

LTSHE

Learning and teaching space in higher education



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Exploration of Policy and Practice: Learning and Teaching Space in German Higher Education

“National Report” by Evaluation Agency Baden-Wuerttemberg
about policy and practice of designing L&T spaces in German
higher education including institutional levels

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Executive Summary

The analysis shows how complex the processes of implementing and designing future-oriented learning and teaching (L&T) spaces are, due to the complexity and diversity of the processes themselves as well as the complex organisational situation in a federal state political structure – the Federal Republic of Germany – with a central government and 16 federal states' governments that have the full sovereignty in all educational matters. It is decisive for the success of these processes that different actors are discursively working together in their respective fields of action and across these fields' boundaries. Important actors and their fields of action participating are:

- Education ministries: establishment of strategic frameworks and sustainable financing structures
- University leadership and management: holistic strategy development with inclusion of different perspectives (organisation, learning architectures, coordination of all actors, cooperation with non-university partners, promotion of collaborative projects)
- University teachers: implementation of future-proof L&T scenarios and types of examinations, participation in the curriculum (further) development
- Students: involvement in the development processes and participation in L&T content
- Didactics centers / Didactics officers: Support for teachers to improve teaching quality
- IT centers: provision of the technical infrastructure, support for teachers and students, participation in (new) digitalisation strategies
- Building departments of the universities in cooperation with experts from the fields of urban planning, architecture, interior design and learning space research
- Advisory institutions such as: University Forum Digitalisation (HFD), German Initiative for Network Information (DINI), HIS Institute for University Development, interdisciplinary research groups on education, design and technology, etc.
- Cooperation partnerships: with companies and representatives from various professional groups, with scientific institutions, etc.

The report also exhibits that many of the challenges for higher education institutions concerning the design and implementation of L&T space or University Learning Worlds are treated by the universities of the German higher education system. However, often individual activities are undertaken which are frequently based on project funding and usually come to a standstill after the end of the project funding period. Project-transcending and structurally anchored funding is largely lacking. Additional problems arise from the federal structure of Germany: the federal heterogeneity of the legislation in the field of education and the agreements between the federal states and the universities make it difficult to compare universities and to transfer good practice. This weakness is balanced, however, by strengths of federal structures, among them the better fit between regional needs and the governance of the regions and the pronounced practical autonomy of universities that are not centrally governed.

Some further characteristics of the German higher education system that are related to the design and implementation of L&T space are the following: Together with the renovation backlog that ran up to 2016, assuming an area expansion of a moderate 1.2% annually for teaching and research, there will be a funding gap for university construction of around € 35 billion by 2025. At many places, there is a need for (more) learning spaces that (better) support students' active engagement with content and include technology options to support multiple and flexible modes of L&T. At many places, there is also a need for (more) learning spaces that (better) enable students' work on an individual base as well as in collaboration with one another. The expansion of universities in the field of lifelong learning and continuing education recommended by the German Science Council in 2019 may also require modernised and new offers of L&T spaces.

Looking at the design and implementation of L&T spaces – the Learning World University – through the perspectives of higher education politics, university strategy and organisation, university didactics, university digital structures and university physical spaces makes clear that a great majority of higher education institutions in Germany (as well as in other countries) have recognised the need for change in these areas. Currently, in the German context the most widespread and particularly far-reaching innovations are in the area of digitalisation and the development of digital structures for L&T. Changes are also becoming apparent in the areas of didactics and physical L&T spaces, although there are structural obstacles. University didactics does not appear to be strategically and comprehensively integrated in the universities to a sufficient extent, while the institutional responsibilities and financing models for the realisation of spatial conversions and new buildings have been largely unclear in Germany since the abolition of spatial planning and implementation as a joint task of the federal government and the federal states' governments in 2007. It is also a general insight that overarching strategies for renovation, modernisation and enhancement – for the design and implementation – of L&T spaces in higher education are largely lacking, on the national as well as the federal states' as well as the individual universities' levels. The reasons for this lack are multi-faceted and not completely clarified. In this sense, there are clear deficits in the area of strategy building and organisational development at different organisational levels of the German (higher) education system with respect to the design and implementation of L&T spaces. One consequence of these deficits is that the processes of designing and implementing (L&T) spaces at German universities are very complex and individualistic and therefore not very transparent to many stakeholders and the public as well.

Some further, more specific results of the study are that the subject of (the design and implementation of) L&T space is not addressed or very vaguely addressed in the higher education laws of the 16 German federal states and on the various strategic levels of German universities as well. There is no reliable stocktaking about the availability of physical, hybrid and virtual L&T spaces. The financing concepts of German universities in particular with respect to the design and implementation of L&T spaces need organisational clarification, more financial resources and continued reliable funding.

On the basis of the report's analysis recommendations for action are suggested for the areas of higher education politics, university strategy and organisation, university didactics, university digital structures and university physical L&T spaces (see Section 6). Finally, in view of the further

goals of the LTSHE project and a comprehensive reflection of the issue several principles of design and implementation of L&T spaces in higher education are gathered (Sections 2.2 and 6.7).

1. Introduction

German universities and higher education institutions worldwide are faced with various challenges resulting from social, economic, ecological and scientific developments and change. These challenges include, for example, globalisation, digitalisation, (Higher) Education for Sustainable Development ((H)ESD) and the shift from teaching to learning (Barr and Tagg, 1995). In addition, in Europe the Bologna Process and administrative and organisational reforms (“New Public Management”) are of particular importance. All these issues pose specific challenges for universities, as they should make a decisive contribution to shaping the future of sustainable development of knowledge societies.

This requires students, lecturers, the management level and other stakeholders in the university to rethink and at the same time to design new structures and approaches as well as to develop changed competence profiles related to the students. This further development and redesign of structures also affects learning and teaching (L&T) as well as L&T spaces (cf. Byers *et al.*, 2014; Ellis and Goodyear, 2016; Ellis and Goodyear, 2018; Fisher, 2005; Huang *et al.*, 2019; Kariippanon *et al.*, 2019). As a result, the universities have to design conceptual, didactic, digital and spatial framework conditions in such a way that self-responsibility in relation to learning, i.e. various modes of self-determined learning (SDL) can also be developed. In other words: Due to the increasing number of students, increasing digitalisation, systematic organisational development and changing didactics as well as other factors, there are new overall needs for L&T spaces in higher education. It is about the optimal coordination of space-related aspects such as space design (architectural construction), interior fittings (type of furniture and flexibility of the furniture, equipment) as well as interior design (atmosphere, light, colours) with the educational content, didactic methods and digitalisation options relevant to the respective educational offers (digital structures; virtual spaces) (cf. Seitter and Feld, 2019, p.7).

Apparently, it is a background assumption of this understanding of the role of L&T space(s) that physical as well as virtual space aspects, the physical and technological structures of L&T space(s) have an impact on L&T, i.e. on student and teacher success and satisfaction (Granito and Santana, 2016), by affecting teaching behaviour, learning behaviour and learning success, in short: L&T performance and success, such as the ability to concentrate, well-being or receptivity and various options for communication and collaboration. This is in line with the hypothesis that “space as a third pedagogue” (Dahlinger, 2008, p.15; Ninnemann, 2018) is effective.¹

Against this backdrop, this Intellectual Output O1 of the LTSHE project explores the policy and practice of designing and implementing L&T spaces in German higher education comprising national, federal states and institutional levels.

Chapter 2 reflects and comments on theoretical issues, specifically the dimensions, players and challenges of the University Learning World as well as principles and requirements for the design of contemporary L&T spaces. Chapter 3 describes the methodological approach.

¹ The question of the extent to which this can be proven with quantitative empirical studies cannot be pursued further here. For a recent overview over the literature see, however, (Talbert and Mor-Avi, 2019).

Chapter 4 gives an overview over German national and federal states' legislations and policies and practice activities with respect to (the design and implementation of) L&T space (broadly) in the German higher education system. This "National Report" is based on document analysis, including national policy and legislation documents as well as research evidence to situate the state-of-the-art in the German national context. This includes material and information drawn from academic and practitioner articles on national policy and practice for the design and implementation of L&T space in German higher education. In view of the LTSHE project's goal of developing a Manual of Principles of Design of L&T Spaces in Higher Education (Intellectual Output 4), Chapter 4 also attempts to provide information about the background and foundation of such (tentative) principles that are addressed in the German national context.

Chapter 5 gives an overview over institutional policies and practice activities with respect to (the design and implementation of) L&T space (broadly) in German universities. In this context key actionable issues and their related responsible addressees and actors are characterised for each of the following institutional areas: university strategy and organisation in L&T; university didactics; university digital L&T structures; university physical L&T spaces. For each of these areas examples of good institutional practice are given.

Finally, Chapter 6 gathers conclusions and recommendations.

2. Theoretical and conceptual issues

2.1 L&T space alias University Learning World: definitions, dimensions, players and challenges

In addition to research and third mission, learning and teaching (L&T) is one of the core areas of higher education institutions that needs to be shaped. Therefore, adequate physical, hybrid and virtual L&T spaces are required. For the present purposes, the following definitions are adopted:

L&T space: L&T space ‘refers to a place and the surroundings associated with that place where teaching and learning occur; it may refer to an indoor and outdoor location, or to a physical or virtual [or hybrid] environment’ (Huang *et al.*, 2019, p.150). L&T spaces ‘are designed to support, facilitate, stimulate, or enhance learning, and teaching. A learning space can be designed to support listening and taking notes (e.g. a lecture hall or traditional classroom). New technologies have added to the complexity of designing effective learning spaces and now require careful consideration of the pedagogy to supported learning. The characteristics of a learning space and its components include many variables, such as size, forms, shapes, environmental setting, technologies involved, intended activities and users, and so on’ (Huang *et al.*, 2019, p.151).

Formal learning: ‘Formal learning is typically organised and structured and has learning objectives; formal learning is normally delivered by trained teachers in systematic and intentional ways within a school or university’ (Huang *et al.*, 2019, p.151).

Informal learning: ‘Informal learning is any learning that has no set objective in terms of learning outcomes [...], which usually occurs in learning commons, multimedia sandbox, and residential study areas’ (Huang *et al.*, 2019, p.151).

Virtual learning: ‘For both formal and informal learning, virtual learning environment refers to the kind of platform that supports mediated exchange of information between users and the system through such digital media as learning management systems, social media websites, and online virtual classrooms and environments’ (Huang *et al.*, 2019, p.151).

The design of L&T spaces is a complex, multi-dimensional challenge because multiple and diverse actors and stakeholders are involved in this core mission and responsibility of higher educational institutions. Based on the political framework, the leadership, administration, IT and infrastructure units, libraries and various L&T centers (e.g. media centers, writing centers) as well as teachers and students of a university are the main actors who design and implement the university theoretically and practically. In view of contemporary conditions and structures, specifically the processes of digitalisation, many of the L&T-related services mentioned are integrated into and implemented by physical learning centers and digitalised campus management systems (CMS) and learning management systems (LMS).

