Lankau, 2017). Instead, the discussion primarily relates to topics such as blended learning, Open Educational Resources (OER) or Learning Management Systems (LMS). These structural elements are an integral part of the current debate about digitization in education in Germany.

However, in an international comparative study (ICILS study) conducted in 2013, German pupils and students performed worse with regards to computer and information-related competences and are far below the international average (Labusch & Eickelmann, 2018).

Students should be prepared for the requirements of the new forms of communication and work by building on the competences acquired in school and digital practice in teaching and research. The study *Monitor Digitale Bildung* (Digital Education Monitor) found that students in Germany, especially in the teaching profession, are not digital-savvy and show little motivation with regard to the use of digital media (Schmidt et al., 2017). If media education in schools is not sufficiently addressed, students who become teachers demonstrate little competence in this area. If there is then a lack of appropriate qualification during their training, media education, in turn, is given little consideration in their own subject teaching after graduation leading to a "vicious circle" in media education that cannot be broken (Kammerl & Dertinger, 2022).

Therefore, the aim should be to agree on objectives in the education sector that are to be implemented with the use of digital media in order to develop education in such a way that the social challenges of the 21st century can be mastered (Kerres, 2018). In this regard, cooperation between subject didactics, media pedagogy, educational administration and school practice is necessary to rethink and redesign previous forms of teaching and learning as well as learning environments (GFD, 2018). In the course of this debate, appropriate technical-infrastructure, legal, personnel, pedagogical and didactical framework conditions must be created.

Universities have a special function in this context as the technological innovations as well as forms and methods of technology-based teaching and learning are researched, developed and implemented in these institutions. In addition to research, university teacher training is also significant, since media education in schools requires teachers to be appropriately qualified and thus requires media education teacher training (Kammerl & Dertinger, 2022). These requirements mean that teachers themselves must be media literate, but they must also be able to teach media literacy.

With regards to the technology-related professional knowledge of teachers, the TPACK model ('Technological Pedagogical Content Knowledge') according to Mishra and Koehler (2006) is often referred to in classroom research (e.g. Wang, Schmidt-Crawford & Jin, 2018; Willermark, 2018). The TPACK model describes this necessary linking of technological knowledge, content

knowledge and pedagogical knowledge in order to use digital media sensibly and adaptively in the classroom and, thus, to be able to convey subject content better (Wendeborn, 2022). However, there is also criticism of the TPACK model in the DACH region (Germany, Austria, Switzerland): On the one hand, this criticism refers to the fact that TPACK is theoretically modelled too functionally-technology-oriented (in relation to the different subject-didactically relevant knowledge areas of the subjects). On the other hand, it is operationalised too generally from the perspective of subject didactic research. Furthermore, the model lacks a personal-reflexive dimension. These weaknesses result in an undercomplex representation of the interrelationship of the TPACK knowledge domains (e.g., Wohlfart & Wagner, 2022; Frederking, 2022; Wendeborn, 2022).

The important position of higher education institutions in the field of digitisation and e-learning is undisputed. Education policy is also aware of this importance. Since the beginning of e-learning development towards the end of the 1990s, the BMBF and KMK have been publishing strategy papers and recommendations as well as promoting e-learning projects within the framework of various funding programmes. The promotion of educational research projects and developments is necessary in order to do justice to sustainable developments of the educational mission in the digital world as well as high-quality digital teaching integrated into pedagogical concepts (KMK, 2016). This promotion requires extensive financial support in all branches of education and corresponding joint agreements, concepts and strategies of all stakeholders (KMK, 2016). Investments should be linked to didactic developments. New concepts of media-didactic teaching should be researched and tested in order to implement the potentials of digital media in practice (Kerres, 2001). Due to this overall situation, research contributions and the development of concepts for the media-pedagogical as well as media-didactical integration of digital technologies in teaching and learning processes are necessary. To this end, projects dealing with the topic of e-learning have already been initiated, promoted and conducted. Nevertheless, it is still impossible to speak of a comprehensive use and anchoring of digital educational technologies in German everyday university life (Getto, 2013). Despite existing demands and years of funding for digital media in universities and schools, Germany has not yet succeeded in sustainably implementing media pedagogical teaching and learning content in teacher training (Kammerl & Dertinger, 2022). There is a lack

of sustainability in relation to media pedagogical practice.; Individual pilot projects and lighthouse projects exist, but have not yet led to any structural changes.