As a starting point, for a systemic description and analysis of the *University Learning World* (“Lernwelt Hochschule”: Becker and Stang, 2020a) alias higher education L&T space, the

following conceptual framework is adopted with changes from the recent German research project “Lernwelt Hochschule” (Petschenka *et al.*, 2020, p.214).² According to this approach, the following five dimensions are differentiated with reference to the design and implementation of L&T space in higher education:

- Higher education politics
- University policy and organisation
- University didactics
- University digital structures
- University physical L&T spaces

It is assumed that these five dimensions are spanning the description and analysis space of L&T phenomena in higher education comprehensively; in this sense any such phenomenon (e.g. political strategies for L&T space; learning gain; achieving intended learning outcomes; practicing of student/teacher communication; practicing of self-directed learning (SDL); practicing of research-based learning etc.) can be positioned within that coordinate space by specifying its features and requirements with respect to politics; strategy and organisation; didactics; digitalisation; and physical space. In other words, an adequate description of an L&T phenomenon must usually refer to a selection of these five dimensions.

The main actors and stakeholders, who are confronted to the challenges of higher education institutions at conceiving, planning and implementing learning worlds, innovative L&T spaces are the following:

- Ministries of education, science, humanities, arts and research
- University leadership
- Organisational units of the university (e.g., IT and infrastructure units; didactics centres; libraries and media centres; learning centers), i.e. their responsible personal representatives
- University teachers including didactics experts
- Students

A preliminary sample of main tasks and challenges with respect to the design and implementation of L&T space in higher education reads:

- To establish coherent education politics
- To establish an adequate financing model including securing the availability of sufficient finances

² This approach itself is an extension of an earlier model based on conceptual dimensions of pedagogy, physical space and digital technology (PST model: Radcliffe *et al.*, 2009).

- To establish coherent, precise and explicit university policies that rely, for example, on policy documents, leadership commitment, mission statements, structure and development plans, goal agreements etc.
- To integrate all relevant institutional actors and higher education stakeholders
- To implement the Shift from Teaching to Learning, i.e. to orient L&T environments at learning requirements and learning processes (based on reflected didactics)
- To acknowledge didactics as key competences and didactics centers as key organisational units
- To develop and implement a digitalisation strategy in L&T including establishing adequate organisational units for ICT and technologies for blended L&T (e.g. campus management system (CMS), learning management system (LMS))
- To acknowledge the design of physical spaces as strategic institutional focus
- To develop and implement hybrid space structures

These challenges are again a starting point for the analyses in Section 4 and 5 where the national policy as well as individual university policies for L&T spaces in German higher education are discussed. In particular, these challenges lead to potential development perspectives that can be related to recommendations for action.³

2.2 Principles and requirements for the design of contemporary L&T spaces

Overall, the core goal of the LTSHE Erasmus+ project is to develop research-informed principles for (re)designing and implementing L&T spaces in higher education which are in turn informed by theory and practice of effective L&T.⁴ Therefore, the LTSHE project may start from principles that were suggested in the literature, for example by Finkelstein *et al.* (2016, p.29) (Table 1) and by the University of New South Wales, Australia (UNSW, 2016, p.3) (Table 2).

Table 1 | Principles I for the design and implementation of L&T spaces in higher education

Learning spaces should allow students to actively engage with content and include a range of technologies that support multiple modes of L&T
Learning spaces should provide features that permit students to work both individually and in collaboration with one another

³ As a matter of fact, there are further dimensions and aspects of university space that cannot be sufficiently analysed in this report but can be approached in later phases of the LTSHE project. Among these dimensions are the following: University space can be seen in a number of different ways, for example, the university in the city; the university campus; individual university buildings; formal learning spaces explicitly intended for L&T (e.g. venues for lectures and seminars such as classrooms, seminar rooms, lecture halls as well as libraries); informal learning spaces that can be used for self-directed learning (SDL) (e.g. libraries, cafeterias, lounges) (Duvivier, 2019, p.21); community space (the university as an intellectual community of learners and teachers, a Strategic Open Republic of Scholars and Students); other spaces (also cf. Temple, 2007, pp.28ff.).

⁴ These principles will be developed throughout the project and proposed and analysed in the final project output O4, a Manual of Principles of Design of Learning and Teaching Spaces in Higher Education. Australian HEIs, and probably also UK and US HEIs, seem to be forerunners, see e.g. (UCISA, 2016).

Learning spaces should facilitate communication and interaction between students and faculty
Learning spaces should be consistent with the university's culture and priorities as reflected in the campus Master plan, follow university design standards, and be designed with future flexibility in mind
Learning spaces exist within a larger campus context; there should be an ease of transition between spaces so as to better support high-impact practices inside and outside the classroom

Source | (Finkelstein *et al.*, 2016, p.29)

Table 2 | Principles II for the design and implementation of L&T spaces in higher education

Learning environments should aim, as simply and cost effectively as possible, to provide maximum opportunities for creative and innovative L&T practices
Learning environments should be designed to give users maximum control of the environment to facilitate and encourage experimentation and risk-taking
Learning environments should encourage interactions between participants to facilitate active and collaborative learning
Learning environments should be co-designed to recognise and facilitate diversity of learning Styles and abilities and difference in teaching approaches and discipline requirements
Learning environments should be designed to maximise all students' use of, and sense of connection With, formal and informal, virtual and physical L&T spaces across the University
Learning environments should support and serve a range of different activities and functions, Forming an integrated portfolio of L&T services, technologies and spaces across the University
Learning environments should be designed for flexibility and equipped to encourage multi-modal Delivery and blended learning experience
Learning environments should enable easy visibility, access and use by all students and staff
Learning environments should provide simple, consistent interfaces and technologies, together With clear and consistent guides for their use

Source | (UNSW, 2016, p.3)

Arguably, the principles of Finkelstein *et al.* (Table 1) and the UNSW principles (Table 2) can be further developed which, however, requires some work investment that shall be done in the LTSHE project. For example, later the SQELT performance indicator set (SQELT, 2020) could be checked for further L&T quality features related to designing proper physical and virtual spaces for L&T thus helping to complement or enrich the list of Finkelstein *et al.*'s principles for designing L&T spaces (Table 1). For example, all principles and issues of designing L&T spaces should be underpinned by sustainability criteria (comprehensive ecological, social and economics responsibility) and fulfil quality criteria. Further, there are governance-related needs and requirements concerning renovation and innovation of L&T spaces:

- There seems to be a need for introducing principles for designing L&T spaces into mission statements (or 'aspirational identity statement[s]'; Finkelstein *et al.*, 2016, p.34) including pedagogical commitments. Such principles should ensure that various university stakeholders can refer to a shared view and common language with respect to the requirements for proper design of L&T spaces.
- Consequently, there is a need for translating principles for designing L&T spaces into design features to guide design decisions.

- Principal missions as well as operational design principles of L&T spaces should be connected to performance indicators of quality educational practice such as, e.g., fostering active learning and facilitating collaborative engagement and student-faculty interaction.

In addition, there are mission- and content-driven needs and requirements concerning renovation and innovation of L&T spaces:

- Sustainability issues require renovation or novel physical university spaces/buildings:
 - Implementing the “Green University” in the true meaning of sustainability.
 - Creating L&T spaces for education in sustainability (e.g. L&T greenhouses).
- In many HEIs, there is a need
 - For online learning and blended learning environments.
 - For proper combinations and flexible arrangements of physical and virtual spaces for teaching, (self-organised) learning and assessments as well as intermediate spaces (e.g. meeting each other, conversation, food and catering).
 - For environments that facilitate and foster student/staff interaction.
 - For flexible L&T spaces (e.g. learning labs that allow for experimenting and testing new L&T arrangements).
 - For L&T spaces that enable integrating formal and informal learning.
 - For room concepts that enable and promote special work techniques through their structure and equipment (e.g. think spaces, cave rooms, makerspaces, fab labs or VR laboratories).
 - For collaboration of academic staff (teaching and research), L&T services as well as L&T planners including architects of L&T spaces, all in service of implementing (more) appropriate L&T spaces.
- In the age of digitalisation, the importance of physical L&T spaces has rather increased: for physically embodied learners and teachers spaces are inevitably spaces of experience, and physical spaces instantiate social binding factors which are of central importance (for the majority of learners and teachers).
- In the medium term, there will probably be novel/additional requirements for physical and virtual L&T spaces because of an increasing focus on measuring learning (e.g. Learning/Student/Teaching Analytics).

As contemporary literature on the design and implementation of L&T spaces in higher education shows, a commonality of approaches is the basic role of communication and collaboration that require appropriate meeting spaces which, with their framework conditions, can support and promote discourse and collaboration. Therefore, it seems adequate that L&T space is understood as a strategic resource and the creation of corresponding physical and digital structures as a core element of organisational development. Further, it seems appropriate to

understand L&T space as a common good, instead of territorial domains of subject fields and departments, because providing L&T spaces is an intra-university and trans-departmental and inter- and transdisciplinary task. In addition, many L&T processes require inter- and transdisciplinary options because they are themselves inter- and transdisciplinary.

3. Methodology

The research for this Intellectual Output O1 of the LTHSE project was organised as a desk-top analysis including content analysis of contemporary research literature, publicly available documentations of L&T spaces in German higher education, policy initiatives and their networking initiatives and activities and funding programmes. Further sources are higher education laws of the 16 federal states of the Federal Republic of Germany (FRG) and (exemplary cases of) institutional strategy documents insofar these refer to the design and implementation of L&T spaces in higher education.

The information and data used for this output were determined through literature research and on the basis of years of experience with the German higher education system from the point of view of evaluation, accreditation and university research. Among the search terms used for the identification of relevant information and data were the following: digitalisation in higher education; higher education funding programmes; higher education law; learning and teaching in higher education; learning and teaching spaces; quality assurance of digital L&T; university didactics; university organisation; university strategy.

A systematic content analysis with category formation and iterative conceptual field analysis (cf. Mayring, 2019) is not necessary, at least in the first analysis, since the underlying text material comes from professional sources that largely follow the same technical language game. This does not rule out the possibility that a semantically deeper analysis may be indicated in a further phase, especially when it comes to examining the material analysed here for the principles of design of L&T spaces in higher education.

A general source of difficulty of this analysis is the size of the country with its more than 400 public and private, publicly recognised higher education institutions. This issue is further extended because there is no national German politics in (higher) education because education, teaching and research are in the sole responsibility of each of the 16 federal states of Germany who all have their own higher education laws. Against this backdrop, it cannot be expected that this Intellectual Output O1 of the LTHSE project can produce a truly comprehensive overview over the policy and practice of L&T spaces in German higher education, also in view of the limited money and time of the project. Rather, to achieve a comprehensive overview further investigation would be required.