2.2 Sustainability of e-learning projects

The topic of sustainable implementations of e-learning in universities and schools has been discussed frequently since the turn of the millennium (KMK, 2012). With regard to a permanent anchoring of e-learning in higher education institutions, sustainable implementation is demonstrated by a permanent use of the results (durability), the dissemination of the results within and outside the higher education institution (broad impact) and the permanent financial security for the maintenance and further development of the products (solid financial basis; Kerres, 2001). It is, therefore, not the project itself, but the further use and development of the results that eventually constitute sustainability. An essential feature for the sustainability of project results is their documentation and subsequent digital availability which presents the only way to enable further development or transfer to other contexts (Haug & Wedekind, 2009). This documentation and availability, in turn, is tied to sustainable funding. However, digitisation at German universities is often financed by project funds which are limited in time. In the meantime, e-learning projects have become a funding priority in Germany. Sustainability is usually low due to the project character as the development perspective of the projects is missing (Clark & Harley, 2020). However, the use of media as well as the maintenance and care of the necessary structures needs to be a permanent task of higher education teaching and cannot be guaranteed by temporary projects (Kerres, 2001). Accordingly, the results of e-learning projects, after the end of the project funding, can often not be implemented in the teaching on site. Simultaneously, the dissemination of the results beyond the project location is correspondingly difficult. In addition to the difficult financial continuation after the end of the project, there are also time-related problems that can prevent not only the continuation of results but also the completion of project products. The mostly missing communication and dissemination as well as marketing and further development of project results increase the danger of multiple developments of media contents and concepts. High-quality results, thus, remain unused in the worst case which results in an insufficient implementation of the sustainability (and this despite the fact that utilization/sustainability concepts are typically required in the project application). Overall, the sustainable implementation of e-learning

projects faces various challenges which do not exclusively relate to long-term funding or technical infrastructures but include strategic, didactic, organisational and legal aspects as well as, among others, competences and acceptance, public relations, marketing and quality assurance (Kerres, 2001).

The funding programmes of the last two decades indicate that there has been a multitude of e-learning projects with different goals and degrees of sustainability in relation to e-learning development at universities. Despite years of funding, the expectations placed on these projects could not be implemented. There is no nationwide dissemination, especially of didactically based technology-supported teaching in universities and schools. However, there are project results with potential, but there is still a lack of dissemination, establishment and sustainability of previous results (Mercader & Gairín, 2020). This lack has an impact on schools as teacher education is affected by the university as a whole. Thus, the question arises in particular as to which topics have been focused on in the previous funding programmes accommodate and what statements can be made about the sustainability of these programmes.

3 Methods

With regards to the initial situation, the present study deals with the question which topics the previously funded research projects on e-learning have covered. Moreover, the study aims to answer the question how sustainable these research projects are. For this purpose, the study examined which e-learning funding projects have existed so far and to what extent these projects have been funded. In particular, this examination will be considered with regards to teacher training. This training concerns both the university and the school level. These two questions point to the necessity of a specific research methodological approach.

As a part of a document analysis according to Mayring (2014), the e-learning projects were analysed according to both quantitative and qualitative aspects in order to be able to make statements about the sustainability and outcome of the projects. To answer the research questions, the federal government's funding database was analysed. The aim was to identify funded research projects. In accordance with the research objective, information on the research participants, the length of the funding period and the amount of funding should be

considered for the quantitative analysis of the projects. The central funding database of the German federal government provides information on all of these aspects mentioned. Thus, this database was identified as suitable for project research. Selection criteria were then defined in order to specify the project selection. First, projects were limited to those that were financed by the Federal Ministry of Education and Research, since teaching, learning, science and research as well as e-learning in education primarily concerns the core areas of this Federal Ministry. In addition, a period was set and only those projects were considered whose funding began in the years 2000 until 2018. The period is based on the increased emergence of the topic of e-learning in the education sector from the beginning of the new millennium and the period of the present study. Search terms were identified from the literature search (Tab. 1). Subsequently, the funding catalogue was searched for suitable projects. In addition, a comparison was made with other project databases and funding initiatives to identify all relevant data. Subsequently, duplicate projects were eliminated. Thematically unsuitable projects were defined as those that exclusively concerned early childhood or vocational education and training as well as continuing and further education and training, and those that focused on companies and distance learning. In addition, projects that did not address the field of digital media/technologies as well as lectures and workshops were excluded. Sub-projects were grouped together.