4. National policy and practice for the design and implementation of L&T space in German higher education

4.1 Legal framework of the German higher education system and its references to L&T space design and implementation

Germany has around 83 million inhabitants and is divided into 16 federal states, which differ largely in terms of area, population, political and economic structures and productivity. Germany has 306 public and 120 publicly recognised, private⁵ higher education institutions with a total of about 2.9 million students (status: 2018/2019/2020). German public higher education institutions comprise 106 universities, 216 universities of applied science, six pedagogical universities, 52 universities of arts and music, 30 universities of applied public administration and 16 universities of theology.

Generally, the 16 federal states of the Federal Republic of Germany (FRG) (Bundesländer der Bundesrepublik Deutschland) are the holders of their respective public higher education institutions. According to Art. 70 § 1 of the Basic Law ("Grundgesetz"; GG, 2019) for the FRG (FMJCP, 2019), the legislative powers with respect to higher education is with the federal states who regulate the status, financing, organisation, employment and affiliation relationships and law-based responsibilities of their higher education institutions. In what follows, the higher education legislations of the 16 federal states of Germany are examined to determine whether they deal with the topic of policy and strategies for L&T space in German higher education.⁶

First of all, a peculiarity of the organisation and administration of the German higher education system in university construction must be addressed, which represents an interface in the design of L&T spaces. The expansion, renovation and new construction of universities in the Federal Republic of Germany has been defined as a joint task by the federal and state governments since 1969 (University Building Promotion Act of September 1, 1969). However, this law was abolished as part of the federalism reform on January 1, 2007. The new division of tasks is regulated in Art. 143c and Art. 91b § 1 and 3 of the Basic Law (GG, 2019) and since then the task and responsibility for the expansion, renovation and construction of universities have been exclusively with the individual federal states. However, the responsibility for monitoring the university buildings has not been clearly established since then.

As a result, arithmetic and visible restructuring backlogs have arisen, since the federal states' university policies and the parliaments do not approach the financing tasks proactively and strategically to a sufficient extent, but rather reactively try to consider acute needs promptly in the respective budget year, whereby often not all financing requirements are approved. In the worst case, the universities themselves can only counteract these deficits by eliminating the deficiencies from their own resources, which should primarily serve research and teaching (Stibbe, 2018, p.5).

⁵ Private and church higher education institutions are adapted in fundamental respects to the public higher education system by obligatory institutional accreditation by the German Scientific Council.

⁶ This analysis refers to the versions of the considered higher education laws as of July 2018 and closely follows (Weichert, 2020). The analysis does not constitute a technical-legal assessment that would go beyond the scope of this presentation. For legal comments, see for example (Lutz, 2016).

Against this background, three types of university property management have developed: the user model, the rental model and the owner model, of which at least the first two are problematic in the context of advancing federalisation and autonomy trends. It is noteworthy that universities are very rare as owners in Germany, while this is standard in the Netherlands and Great Britain, for example (Becker and Stang, 2020b, p.82; after Ruiz and Schwanck, 2015, pp.15-16). On the basis of the facts that there is a major restructuring backlog, responsibilities are currently unclear and organisational development is taking place as a result of New Public Management, it can be assumed that the universities will continue to develop their own responsibility. Universities as owners of their properties could possibly deal more effectively and efficiently with spatial planning and construction measures (Becker and Stang, 2020b, p.82). However, this assumption is by no means certain; the price that would have to be paid for construction work on one's own has yet to be analysed.

However, in view of the situation described above, it can be assumed that at the political levels of Germany and its federal states as well, at least with regard to physical L&T spaces, there are currently no or only rudimentary functional strategies with regard to the design and implementation of L&T spaces in German higher education.

A more detailed look also shows that the general organisational structure and the responsibility of the committees and the university management are set out in detail in the higher education laws of the federal states. However, there is no direct, explicit reference to the topic of L&T space in higher education institutions and the more so with respect to its sub-dimensions of university strategy and organisation, university didactics, digital structures and physical and virtual L&T space (Weichert, 2020, p.48). Therefore, such references must either be found in the statutes or structure and development plans of the higher education institutions or they are omitted entirely.⁷

Although the higher education laws of 12 federal states relate to aspects of didactic conceptions, no connection is made in any of the 16 higher education laws between didactics and university space. The higher education laws' references to didactics are rather general, such as that the formats of L&T should fulfil the methodological and didactic requirements of higher education (Weichert, 2020, pp.50–51).

Digitalisation is mentioned in 12 higher education laws and in the Art College Law of North-Rhine Westfalia.⁸ A general tenor is that the opportunities offered by ICT at universities should be used in the provision of courses (e.g. offering online courses) and the reform of L&T. In five higher education laws (Baden-Württemberg, Mecklenburg-Vorpommern, Lower Saxonia, North-Rhine Westfalia, Saarland), the mentions of digitalisation relate to the organisation and tasks of operating units such as university-wide information centres, libraries and computing centres which certainly correspond to university spaces (Weichert, 2020, pp.52–53). However, an explicit relation to L&T spaces is not established, neither in these five higher education laws nor in the eleven others.

Issues related to the design and implementation of L&T spaces are not named in any of the 16 German federal states' higher education laws. Physical L&T spaces are only referred to in very

⁷ For more information on this, see Section 5.1.

⁸ For more details, see (Weichert, 2020, p.51).

few higher education laws and in very general terms such as that the spatial equipment of higher education institutions should be adequate and sufficient. A bit more can be found on the federal states level with respect to general laws and regulations for building universities which concentrate on the distribution of responsibilities between the holders (federal states) and the higher education institutions. However, these regulations focus exclusively on administration tasks concerning property and organisational units (Weichert, 2020, p.54).

The system-wide policy for L&T spaces in German higher education can be summarised as follows: Formally, there is no effective national politics of higher education including, of course, politics of L&T space design and implementation, since publicly organised and funded education, science and culture are in the sole responsibility of the 16 German federal states ("Bundesländer"). The German federal states' politics and policies for L&T spaces in higher education are based on the respective 16 higher education laws (and a few additional laws such as Vocational Academy Acts). The analysis shows that, strictly speaking, there is no reference to the design and functions of L&T spaces, physical as well as virtual, in the 16 German federal states' higher education laws.⁹ However, there exist initiatives, funding programmes and research projects which are neither legally prescribed nor legally binding, that actually fill the open policy space between the national level and the federal states' levels with respect to various current and relevant topics of higher education development/enhancement, among them the theme of design and implementation of L&T spaces (see Section 4.2).

This situation is in accordance with the understanding that state legislation sets out a legal framework of general character and that specific measures and specific provisions for planning and designing the 'University Learning World' ('Lernwelt Hochschule': Becker and Stang, 2020a) can be expected at this level only in a very general form. At the same time, planning, designing and implementing L&T spaces in (higher) education institutions are activities with fundamental effects that represent constitutive features, and the German federal states via their holdership have the legislative and executive responsibility. In this function, the federal states in turn grant the universities an autonomy that is manifested in the freedom of art, science, research and teaching which is contained in the Basic Law (GG, 2019, Art. 5 §3). The regulation of very specific academic constitutional characteristics thus takes place in a complex and sensitive university policy field (Weichert, 2020, p.55) with a relatively high potential for university self-determination.

Against this background, it must be stated that in Germany the design and implementation of L&T spaces currently is not a subject of the (16) higher education laws. The question of whether this ultimately represents a strength or weakness with regard to the identification and implementation of development options at universities must remain open here. Likewise, it cannot be definitively clarified in the present framework whether the failure to take into account the design and implementation of L&T spaces at the level of university law stems from a deliberate decision by politicians (political ministries) to strengthen the autonomy of universities, or from a rather low-level content evaluation of the topos. In this context, however, it should also be noted that the responsibilities for building and property management at

⁹ Trivially, this also implies that the following demanding topics on the design and implementation of L&T spaces are not mentioned as such in these laws: sustainability; diversity or inclusivity; internationalisation; massification; safety; monument and asset protection; aesthetics; quality assurance.

universities in the federal states are regulated very differently (Stibbe *et al.*, 2012) and that very few universities are autonomous property owners and builders.

Therefore, the questions arise: If a higher education institution intends to build or further develop L&T spaces and places, physical or virtual, how would or should its leadership, committees, members and stakeholder groups proceed? Are such themes referred to in university statutes or structure and development plans? As far as possible, these questions are answered in Section 5.1.

4.2 National/federal higher education policies and good practices

Several examples of democratic, federal state initiatives and related good practice in German higher education politics can be identified that mediate between the requirements, goals, responsibilities and tasks on the national and federal policy levels in (higher) education. The following list of institutional actors, project programmes and included project initiatives is not comprehensive and open for further analysis.

4.2.1 Standing Conference of the Ministers of Education (KMK)

The ministers responsible for education and upbringing, universities and research as well as cultural affairs of the federal states work together in the *Standing Conference of Ministers of Education and Cultural Affairs of the Federal States in the Federal Republic of Germany* (in short: "Conference of Ministers of Cultural Affairs": "Kultusministerkonferenz" – KMK). Thus, the federal states assume their responsibility for the state as a whole in a self-coordinating manner. In matters of cross-border importance, they ensure the necessary degree of commonality in education, science and culture.

A major task of the Conference of Ministers of Cultural Affairs is to ensure the highest possible level of mobility for learners, students, teachers and academics through consensus and cooperation, to contribute to the equivalence of living conditions throughout Germany and to represent and promote the common interests of the federal states in the field of culture. This results in derived tasks: agreeing the uniformity and comparability of certificates and degrees as a prerequisite for mutual recognition; work towards ensuring quality standards in schools, vocational training and universities; promote cooperation between educational, scientific and cultural institutions.

The necessary coordination takes place through decisions, recommendations, agreements or even state agreements that provide a binding framework. It is worth being noted that in the sense of the desired diversity in the German education system, detailed regulations are dispensed with by KMK in order to leave room for innovations. The Conference of Ministers of Education and Cultural Affairs is not a constitutional body and therefore cannot take decisions with legal effect. Nevertheless, the decisions and agreements are effective as a political obligation and as a guideline for the action of the individual federal states.

Against this backdrop, the KMK sets framework conditions and promotes projects in the fields of fundamental, structural questions of higher education; quality development, accreditation, promotion of excellence; study and examination; student affairs; service law and remuneration; university medicine and healthcare; libraries; international university affairs (KMK, 2020). The

only available document that could refer to L&T space in German higher education is subsumed under the first topic of fundamental, structural questions of higher education and is a decision of 11 February 2016 about *Solid buildings for efficient universities. Ways to reduce the renovation and modernisation backlog in the higher education sector* (KMK, 2016). However, there is no mention of (the design and implementation of) L&T space in German higher education. The document only deals with questions of potential funding and burden sharing between the federal government, the federal states, the universities and private sponsors.

4.2.2 Federal Ministry for Education and Research (BMBF)

The Federal Ministry for Education and Research (BMBF) is promoting and funding programmes and projects for the development of the higher education landscape, often together with the federal states of Germany and other network players in the area of L&T quality enhancement. Several prominent examples of related initiatives are characterised in the subsections below. The BMBF project database “Projects in the Quality Pact for Teaching” collects knowledge from all projects funded in this programme (BMBF, 2020). Another BMBF funding initiative is the support of the the development of digitalised L&T as well as the university’s internal infrastructure with the “Digital Higher Education” programme (DHB, 2020).

4.2.3 Quality Pact for Teaching

The *Quality Pact for Teaching* (“Qualitätspakt Lehre”) was funded by the federal state government together with the 16 federal states’ governments. The funding period ran from 2012 until 2020 (BMBF, 2019a). Projects were funded almost everywhere in the German higher education system¹⁰, see also Section 5.2.1.

4.2.4 Future Contract Strengthening Teaching and Learning

On 6 June 2019, the federal state and Länder government leaders decided on the *Future Contract Strengthening Teaching and Learning* (GWK, 2020) which is the follower contract to the *Quality Pact for Teaching*. The goals of this contract is to jointly and permanently improve L&T quality in the German higher education system. At the same time, the study capacities built up in particular with the University Pact should be maintained as needed. Permanent funding from 2021 onwards is intended in particular to expand permanent university staff who are involved in L&T. Other quality-enhancing measures, such as the dissemination of innovative L&T concepts or the expansion of counseling and support services, are also planned. The funds of the future contract are also used for digitalisation in L&T, including the expansion of digital offers in teaching as well as the expansion of the digital infrastructure at universities. Thus the contract explicitly aims at supporting the enhancement of university digital structures. The implementation of the future contract should take into account the diversity of the German university landscape. Every seven years, each federal state, in coordination with the federal government, sets out in a declaration of commitment which country-specific strategic

¹⁰ In the framework of the *Quality Pact for Teaching* 253 projects at 78 universities, 78 universities of applied sciences and 30 universities for art and music were funded from 2012 until 2016, and 71 universities, 61 universities of applied sciences and 24 universities for music and art were funded in the second funding period until 2020.

approaches it uses when using the funds in order to achieve the mutually agreed goals of the future contract. The federal states' declarations of commitment for the years 2021 to 2027 were noted and published at the end of June 2020 by the Joint Science Conference ("Gemeinsame Wissenschaftskonferenz") between the federal government and the states.¹¹

As already mentioned above, the *Future Contract Strengthening Teaching and Learning* is mainly oriented at increasing the number of teaching posts and in particular the proportion of permanent positions. The enhancement of digital structures is included since digitalisation is a permanent developmental issue and top on the strategies' lists of higher education politics and policies. Issues of didactics and physical L&T spaces development are not included in this contract. Analysts of the federal states' declarations of commitment from June 2020 even criticize that individual states are planning to use future contract funds for reducing the modernisation backlog in university construction under the heading *Framework conditions for study and teaching* or for financing the long-promised establishment of a cloud-based library management system (GEW, 2020).

4.2.5 Innovation in Higher Education Teaching

On 6 June 2019, the federal state and Länder government leaders decided on the agreement *Innovation in Higher Education Teaching* (GWK, 2019) between the federal state and the 16 Länder. This agreement was also made as a successor to the *Quality Pact for Teaching*. It is intended to promote the renewability of university teaching so that it can better and faster adapt to new social challenges and needs from science and industry/economy.

Projects are funded within the framework of funding lines¹², in particular a) to strategically and structurally strengthen universities' L&T, including the improvement of study conditions and conceptual-structural developments in L&T; b) on current, subject-related challenges in L&T; c) for open-ended testing of new ideas or the transfer of tried and tested approaches to other subjects and universities. Project funding can include personnel and material resources as well as, if necessary, project-related investments of a non-structural, non-building type. (2) The funding lines enable in particular a) projects to implement new ideas in university teaching; b) projects for (subject-related or method-related) testing of innovative L&T approaches and innovative structures; c) Projects for transferring proven L&T approaches and for designing the L&T environment to other subjects, to other types of study or other universities in the sense of the renewability of teaching; d) projects to transfer new knowledge from university research into practice; e) Projects for the sustainable promotion and further qualification of staff in terms of the renewability of teaching; f) Projects for the evaluation and impact research of concrete measures in university teaching; g) joint projects of several universities (collaborative projects). (3) The projects are selected in a science-based procedure, in accordance with the funding

¹¹ From 2021 to 2023, the federal government will provide 1.88 billion euros a year for the "Future Contract for Strengthening Teaching and Learning", and from 2024 onwards permanently 2.05 billion euros per year. In addition to the basic funding of the universities, the federal states provide the same amount so that the future contract will provide around 3.8 billion euros a year until 2023 and a total of 4.1 billion euros annually from 2024 to support L&T. The federal funds shall be distributed among the federal states transparently according to a key that is recalculated each year.

¹² 150 million euros will be made available annually, initially by the federal government alone and from 2024 onwards with a state contribution of 40 million euros.

announcements, which may include details of the specific objectives and the requirements for funding including eligibility to apply (GWK, 2019).

Again, design and implementation of L&T spaces is not mentioned in this funding line and it is not explicitly in its focus. Funding of projects on building facilities and physical L&T spaces is explicitly excluded, while themes concerning digital structures and didactics in L&T are in the focus of this funding line. However, there is a lot of freedom in using this line and the foci of concrete projects are decided by the applications and their reviewing peers.

4.2.6 Center for University Development (CHE)

The *Center for University Development* (“Centrum für Hochschulentwicklung” – CHE) sees itself as an independent, implementation-oriented and internationally oriented think tank. The main focus is on German and European higher education. CHE intends to stimulate innovation and reflection on reform results. CHE’s considerations take international trends and experiences into account and are implemented in a partnership-based dialogue with experts and decision-makers from science, administration and politics (especially universities, research institutions, ministries, the EU, foundations and other NGOs). CHE wants to make convincing “good practice” solutions available to the general public (CHE, 2020a).

CHE composed an overview over the German universities’ reaction to the consequences of the Covid-19 pandemic and the stakeholders’ satisfaction with the universities’ problem tackling with a focus on digitalisation (CHE, 2020b). Among the results of this analysis are the following: Despite the Corona crisis, the three major Berlin universities have so far not seen any noticeable drop in students. 94% of German universities see a long-term opportunity for digitalised L&T. 76% of the courses can be offered despite the online semester. Despite Corona, 62% of the exams can be offered (CHE, 2020b).¹³

From this, the following key challenges of digitalised L&T at German universities in the summer semester 2020 can be tapped, which should remain relevant in the near future: (1) The basic requirements for participating in digital L&T are not fully available nationwide. Students lack technical infrastructure, e.g. a well-functioning Internet from home, or study spaces that enable concentrated learning. (2) There is an increased workload for teachers and students because of the many new digital formats. (3) The support structures (data centers, HelpDesks etc.) at the universities are currently not designed so that all teachers and students can be supported for comprehensive digitalised L&T. (4) The didactic potential cannot be used adequately due to the unplanned changeover and complete online teaching. (5) The ad-hoc conversion to a complete online teaching operation is at the expense of equal opportunities for students. Those who successfully studied before the Corona semester and had good prerequisites (technology, learning environment) now have better chances. (6) Because of the concern that they will not be able to offer legally compliant digital exam formats, many universities continue to use the classic face-to-face exams with appropriate distance rules in the summer semester 2020. This

¹³ A joint survey by Times Higher Education (THE) and Microsoft showed that more than half of the 200 universities surveyed from 53 countries offered all of their teaching digitally in the 2020 summer semester. 44 percent of the universities surveyed conduct the exams entirely online, 43 percent at least partially. 85 percent of the universities are satisfied with the technical solutions found. According to the respondents, medicine and dentistry are the hardest to digitalise of all study subjects (CHE, 2020b).

means that urgently needed innovations in the examination area cannot be further developed or tried out (CHE, 2020b).

4.2.7 German Initiative for Network Information (DINI)

The *German Initiative for Network Information* (“Deutsche Initiative für Netzwerkinformation e.V.” – DINI) promotes information and communication services and the necessary development of information infrastructures at German universities, also in relation to the design of L&T spaces.

The DINI Working Group “Learning Spaces” (DINI, 2020a) deals with the interaction of virtual and physical learning spaces. The working group develops recommendations for educational, information technology, structural and organisational framework conditions as well as their practical implementation, which is based on the requirements and needs of students. The aim should be spaces that support individual media, information and IT skills development through technical and personnel equipment. As university service and advisory offers for learning spaces are only to be considered integratively, the libraries, computing and media centers and didactically oriented facilities collaborate in the working group.

One of the core activities of the DINI Working Group “Learning Spaces” was the research project *Learning World University* (“Lernwelt Hochschule”) which was organised from 2017 to 2019 (LWH, 2020). The project intended to capture the state-of-the-art of the design and strategic planning of learning worlds in the German higher education system.¹⁴ Basic and final publications of the *Learning World University* project are (Becker and Stang, 2020a; Stang and Becker, 2020); they are particularly referred to in Chapters 5 and 6.

As part of the project *Learning World University* (LWH, 2020), a systematic overview of the development of the “Lernwelt Hochschule” in Germany was also worked on. The result is the DINI Atlas (DINI, 2020b), which is continued by DINI. The aim is to map the situation in relation to the learning environment of all German universities. In addition, the atlas should serve to filter out good practice in order to provide universities with an orientation on how developments can be promoted. The DINI Atlas is work in progress.

4.2.8 Higher Education Forum Digitalisation (HFD)

The *Higher Education Forum Digitalisation* (“Hochschulforum Digitalisierung” – HFD) orchestrates and promotes the discourse on higher education in the digital age and sees itself as a think tank that provides studies and working papers for university practice. As a central initiator, it informs, advises and networks actors from universities, politics, economy and society. The HFD was founded in 2014. It is a joint initiative of the *Donors’ Association for German Science* (“Stifterverband für die Deutsche Wissenschaft”) with the *CHE Center for University Development* (“Centrum für Hochschulentwicklung” – CHE) and the *University*

¹⁴ In addition to DINI, the institutional cooperation partners of the project were: Media University (HdM) Stuttgart, University of Applied Sciences Hamburg (HAW), University Library of the Otto-Friedrich-University Bamberg, Center for Information and Media Technology at the Heinrich-Heine-University Düsseldorf.

Rectors' Conference (“Hochschulrektorenkonferenz” – HRK). It is funded by the Federal Ministry of Education and Research (BMBF).

It is one of the basic assumptions of the HFD that the development of 21st century skills in addition to suitable L&T formats requires physically and virtually adequate learning spaces that work integratively. According to HFD, this is not primarily a question of equipping existing learning spaces in universities with media and modern facilities. Rather, it is about initially conceiving the learning architecture in a holistic, strategic manner on the basis of pedagogical requirements and then building on it to design the L&T spaces in practice in such a way that added value is created for learning processes. Accordingly, future-oriented L&T space design should interlock didactics, space and university organisation (Günther *et al.*, 2019, p.8).