Tab. 1 Search terms used in the federal government's funding catalog (multi-level)

- E-Learning	- e-teaching
- Elearning	- digitale Bildung [digital education]
- Blended Learning	- Medienkompetenz [e.g. media literacy]
- Open Educational Resources/OER	- E-competence
- Learning Management System/LMS	- e-Kompetenz [e-competence]
- Lernplattform [Learning platform]	- multimediale Lehre [multimedia teaching]
- Offene Bildungsressourcen [open educational resources]	- digitale Schulbildung [digital education]
- Mediendidaktik [media didactics]	- digitale Kompetenzen [digital skills]
- Medienbildung [media education]	- Lernmanagement [learning management]
- Digitale Medien [digital media]	- hybrides Lernen [hybrid learning]
	- Medienpädagogik [media education]

- Notebook-University	-,Schulen ans Netz' [school goes online]
- Notebook University	

A total of 207 relevant projects were selected and analysed according to the quantitative criteria of *project participants*, *project duration* and *project funding amounts*. For each criterion, three categories were created into which the projects could be classified. These criteria and the respective categories are shown in Table 2.

Tab. 2 Quantitative analysis criteria and their categorisation

Criterion	Categories
Project participants	1 for individual projects
	2-5 for small collaborative projects
	Larger 5 for large collaborative projects
Project duration in months	1-36 months (0-3 years)
	37-60 months (over three to 5 years)
	More than 60 months (over 5 years)
Project funding amounts in euros	Smaller 1million
	2-5 million
	5 million

In addition, the projects were analysed from a qualitative point of view. Due to the scope and timeframe of the study, it was impossible to analyse all 207 projects in depth. Therefore, a further, second selection of projects was made. The aim was to analyse these for an in-depth qualitative analysis in order to be able to make statements about the added value and the content-related orientation of the projects. Due to the rapidly advancing developments in the technical field, the projects selected in the second selection were those whose funding ended in the last five years, i.e. in the period from 01.01.2014 to 31.12.2018 resulting in 27 remaining projects. The analysed criteria *area*, *objectives*, *key terms*, *results* and *project products* were used for the analysis. For the analysis of these criteria, the project reports as well as the projects' websites were used, if available. The criterion *area* provided information about the educational and subject area of the e-learning projects of the last five years. This criterion examined whether the projects concerned school education and/or higher education as well

as branches of education that were additionally served (vocational and/or continuing education). In addition, the reference to concrete subject areas was to be considered. In both categories, several statements can be applied to one project. The *objectives* criterion attempted to present the main objectives of the selected projects. The objectives corresponded strongly with the key terms given in the project descriptions. Nevertheless, it is important to identify the project goals in order to discuss them later in relation to the objective of the present study. The next analysis concerned *key terms* of the projects as these can give an insight into the content-related orientation of the projects. In order to enable comparability, key terms and word groups were noted based on the project title and, if applicable, sub-titles of the project report as well as on general chapter sections. These chapters were usually named project description, task definition, thematic focus or similar wordings. The noted key terms were then summarised into 13 categories.

Afterwards, the *results* were examined. Only the section on a brief presentation of these results was considered in the project report. In order to be able to compare or make a central statements about the results, these results were summarised into 14 categories. Based on this analysis, the type of benefit of the projects became apparent. Finally, *project products* were listed and, if possible, provided with a link or a source of the products. The listed products were considered in connection with the category of the funding amount, since a specific reference to the sustainability can be drawn. The listed products showed which specific products were created by the funding and to what extent these products can be used. A qualitative analysis of the products was not conducted as the amount of data is too large in the context of this study.

4 Results

4.1 Quantitative analysis

In order to provide an overview of the projects analyses, figure 1 shows the results of the quantitative analyses of the 207 projects. The majority are individual projects (39%) or small collaborative projects with two to five partners (44%). Only a few projects are large collaborative projects with more than five participating institutions (17%). In terms of total duration, most projects were funded between one and 36 months (69%), i.e. up to three years. Fifty-eight projects were funded between 37 and 60 months (28%) and seven projects were

funded for more than 60 months (3%), i.e. for more than five years. Long-term funding is, thus, rare and usually associated with two longer funding phases (follow-up funding).

Finally, with regards to the amount of funding, it becomes apparent that just over half of all e-learning projects were funded with financial resources of less than one million euros (51%). The average funding amount in this category is around 508,000 euros. Ninety-six projects were funded with one to five million euros (46%), the average value is around 2,066,000 euros. Projects were rarely funded with more than five million euros (3%). In these cases of multi-phase projects, funds have totalled up to more than 13 million euros. The average funding amount per project is around 9,548,000 euros.