From 2018 to 2019, the ad hoc working group on learning architectures at the HFD identified design dimensions for learning space development against the background of digital change and presented practical implementation approaches. A series of discussion points and recommendations were developed that universities can use to open up the topic of future-proof (physical and virtual) learning space design as a strategic field of action. Addressed decision-makers are university leadership, didactics officers, IT and infrastructure managers, teachers and students.

4.2.9 Leibniz Institute for Knowledge Media (IWM)

The non-university research institute Leibniz Institute for Knowledge Media (“Leibniz Institut für Wissensmedien” – IWM) in Tübingen is engaged with supporting L&T processes in (higher) education in its digitalisation. The institute’s core questions are: How can digital media be used to improve knowledge processes? How can they deepen our thinking and optimise our understanding? What is their role in the exchange of knowledge? (IWM, 2020).

Following this mission, the IWM contributes to developing university digital structures because one of its main areas of activity is to support the development and improvement of digital L&T in German universities. The IWM established the non-commercial information portal *e-teaching.org* that offers scientifically based information on didactic, technical and organisational aspects of e-L&T and design and evaluation of digital learning and work environments (ETO, 2020).

4.2.10 Virtual University of Bavaria (vhb)

The *Virtual University of Bavaria* (“Virtuelle Hochschule Bayern” – vhb) is the joint virtual campus of the Bavarian universities and universities of applied sciences. vhb promotes both the development and implementation of cross-university online teaching. Several hundred professors from 31 supporting universities are committed to the *vhb* and enable a wide range of online courses. The network character ensures that the professional, technical and didactic potential of the Bavarian universities in the field of online teaching can be used by many (VHB, 2020).

Since 2000, the vhb has been pursuing the idea of sharing and networking digital teaching and promoting and supporting the development of digital teaching units and advocates exchange and cross-university use. All courses are developed by professors from the member universities

and can be used across university boundaries. In CLASSIC vhb courses, ECTS points can be earned for studies. These courses are available free of charge to all students at the member universities. With the course offer OPEN vhb every interested person is given the opportunity to take a look at the virtual showcase of university teaching in Bavaria and to acquire knowledge at university level. The SMART vhb course offering includes blended learning units. The online learning units can be flexibly integrated into classroom teaching and are designed for cross-university use (VHB, 2020).

5.0 University strategy and practice for the design and implementation of L&T space in German higher education

The integration of physical and digital L&T spaces, didactics and organisation is of fundamental importance for the future design of the *University Learning World* (Becker and Stang, 2020a).

5.1 University strategy and organisation

5.1.1 Key issues

As already mentioned above, one consequence of the rather strong autonomy of German higher education institutions is that the design, planning and implementation of L&T space with all its facets in the last resort is delegated to the individual institutions (see Section 4.1). Thus, the institutions' leadership and engaged committees, organised members and stakeholder groups, particularly the building department of the university have the responsibilities for planning, designing and implementing adequate and competitive L&T spaces. At the same time, as shown above, the higher education institutions are not completely left alone with these tasks since there are several ongoing initiatives and funded projects on the national policy level and the federal states' policy levels that push developments and can advise activities concerning the design, planning and implementation of L&T space (see Section 4.2 as well as this chapter).

This leads to a few questions that might help to come closer to understanding how universities proceed: Are such themes referred to in university statutes or structure and development plans? How, by whom, in which forms is the design, planning and implementation of L&T spaces organised? How successful is this?

In the framework of the recent German project "Lernwelt Hochschule" (Becker and Stang, 2020a) good practice universities were identified on the basis of 41 guideline-structured interviews with various actors in leadership positions of 35 different German universities. This way, manifold strategies, conceptions and measures to cope with the development of L&T spaces were described (cf. Aschinger, 2020). These surveys, on which the following presentation is based, are not statistically representative of the German university landscape, even though their results can be regarded typical against the background of diverse experiences and observations as well as the research literature.

In the realm of strategy and organisation with respect to the design, planning and implementation of L&T space, higher education institution leadership, particularly rectors and presidents of 13 German universities were interviewed. The leaders mentioned in particular the topics of teaching and research, interdisciplinarity and internationalisation, diversity, further education and digitalisation as current main tasks within the framework of the university strategy. They also emphasized that the focus is on the students (student centredness), which is also stated in the respective mission statements (also cf. Leiber, 2016a; Leiber, 2019b) and the structure and development plans. In addition, the orientation towards the Bologna Process was explicitly mentioned, according to which the competences to be acquired by the students should be the primary strategic and organisational goal of L&T (Aschinger, 2020, p.126).

However, comprehensive institution-wide, explicit strategic conceptions (strategies) for the development of student-centred higher education and, more specifically, L&T spaces could not be identified at any of the 35 investigated universities that were situated in nine federal states.¹⁵ Issues that appear on strategic levels, for example in mission statements and structure and development plans, are flexibilisation of the student life cycle to better consider the needs of the heterogeneous student body, interdisciplinary L&T formats and cross-study programme cooperation to better meet the student qualification needs (Aschinger, 2020, p.126–127). Although these strategies are related with the design and implementation of L&T spaces because each of them has their organisational, didactic, digitalisation and physical space specificities and requirements, the latter are neither mentioned in interviews with leadership nor in strategic documents. However, the topic of digitalisation of universities, including innovative digitalised L&T environments, has ultimately been pursued strategically at least formally for decades and progress and success of digitalisation of L&T can be observed in different respects, while the development is sometimes also surprisingly sluggish in different ways, for reasons that are usually not as surprising. In particular, apart from the recent acceleration due to the effects of the Covid-19 pandemic, the development of digitalised teaching seems to be rather sluggish, project-dependent and not covering the breadth of subjects and teachers.

As far as the present analysis allows to overview, themes like demands of sustainability, internationalisation, diversity and inclusivity as well as quality assurance of design and implementation of L&T spaces are not represented in strategies of German universities. Therefore, it can only be assumed that these themes are regulated in the context of individual design and building projects whose key players are the university rectorate/presidency and the university building department together with affected and engaged subject field faculties and departments.

It should be added, that, of course, quality assurance with respect to the design and implementation of L&T space in higher education – including institutional strategy and organisation, didactics, digital structures and physical L&T spaces – must be based on reliable quality criteria of these core issues. One prominent and promising way of implementing this is the monitoring and practice of action research on the basis of a set of relevant quantitative and qualitative performance indicators.¹⁶

5.1.2 Good practices

Several examples of good practice of strategy/policy and organisational aspects of German universities can be identified with respect to the design and implementation of L&T spaces. The following list of good practices is not comprehensive and open for further development; particularly, in most cases further investigation including personal contact, interviews and on-

¹⁵ For more details on the sample see (Aschinger, 2020, p.124).

¹⁶ An exemplary performance indicator set has been recently suggested (Leiber, 2019c) and is currently further developed (SQELT, 2020). However, these sets are not specifically focusing the theme of L&T space broadly, and therefore they are open for (and possibly require) some further development that focuses this theme more deeply.

site visits would be required to better understand the institutional practices in design and implementation of L&T space:

- University of Applied Sciences Potsdam (FHP)

Since 2016, the University of Applied Sciences Potsdam (FHP) has a vice president for special tasks – focus: campus development, who is a professor of building physics and building climate and heads the FHP’s building physics laboratory. Among other things, he is responsible for the internal and external coordination of all new building and renovation measures that arise as part of campus development. This also includes coordination with the state authorities and with internal users (FHP, 2020).

According to FHP, the Vice President for Campus Development represents the specific interests of the university vis-à-vis the state authorities and advises the President on construction-related topics. In addition, he is responsible for identifying development opportunities, providing impulses for further development and long-term optimisation, and accompanying the implementation. For FHP management, campus development is an important parameter for the further development of the entire university (FHP, 2020).

According to the Vice President, the quality of teaching, the identification with the university, but also the external impact is largely determined by the building qualities and the dynamics of the campus development, which is seen as a contribution to strengthening the internal qualities of the university, but also as a contribution to urban development. In particular, the campus is to be integrated into the urban climate policy as a “Climate Campus”. The campus should serve as a source of ideas and a role model for sustainable and sustainable living and business in the city (FHP, 2020).

- SRH University Heidelberg

The SRH University Heidelberg¹⁷ developed the strategic study model CORE (Competence Oriented Research and Education) that orients all courses towards competence¹⁸ development and the overall strategic L&T orientation (student centredness) for the university (Ninnemann *et al.*, 2020; Prill, 2019, pp.17–21; see also Sections 5.2.2 and 5.4.2).

- CODE University of Applied Sciences Berlin

The campus of the CODE University of Applied Sciences Berlin, founded in 2017, is conceived as a community space. Accordingly, the university management follows the strategy of building a “Community of Equals” by further developing the organisation at eye level. Learning space design and development is seen as a permanent strategic task that is oriented at the learning model of curiosity-driven education with the didactic core element of interdisciplinary project work (Prill, 2019, pp.17).

¹⁷ The SRH University Heidelberg is a state-recognized private university of the SRH group (Stiftung Rehabilitation Heidelberg).

¹⁸ Including self-competences, social competences, subject competences and methodological competences (cf. Leiber, 2016b).

- University of Hamburg

The University of Hamburg has a BMBF-funded project area *University Teaching and Student Participation* (“Hochschullehre und studentische Partizipation”) that offers support for participation of students and teachers in the improvement processes of L&T spaces and structures. This shall be achieved by various online self-assessments of students and teachers concerning optimised features of participative L&T spaces, enabling student participation and expressing participation expectations. As such, these online assessment tools reflect a number of criteria of more participative L&T spaces in favour of self-directed learning (UH, 2020).

- University of Trier

At the University of Trier, a comprehensive digitalisation strategy was developed from 2000 onwards that takes digitalised L&T formats as a starting point for further university development (Höfler-Hoang *et al.*, 2020; see also Section 5.3.2).

- University of Halle-Wittenberg

The University of Halle-Wittenberg has a strategy for multimedia-based didactics and required digital structures: ‘As a modern face-to-face university, the Martin Luther University Halle-Wittenberg supports multimedia L&T in the form of “blended learning” as an integration of face-to-face and online learning. In terms of content, with the use of new teaching, learning and examination forms, the university is pursuing an increase in the temporal and spatial flexibility of learning, an adaptation to individual learning speeds and learning levels (with special consideration of inclusion), more effective supervision, support for internationalisation and family-friendliness and sustainable skills acquisition with a view to the demands of the professional world. [...] The Martin Luther University Halle-Wittenberg supports the necessary media didactic qualification of teachers and provides incentives for a broad use of modern forms of teaching, learning and examination. [...] The university promotes cooperative, interdisciplinary research projects that accompany and develop the innovation process. A high reputation in research and teaching in the fields of multimedia L&T is seen as a competitive advantage and an integral part of the university’s self-image. The university is committed to a modern technical infrastructure as a prerequisite for the use of modern teaching.’ (ML, 2020). This strategy is followed by the Center for Multimedia Teaching and Learning (@LLZ) that aims to shape digital higher education through advice and support, evaluation and research (LLZ, 2020).