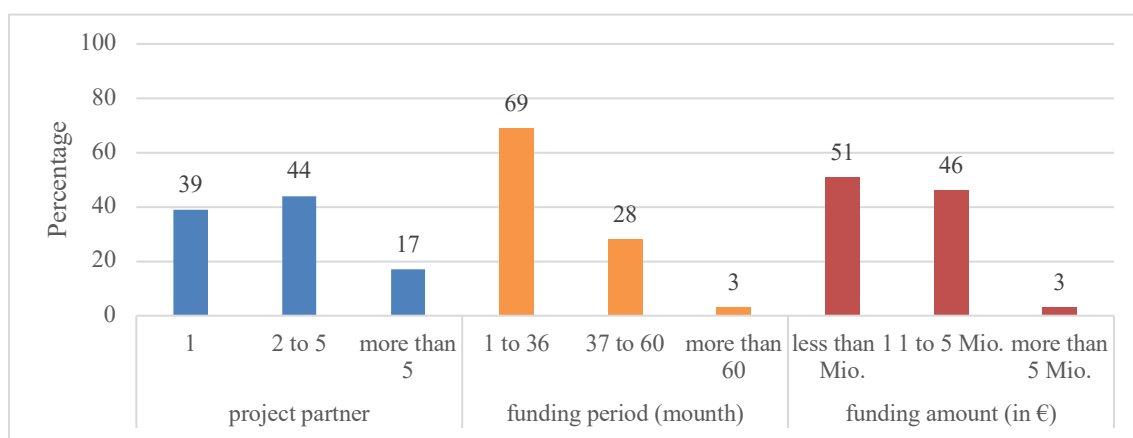


Fig. 1. Results of the quantitative analysis (n=207)

4.2 Qualitative analysis

The results of the qualitative analysis of the 27 projects are described below. These results are subdivided according to the five criteria *area*, *objectives*, *key terms*, *results* and *project products*.

Area

With regards to the area of education, 26 projects were related to higher education (96%), 13 to school education (48%) and 13 of them additionally to other fields of education (vocational and further education; 41%). The majority of the projects (78%) concern various subject areas that were not specified. The few projects that can be assigned to a concrete subject area concern mathematics and natural sciences (STEM subjects; 15%). A specific reference to teacher training is low and present in four of the projects (15%). The projects can be named

more than once (e.g. teaching profession, different subject areas). Table 3 shows an overview of the results described.

Tab. 3 Analysis of the projects according to the education sector and subject area (n=27)

education sector/ subject area	Number of projects
Higher Education	26
School Education	13
Other Area of Education (vocational and further education)	11
Interdisciplinary	21
Science and mathematics (STEM)	4
Teaching	4

Objectives

The objectives of the projects were diverse. Basically, the funded projects dealt with one or two of the following three focal points: 19 projects (70.1%) dealt with (1) the goal of developing and/or implementing OER materials for schools or universities. The related intentions differed between the projects (e.g. democracy education, digital literacy development, multiplier training). (2) Eleven projects (40.7%) focused on qualification and/or competence development with or through digital teaching-learning offers. Either this qualification related directly to the specific target groups (e.g., teachers, students) or multipliers were to be trained. (3) Seven projects (25.9%) were more or less concerned with the issue of establishing cooperation networks between different educational institutions (e.g., school and university) on the basis of blended learning solutions or setting up e-learning competence centres. These competence centres were designed as institutional contact points for consulting and supporting e-learning projects.

Key terms

It is obvious that the key terms of the projects are closely linked to the project objectives. In the analysis of the key terms, the topic of OER stood out. More than half of the projects included the topic of OER. The same applies to disseminating and publicising the project content or results as well as networking and synergy with external parties (63% each). Some

of the projects (55%) planned to implement (further) qualification in the field of e-learning. Topics that were included in about half of the projects were didactic and technical aspects as well as the creation or collection of materials. One third of the projects specifically mentioned sustainable implementation. About a quarter of the projects dealt with blended learning and legal aspects of e-learning.

Project results

The analysis of the project results emphasised that the creation and/or collection of materials (teaching-learning material, information material) is a frequent outcome (89%). Access to (parts of) these materials is possible for external parties for about three-quarters of the projects. Another frequently achieved project outcome is the provision of advice and information (63%). This provision can be online (e.g. via a webinar, online registration for workshops, wikis etc.) or via support structures/information events in the individual institutions. Furthermore, the creation of a dedicated website for the project often occurred as a result. The possibility for trainings, workshops or in-service trainings in order to qualify teachers (and interested people) in the field of e-learning was about 50% of the projects' outcomes during the implementation and/or further on. The development of didactic e-learning concepts, the use of e-learning applications (e.g. ePortfolio, virtual labs) as well as the development of software developments/apps, the expansion of the technical infrastructure and the analysis of the respective projects can be mentioned in isolated cases as project results.