- University of Duisburg-Essen (UDE)

The University of Duisburg-Essen (UDE) has a strategy for digitalisation in L&T. The strategy covers all dimensions of university L&T and directs the focus on the opportunities of digital tools for the design of learning events, learning environments and study conditions in general. Within the strategy, seven challenges and objectives with strategic topics and key measures are named: Support teachers in the implementation of e-learning/blended learning (provision of service offers and measures for further qualification and networking); Enable students to provide regular

feedback on their performance level (expansion and further development of the e-assessment tools); Promote diversity-appropriate design, also across courses (testing of e-learning concepts in event clusters); Create occasions for mutual learning/identity formation (promotion of collaborative and cooperative forms of L&T); Digitally support the quality of study conditions (support for the organisation of studies and orientation at the university by expanding the online services/campus app); Promote networking and exchange/cooperation and innovation culture (support for the use and provision of open educational resources); Gaining data for decision-making in quality management (introduction of learning analytics to evaluate usage data and further development of courses) (UDE, 2020).

Further, UDE's digitalisation strategy sets the following strategic topics and high priority measures: service-offerings and measures for further qualification and networking; e-assessments; optimization of curricular structures; collaborative and cooperative formats; integrated solutions to orient and support the organisation of studies; open educational resources and learning analytics (UDE, 2017).

- University of Applied Sciences Bielefeld

The University of Applied Sciences Bielefeld launched the institutional programme "Digitalisation" (2016-2021) program in the university development plan and integrated the service network of the central data processing center and university library within the framework of MIND (Media and Information Services).

According to the mission of the programme "Digitalisation", it supports those involved in the university in a targeted manner in designing efficient university-wide processes through transparent, high-quality digital technologies. The programme offers the necessary digital infrastructure to flexibly meet individual needs and thus to guarantee the self-organisation of each and every individual. With the help of modern information and communication channels and skills development, learning, research and working conditions are to be improved. The university also sees itself as a learning organisation with regard to digitalisation, which is understood as an original teaching and research assignment that is also intended to influence the social discussion (FHB, 2020a).

MIND (Media and Information Services of the Bielefeld University of Applied Sciences) is the service network of the central facilities, data processing center and university library. The aim is the strategically bundled and user-oriented development and expansion of services for studies, teaching, research, further education and administration. Projects and services are implemented in the learning center and in the area of "Digital L&T": The learning center has data processing pools and bookable group rooms for students. Events, workshops and training courses for different target groups are organised, for example for students in the field of academic work and for teachers who support digital teaching. The area of "Digital L&T" comprises services that support L&T in an innovative way, for example the conception, realisation and permanent improvement of physical and virtual learning environments as well as the development and realisation of new offers for cross-disciplinary and cross-media learning communities (FHB, 2020b).

- Technical University of Wildau

At the Technical University of Wildau (TH Wildau), the Digital Competence Center implements the digital agenda of the university as a strategic instrument to increase the degree of digitalisation in various areas, among them the following: teaching; know-how management; institutional processes; research and transfer; work conditions for all members and employees (THW, 2020).

5.2 University didactics

5.2.1 Key issues

Although our knowledge about the mechanisms how L&T spaces affect – trigger, enable, facilitate, support, foster etc. – L&T experience, satisfaction and success of students and teachers is incomplete and should be expanded (Ellis and Goodyear, 2016, p.181), there are some analyses available that can help to (further) develop L&T spaces in line with pedagogy and thus link pedagogical activities and attributes to behavioural premises that are in turn supported by certain spatial and ICT arrangements of L&T spaces. Such an analysis is presented in Tables 3 and 4 that are adapted from (Huang *et al.*, 2019, p.153–154) and in some parts can be transferred to the other learning world dimensions of university strategy and organisation, university digital structures and university physical spaces. It is beyond the limits of the present report to explicitly proof that all strategies and (good) practices of the design and implementation of L&T space in German higher education take into account all issues that are mentioned in Tables 3 and 4 in sufficient ways. However, it can be shown that many aspects are taken into consideration (see Sections 5.1.2, 5.2.2, 5.3.2 and 5.4.2).

Table 3 | Relating pedagogy and L&T space design and implementation including its evaluation

Focus	Conception	Implementation, operation and evaluation
Overall	What are the goals of the (L&T space) initiative? Who are the proponents and opponents? How can the opponents be persuaded? What lessons can be learned for the future?	What are the success criteria of the (L&T space) initiative with respect to the various involved stakeholders? To what extent are the success criteria fulfilled? What is the evidence? What lessons can be learned for the future?
Pedagogy	What type(s) of L&T shall be fostered for which reasons? Why is this likely to make a difference to learning? What is the theory and evidence? Which modifications of programmes and courses are planned to take advantage of the new L&T spaces and facilities? What education or training for academics and other staff is planned?	What type(s) of L&T are observed to take place? What is the evidence? What evaluation methodology or approach shall be used to gather and analyse data? Which stakeholder groups will be included (students, academics, teachers, leadership, administrators, facility managers, technology staff, other staff)?
L&T space(s)	What aspects of the design of the L&T space and provisioning of furniture and fittings will foster these types of L&T in which ways? Which existing facilities will be considered in developing the new L&T concepts?	Which aspects of the new L&T space design and equipment work and which do not? For what reasons? What are unexpected (unintended) uses of the new L&T spaces and facilities? Which of them support L&T and which do not? Which stakeholder groups and

		individual players are involved in the assessment of concepts and detailed design? What are their primary issues and concerns?
Technology (ICT etc.)	What technology will be deployed to complement the L&T space design in fostering the desired L&T patterns? How? What is the relationship between the design of L&T space(s) and the selection and integration of technology?	What technologies are most effective at enhancing L&T for what reasons? What are unexpected (unintended) effects (positive and negative) of the technology on L&T?

Source | Adapted with changes from (Huang *et al.*, 2019, p.153)

Table 4 | Linking pedagogical activities to settings of L&T spaces

Pedagogical activities	Pedagogical attributes	Process steps	Behavioural premise	Spatial icon
Delivering	Formal presentations; Instructor controls presentations; Focus on presentation; Passive learning	Deliver information and knowledge to an audience	Inform and instruct (passive) audience	Audience vis à vis instructor
Applying	Controlled observation; One-to-one situation; Master and apprentice alternative control; Informal; Active learning	Transfer knowledge via demonstration; Practice by recipient	Be learner-centered and apprentice model-oriented	Learner-centered apprenticeship models
Creating	Self-organised and more egalitarian; Distributed attention; Casual style; Active learning	Research; Divergent thinking; Incubate; Interpret into innovation	Be innovative	Different types of L&T spaces combined in one complex space
Communicating	Impromptu delivery; Casual style; Active learning	Organise information; Receive and interpret	Share information; Provide quick exchange	Roundtable
Decision-making	Directed attention; Chair set final direction; Protected situation; Semiformal to formal; Passive/active learning	Review data; Generate strategy (plan) Implement one course of action	Make decision	Long table with chair

Source | Adapted with changes from (Huang *et al.*, 2019, p.154)

The expansion or improvement of the systematic-didactic structuring of L&T including the digital offer in the area of teaching is on the agenda of the great majority of German universities. This

is implemented, for example, in the framework of the national and federal-state programme *Quality Pact for Teaching* (“Qualitätspakt Lehre”), whose funding period ran from 2012 until 2020 (BMBF, 2019a) and which funded projects almost everywhere in the German higher education system. From 2021, the follower programme *Innovation of Higher Education Teaching* („Innovation der Hochschullehre“) will also start¹⁹, which informally can be seen as the third funding period of the *Quality Pact for Teaching* (see also Sections 4.2.3, 4.2.4 and 4.2.5).

As part of these programmes’ funding, universities can develop and test new L&T formats, including pedagogy and curriculum design, which should increase study success and the flexibility of the student life cycle. For example, new L&T formats focus on self-directed learning (SDL), project-based learning, research-informed learning, service learning, learning oriented at professional practice. Funding within the *Quality Pact for Teaching* and its follower programme also comprises projects focusing on learning advice and learning support that work on the development and improvement of digital Campus Management Systems (CMSs), Learning Management Systems (LMSs) and other platforms including digitalised management of study programmes for individual monitoring of course of studies and support and counseling of students.

While most of these initiatives have their focus on pedagogy and curriculum design, it is obvious and inevitable at present that the majority of these initiatives include the design and implementation of digital structures in L&T– in other words, through these initiatives digital L&T spaces are also implemented. A thematic or even strategic focus on innovations in the area of L&T spaces is not foreseen in the funding programmes, however, and therefore is also not present in the funded projects (as far as this analysis can show). In addition, a focus on the design and implementation of L&T space would generally also exceed the legal and factual competences of the L&T units funded in the framework of the *Quality Pact for Teaching*.

5.2.2 Good practices

Several examples of good practice of didactics of German universities can be identified with respect to the design and implementation of L&T spaces. The following list of good practices is not comprehensive and open for further development; particularly, in most cases further investigation including personal contact, interviews and on-site visits would be required to better understand the institutional practices in design and implementation of L&T space:

- SRH University Heidelberg

The SRH University Heidelberg²⁰ strategically orients its study programmes at student-centred Competence²¹ Oriented Research and Education (CORE) (cf. Ninnemann *et al.*, 2020). Within the project *Learning Space Campus* (“Lernraum Campus”; 2015-2016), these teaching-strategic approaches were translated spatially and served as a reference point for decisions in the design of L&T spaces (see Section 5.4.2).

¹⁹ The provided funding will be 150 millions Euro per year.

²⁰ The SRH University Heidelberg is a state-recognised private university of the SRH group (Stiftung Rehabilitation Heidelberg).

²¹ Including self-competences, social competences, subject competences and methodological competences (cf. Leiber, 2016b).

- CODE University of Applied Sciences Berlin

The CODE University of Applied Sciences Berlin follows a curiosity-driven model of education, meaning that students should be driven by their individual curiosity and learn independently from explicit teacher instruction (as far as possible). Accordingly, SDL based on competence-oriented and experience-based didactics comes to the fore, while pure content transfer and memorisation become rather unimportant. SDL is conceptually implemented through interdisciplinary project work, mastery learning, flipped classroom and peer learning. Education and development of social, communicative and collaborative skills is in the focus of CODE without neglecting subject content. Teachers should mainly act as coaches, mentors and learning guides. Study programmes' partnerships with partner companies are encouraged (Prill, 2019, p.14). The CODE University of Applied Sciences designs and implements its L&T spaces following the requirements set by the adopted didactics, see an example of a shared use of creative spaces in Image 1.

Image 1 | Shared use of "Factory" creative spaces



Source | Photo: CODE University of Applied Sciences Berlin (Prill, 2019, p.14)

- University of Leipzig

With the establishment of the *LaboratoryUniversity* ("LaborUniversität") at the University of Leipzig in October 2011, an infrastructure was created that enables university-level didactic support for teachers in the development and implementation of innovative L&T projects. The focus is on individual teaching competence development and course development, i.e. the transfer of the experiences of L&T projects into further courses, study programmes and faculties, as well as promoting the networking and exchange between teachers (LABU, 2020).