Project products

The specific project products achieved were correlated with the funding amounts of the projects in order to subsequently be able to assess the sustainability of the projects. A project report was available for all projects in the first funding category (less than 1 million euros). Almost all projects in this funding category make project products available to external parties free of charge. These products were, for example, information materials, teaching and learning materials, event information or handouts and recommendations which are made available via the project websites or via the websites of the colleges and universities. However, it remains uncertain how long this access will be available after the end of the projects as well as how the materials will be assessed qualitatively. For the projects with funding amounts of

one to five million euros, it can be stated that almost all projects provided several publications. In addition to articles, these also include lectures or poster presentations, for example at conferences. In addition, a final report is available for each project. With the exception of two projects, all of the projects offered materials resulting from the project on their own project website for external users.

The project reports of the two projects in the highest funding category (over €5 million) are short in comparison to the other project reports. In these cases, various publications can be presented that were published in the course of the project. One of the projects has designed a large number of virtual laboratories for use in higher education teaching and made some of them publicly accessible via its own project website, including one for use in schools. The e-learning structures and materials created in the other project, in contrast, are mainly used within the university.

5 Discussion

Small and nice or too big to fail!?

With regards to the results of the quantitative analysis of the 207 projects, it is noticeable that the majority are individual or smaller collaborative projects. However, some larger projects have also been funded. It can be assumed that it is more difficult for smaller projects to achieve sustainable project results in the course of a funding phase (usually three years). This sustainability can only be reached if the implementation of the results is already included in the project planning (e.g. in the form of cooperation with implementing organisations). In the case of collaborative projects, there are more opportunities in terms of sustainability. However, it is understandable that the challenges for sustainable education increase with the number of project partners. However, all projects were able to produce various project products. The projects with a low level of funding mostly made these products available digitally. The projects with funding of one to five million usually have a more detailed report of results and a large number of publications. Most of the projects provided various materials for use in the teaching practice of their own institution/project area. The analysis of the project products highlighted that products for external use are made available online.

Thus, even larger project networks can fail if there is no elaborated procedure for the dissemination of the results. However, ensuring the sustainability of project results is not only the task of the responsible scientists. The course for sustainable implementation is set during the call for proposals.

Slow and steady wins the race?

In terms of funding duration, most projects are funded by the BMBF for up to three years. This duration corresponds to international funding lines (e.g. ERASMUS+, Horizon 2020). With regards to the chance of sustainable results, a shorter funding period in the analysed projects has a negative impact on the dissemination of the results. This impact is understandable since dissemination or continuation of the work becomes more difficult as soon as the financial support ends. Additionally, the staff employed in the project is usually no longer available. Moreover, the sustainable provision of the knowledge acquired in the project is impeded by various university regulations. Accordingly, project positions are often qualification positions of junior scientists. These positions are required in order to qualify within the project period. Longer funded projects could offer the chance to evaluate the dissemination of the project results and to accompany an implementation scientifically. Hence, multi-stage project funding seem most sensible in terms of sustainability.

Don't put all your eggs in one basket!

As mentioned above, the content areas of the 27 selected projects were analysed by using key terms. In particular, the topic of OER was emphasised as a core topic. This emphasis corresponds to the orientation of the BMBF (2017) to establish the OER approach in education. OER have the potential for sustainable developments of high-quality learning materials. Other topics of the funded projects were public relation and dissemination (e.g., of information, project results, and products) as well as networking and synergy. Furthermore, the creation of material collections as well as the implementation of qualification and information offers were a central focus of the results. These aspects have a positive influence on the durability and broad impact of the project results. One should note critically that the funded projects – with the exception of the STEM projects – do not establish any subject references. Without subject matter, however, digital competencies have no object to which they can be applied to. Digital competencies can only acquire an applied, practices, reflected

and promoted focus if these competencies are combined with subject-specific competencies and related content (Wendeborn, 2022).