- University of Mainz and Mainz University of Applied Sciences

At Johannes Gutenberg University Mainz and Mainz University of Applied Sciences, numerous innovative teaching projects and media didactic models have been developed

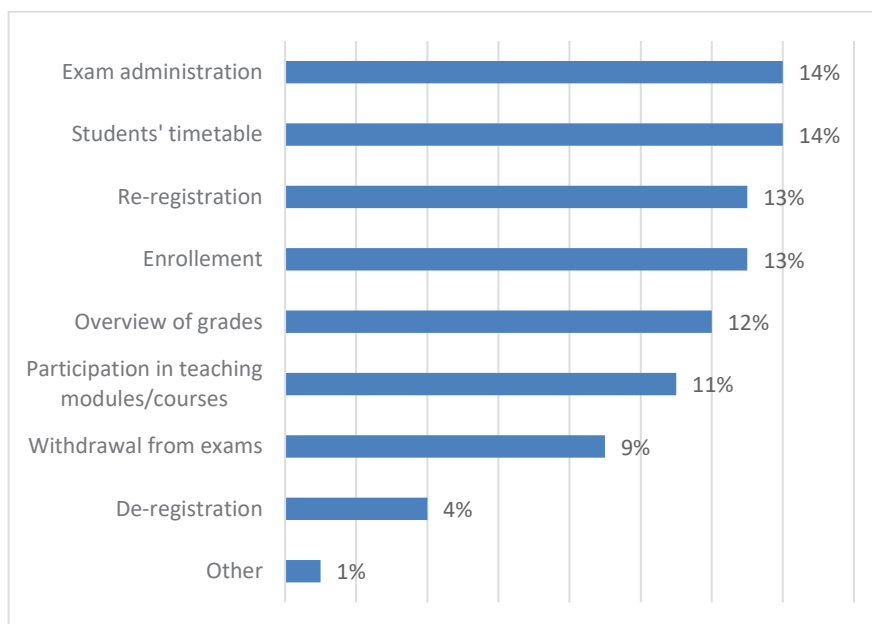
in recent years, which could also represent significant added value in other subject fields. The primary task of the project “Networking teaching ideas” is that teachers with common teaching interests organise themselves. In an intensive personal exchange they should support one another, develop teaching ideas and pass them on. This can be done virtually, but above all through observation in courses, meetings in workshops, barcamps or with collegial mentoring. An online platform is made available to enable this. In addition, regular events for networking and exchange are planned and advice on planning and implementing teaching concepts is offered (LIV, 2020).

5.3 University digital structures

5.3.1 Key issues

Observations, information and research suggest that the great majority of German higher education institutions are active in the realm of digitalisation (cf. e.g. Günther *et al.*, 2019; section 4.2.8). Without doubt digitalisation is an important strategic goal of higher education. Nevertheless and somehow astonishingly, explicit institution-wide strategies for digitalisation are still not the rule and digitalisation largely remains on time-limited project levels.

Graphic 1 | Digitalised elements of administration of study (number of university respondents n=128; multiple choices possible)



Source | (Becker and Stang, 2020b, p.105)

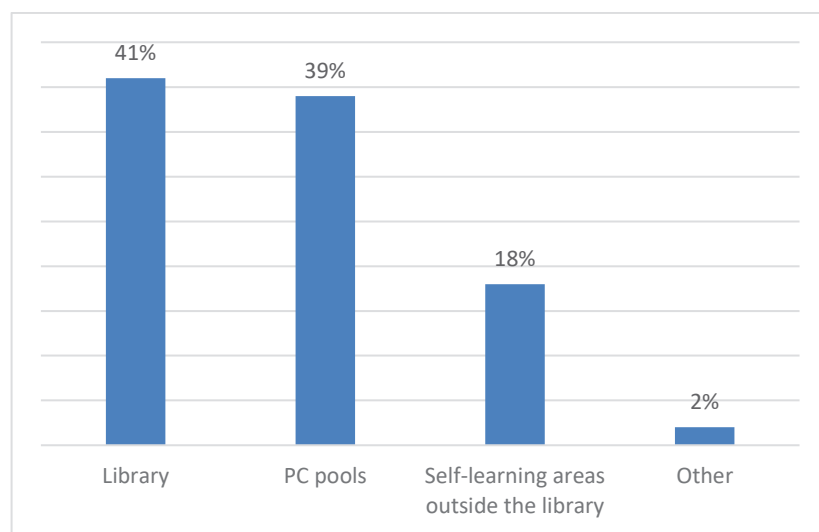
In the following a few results from a recent survey of German universities²² concerning digitalisation of L&T processes and their administration is reported. Since digitalisation of L&T spaces cannot be sharply distinguished from digitalisation of the student lifecycle and its administration, it is informative to learn that above and around 10% of responding German

²² 429 state-approved universities were invited to take part in the survey.

universities confirm that they have digitalised their exam administration, timetable, re-registration, enrollment, overview of grades, participation in teaching modules and courses, withdrawal from exams and de-registration (Becker and Stang, 2020b, pp.104–106; Graphic 1).

Another interesting aspect in which virtual and physical L&T spaces meet is the location of PC workstations for students, among other things because the university's PCs often have study-related software that students do not have on their private devices. 80% of the PC workstations are in the libraries (41%) and in PC pools (39%). In 18% of the universities there are PC workstations for students in self-study areas or self-learning centers outside the library (Graphic 2).

Graphic 2 | Localisation of PC working places for students (number of university respondents n=121; multiple choices possible)



Source | (Becker and Stang, 2020b, p.107)

Most German universities are currently assuming that hybrid L&T formats should be increasingly established in order to transform teaching in the sense of a sustainable implementation of digital media wherever digitalisation brings added value. As can be seen from public and non-public discourses in higher education, this can presumably only be successfully organised if the following framework conditions are met: The promotion of digitalisation in L&T must not be made exclusively through project funds; instead it must be based on permanent funding. Processes and structures for sustainable quality assurance of digital L&T must be established. When it comes to digitalised data collection and technology use, the legal framework must be adapted and legal hurdles removed (e.g. data protection, data security). The universities and university leadership should formulate strategies that define university-specific development goals, participation options, decision-making structures and responsibilities for the design and implementation of digital structures. In order to involve as many teachers as possible in the digital transformation of L&T, incentives for digital teaching must also be created (e.g. recognition of teacher successes, consideration in appointment procedures).

The following tasks can therefore currently be regarded as urgent: The didactic quality of digital L&T must be promoted (e.g. through qualification and motivation teachers as well as students).

Measures to avoid or remedy digital divides (that occur, for example, due to the heterogeneous affinity of students towards digitalisation; due to different opportunities for participation due to equipment deficits in hardware and software) must be taken. On the basis of existing initiatives and cooperations/networks, comprehensive structures should gradually be established in order to professionalise digital L&T, for example by exchanging experiences between universities, collecting good practice examples that can be converted into generally shared standards, and associated benchlearning.

Finally, it should be noted that the consequences of the corona pandemic brought about an activation boost in the digitalisation of university L&T that was previously hardly thought possible. This boost should be productively transferred into the coming semesters and the organisational development of the universities thereby building on the numerous digitalisation initiatives already in existence. Digitalisation deficits in L&T should be corrected in this context.

5.3.2 Good practices

Several examples of good practice of digital structures of German universities can be identified with respect to the design and implementation of L&T spaces. The following list of good practices is not comprehensive and it is open for further development:

- Digital Learning Map

The Digital Learning Map is a dynamic outcome of research organised at the Leibniz Institute for Knowledge Media (IWM) Tübingen (IWM, 2020). It shows L&T scenarios at German universities that use digital media – university digital structures; currently, 139 examples of practice²³ are represented in the map (DLM, 2020).

- Technical University of Munich (TUM)

At the Technical University of Munich (TUM), the central scientific unit *ProLehre | Media and Didactics* supports teaching in various ways. *ProLehre | Media and Didactics* was created in 2017 through the merger of university didactics and the media center. The unit bundles diverse university and media didactic competencies and combines scientific findings from L&T research with the experience of university lecturers and the design options that educational technologies and digitalisation open up. Video and design teams integrate professional science communication into the TUM and media didactic portfolio. *ProLehre | Media and Didactics* offers and supports the following digital infrastructures: LMS Moodle; e-assessment; lecture recording; video server; didactics apps; further digital L&T tools (ProLehre, 2020).

- Hamburg Open Online University (HOOU)

The Hamburg Open Online University (HOOU, 2020) sees itself as an interactive partner of a “network” of five of Hamburg’s six public universities and is involved in research

²³ These exemplary cases could be used for further investigation of the design and implementation of university digital structures (as a sub-area of L&T space) in the German higher education system.

projects such as BRIDGING (“Transfer of Digitalised Higher Education Conceptions”) (BRIDGING, 2020).

- openMINTlabs – Virtual laboratories for greater learning success

The universities of Kaiserslautern, Koblenz and Trier develop virtual laboratories for the preparation and follow-up of laboratory internships, which supplement laboratory experiments in the disciplines of physics, chemistry, biology and engineering with contemporary elements of digital teaching. A decisive basis for the success of the joint project is that the three universities provide around 80% of all laboratory-intensive engineering/technical study places in the federal state of Rhineland-Palatinate. (OML, 2020).

- University of Trier

At the University of Trier, a digitalisation strategy was developed from 2000 onwards that takes digitalised L&T formats as a starting point for further university development. The university has institutionalised the coordination center for e-learning with a wide range of activities: eLITE (eLearning Infrastructure and Teaching Environment) and initiated projects in the context of L&T (Höfler-Hoang *et al.*, 2020).

The digitalisation focus was and is on the implementation of structural measures to establish a digitally organised administration of L&T events (e.g. CMS) and basic services of e-learning (e.g. LMS and learning platform including flexible interface management).²⁴ That digital structures are a core ingredient of L&T spaces becomes evident when the LMS offers communication channels between teachers and students and promotes learning outcomes, for examples media skills and social competences, of the target groups. Specifically, this is achieved through communication and collaboration tools, virtual seminar rooms, digitalised L&T materials, interfaces to self-assessment offers, video management software, plagiarism detection software, audience response services and electronic semester apparatus in the library. In addition, an infrastructure for long-term archiving of this digitally structured environment is also put in place (Höfler-Hoang *et al.*, 2020, pp.36–37).

A further digitalisation initiative at the University of Trier is the digital teaching project TRIGITAL 2010 that institutionalised e-learning, i.e. the conception, implementation and use of digital media in teaching, studies and further education, under the auspices of the Rector's Office. In cooperation with the Quality Assurance Department, the University Video Department, the Media and Electronics Department and the Rhineland-Palatinate Virtual Campus (VCRP), the university's e-learning approach also offers initiatives for the integration of educational technologies in L&T, targeted support and qualification and training offers for lecturers as well as solutions for creating digital L&T formats (Höfler-Hoang *et al.*, 2020, pp.37–38).