Furthermore, one should note that the projects analysed up to 2018 shows a clear concentration on higher education in terms of funding. School-based projects are a minor focus. Corresponding projects appear to have been funded rarely during the analysed period. On the one hand, this imbalance results from the focus of the BMBF's calls for proposals (university teaching, digital competence development of students and lecturers) where the qualification of teachers (training, advanced training and continuing education) has largely been ignored. On the other hand, the reference to the teaching profession and the training of future teachers is extremely low overall. In relation to the strong support of the higher education sector and the promotion of e-learning projects, too little importance is attached to teacher training. This unimportance is not in line with the strategy papers of the KMK and BMBF which explicitly state the need to qualify student teachers as well as to the development of media pedagogical and didactic competencies. In addition, there is a lack of teacher training that addresses the developments of digitisation and the requirements of media education in schools.

Did it last too long?

As mentioned above, there has been a strong focus on higher education in funding. This changed with the federal government's Digital Pact for Schools in 2019. The goal of this pact is to ensure that the educational infrastructure is improved nationwide by supporting the federal states. According to the administrative agreement of the BMBF (2019), the federal government provided more than 5 billion euros within this framework. Thus, by the end of 2021, more than 80 projects (2.372 billion euros) focusing on schools were funded. In addition, the further training of teachers is to be strengthened by the establishment of so-called competence centres for digital and digitally supported teaching (for STEM, languages, social sciences and economics; arts and creative subjects and physical education; digital school development). This establishment will be conducted by research projects funded with 205 million euros by the BMBF until the end of 2026 (BMBF, 2022a).

What is left at the end?

In summary, the products of the analysed projects show an overall development in terms of availability (i.e. possibility of dissemination and use of the project products). The majority of the projects provides information offers, material offers and/or references to events. These offers are usually available free of charge. In most cases, the products mentioned in the project report can be found and used online. However, in most cases, the end of the funding phases was less than one year ago. It will, therefore, be interesting to observe whether the websites and collections of materials will continue to exist, be updated, and be developed in the coming years.

With regards to the research question, a sustainable implementation of digitally supported teaching and learning processes was not initially realised in the federally funded e-learning projects. However, the project analysis highlighted that the e-learning projects offered a certain benefit during the analysed period. However, this benefit predominantly relates to university teaching and is limited to the development of teaching concepts and teaching-learning materials as well as the development and dissemination of OER materials. However, the developed OER materials might also be used in the school sector. The sustainability aspects of the analysed projects showed a slightly positive development. This development is mainly due to the dissemination of the project results through publications and in the form of digital offers. These publications and offers enable both use and development and have a positive effect on the durability and broad impact of the results.

6 Final remarks

The strategies developed in Germany for education in the digital world emphasise the role of teacher training in particular. However, the present study shows that the overall benefit for teacher education, for example, is rather low. This low benefit is due to the fact that most projects do not explicitly address this area. Furthermore, most of the projects - with the exception of those funded in the STEM area - do not have any direct subject-related reference points. Based on a pedagogical and didactical integration into an overall concept, a subject-related connection must be drawn with technology-based teaching and learning, because without a subject-related object the use of digital media and the intended mediation of media skills is neither expedient nor purposeful (GFD, 2018). With the funding of research alliances

by the federal government from 2023 (BMBF, 2022b) onwards consisting of universities and non-university research institutes (e.g. Centre for Teacher Education, state institutes), the different actors in teacher education will be structurally united for the first time. These actors are to contribute to high-quality and practice-oriented continuing education programmes for teachers. Furthermore, an enormous focus of the topic OER was exposed in the present study. This focus unveils possibilities for the consideration of sustainability aspects as well as for the use in higher education, especially in teacher education. However, these possibilities seem to remain largely unused/ignored. According to the authors, this ignorance is mainly due to the lack of subject matter expertise of the materials, the concrete subject reference as well as the structural anchoring of OER. In the future, it will be important to reach a common understanding on how to deal with digitisation in schools and universities in a feasible way. This process includes a uniform understanding of teaching and learning with digital technologies as well as the development and implementation of didactically meaningful implementation options. These aspects need be the goals of communication and decisions for action in education and politics. In the context of the development towards sustainability and educational quality, a realistic picture of the current educational situation is necessary. The goal of sustainable developments in education cannot be implemented if the funded education policy projects and research projects are not sustainable themselves. Keeping this predicament in mind, teacher training must be promoted in a subject-related manner and media education must be anchored sustainably. by following this path, schools and universities will be able to meet the changing demands regarding media education in practice as a result of digitisation. Research projects dealing with this topic are currently and will presumably continue to be of great importance in order to support and accompany the digitalisation process constructively and critically.

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