²⁴ This is what happens at many German universities.

5.4 University physical spaces

5.4.1 Key issues

Despite the advantages of time and location independent learning and teaching, which is made possible by increasing digitalisation, the physical L&T space remains important in some respects and maybe even indispensable (cf. Stang, 2017). This is likely to be true even in times of a pandemic that requires physical distance to slow or stop the spread of a virus. Without the specific contextual conditions of an active pandemic, students and teachers seem to want learning environments and learning situations that support and facilitate L&T on the physical campus with the inclusion of modern IT offerings, instead of completely moving L&T to virtual space (Bachmann *et al.*, 2014). Based on this assessment, it also seems plausible to favour hybrid L&T formats for the situation of an active, longer-lasting pandemic, which enable sufficient physical distance.

In order to adapt the universities to the requirements and needs of students and teachers, in particular to enable various forms of learning and to implement innovative teaching formats, new concepts for the design of physical L&T spaces are required. This includes all types of L&T spaces (e.g. lecture halls, class rooms, seminar rooms, laboratories, etc.) and a wide variety of self-study areas in the library, in open spaces in other university buildings or social contact rooms. In general, it must be taken into account that, depending on the size, spatial structure of the building(s) (e.g. age, substance of buildings, monument protection) and the range of subjects at the university, it is more or less complex to develop and implement university-wide concepts for L&T spaces (cf. Aschinger, 2020, p.140) – if it is possible at all.

The need for physical (as well as digital) L&T spaces and the associated equipment is constantly changing at universities because student numbers are increasing and students' needs, habits and expectations are changing. Nevertheless, nine out of 17 surveyed library managers and heads of infrastructure departments at German universities explicitly stated that no university-wide concept development with respect to physical L&T spaces is currently taking place. At the universities where cross-unit planning happens, it is more a matter of agreements between several organisational units (e.g. library, computing center, didactics center, language center) on individual aspects of the design of interior spaces. While university-wide activities relate more to the availability of existing types of rooms, less to their design or restructuring (cf. Aschinger, 2020, pp.140–141).

Several reasons can be named for the deficit of institution-wide conceptions of the design and implementation of L&T spaces: Firstly, at least in the case of very large universities, the practically not implemented autonomy in terms of institutional L&T space planning is mainly attributed to the dynamic complexity of the universities as hybrid-multiple organisations: There are massive difficulties in getting an overview of the existing L&T spaces and keep it. In particular, changing responsibilities, fluctuating stakeholder groups and parallel activities are seen as a hindrance here. Secondly, it is very difficult and in some cases impossible in practice to develop a university-wide view that takes into consideration the various needs of various faculties, departments and subject fields and is accepted by all of them. Therefore, development is in favour of independent concepts that are specific to individual faculties, departments and subject fields. Thirdly, in recent years universities made the experience that learning needs

change very quickly (e.g. the library as a house of stocks and stockpiling becomes a house for the learners' learning needs with adequate quality of stay) (cf. Aschinger, 2020, p.142).

In return, the theoretically existing, but in practice obviously not very well developed, institutional autonomy of public universities in Germany in the area of design and implementation of L&T spaces²⁵ provides individual organisational units with great scope for decision-making and action. For example, libraries are very free in the design and implementation of their spaces and thus also become important initiators in that the innovative space concepts they have tried out can also be transferred to other university areas (cf. Aschinger, 2020, p.141).

Students' opinions on the design of the learning space are usually obtained through user surveys or through the participation of student representatives. Active participation in the development process seems to be an exception. There are also temporary project initiatives such as learning space or design thinking workshops (cf. Aschinger, 2020, p.141).

According to surveys of leadership of libraries and infrastructure departments extensive innovative ideas have been implemented for some years now or are in the planning stage with regard to the design and equipment of physical L&T spaces: the establishment of learning spaces with flexible furniture, more variety of spaces (e.g. individual and group workplaces, group rooms in various sizes with presentation options etc.), the opening of classrooms and cafeterias for student learning and the creation of more learning areas – especially for (smaller) group workplaces – by reducing the number of books in the library and renting external rooms including learning space containers (cf. Aschinger, 2020, p.143).

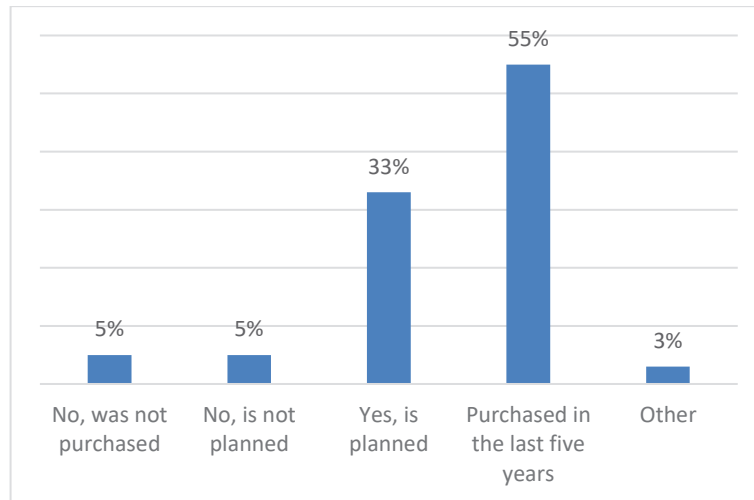
Despite increasing digital offerings, libraries at German universities continue to be indispensable places of learning for many learners. According to a recent study (cf. Vogel *et al.*, 2019), a third of students prefer to study at the university and spend an average of 2.5 (universities of applied sciences) to five hours (universities) a week in the library. This makes the library by far the most popular place for self-study at the university, for which the concentrated work atmosphere, the opportunity for group work and mutual social control are primarily said to be responsible. (cf. Aschinger, 2020, p.145–146).

However, under contemporary conditions of activating and student-centered learning didactics as well as the diversity of students, flexible room design is becoming increasingly important in order to enable multifunctional use. A recent survey of German universities²⁶ showed that more than half had made purchases for equipment for flexible L&T spaces in the past five years. Another third are planning these purchases in the next five years (Graphic 3).

²⁵ In the case of very large universities, the practically not implemented autonomy in terms of institutional L&T space planning is mainly attributed to the dynamic complexity of the universities as hybrid-multiple organisations: There are massive difficulties in getting an overview of the existing L&T spaces and keep it. In particular, changing responsibilities, fluctuating stakeholder groups and parallel activities are seen as a hindrance here.

²⁶ 429 state-approved universities were invited to take part in the survey.

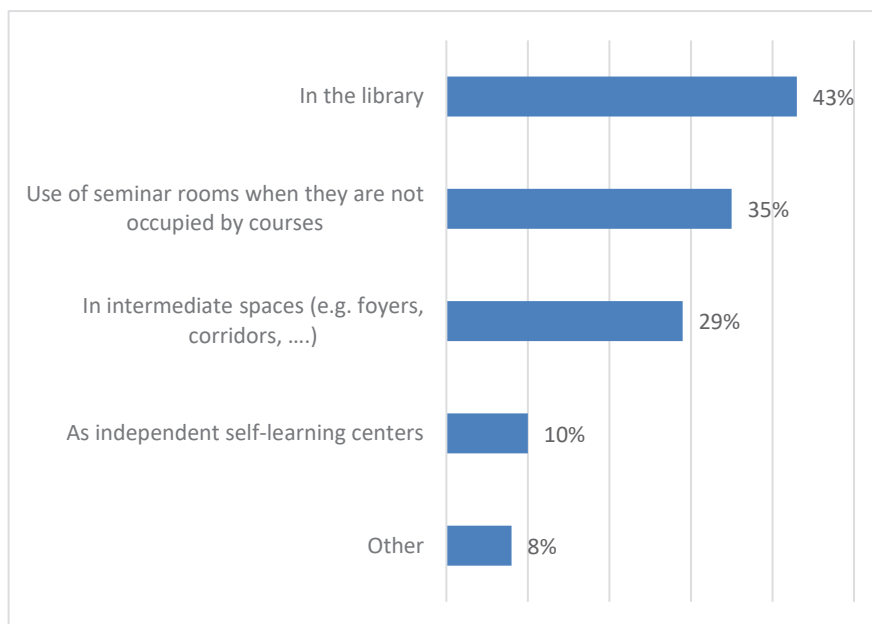
Graphic 3 | Acquisitions of equipment for flexible teaching-learning rooms (number of university respondents n=42)



Source | (Becker and Stang, 2020b, p.103)

Self-learning spaces are localised mainly in libraries (43%) and seminar rooms (35%) which are the traditional options. A relevant portion of 29% of responding universities conforms that self-learning spaces for students are located in intermediate spaces such as foyers and corridors. That there is development potential in view of fostering modern transformative self-directed learning can be seen from the fact that only 10% of respondents say that self-learning areas are located in independent self-learning centers (Graphic 4).

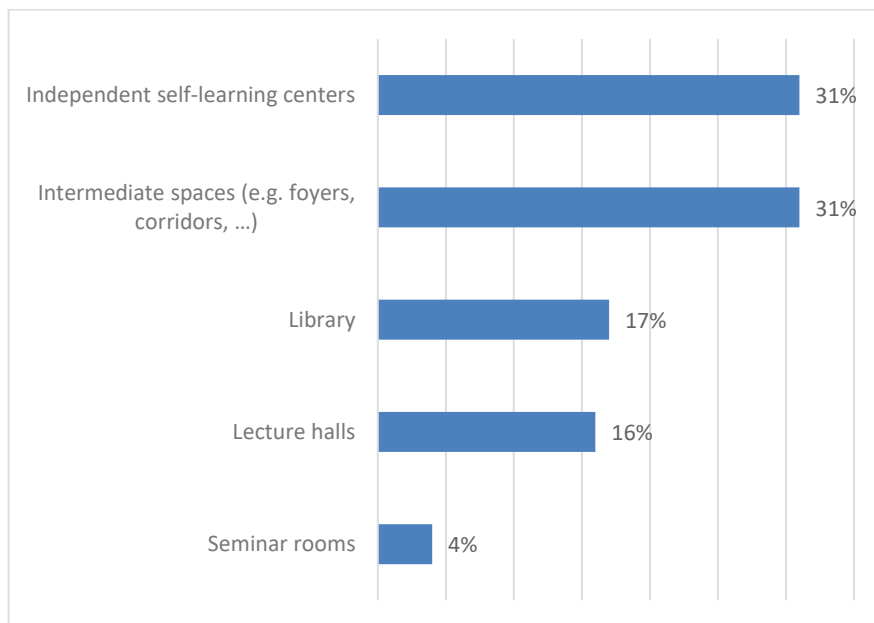
Graphic 4 | Localisation of self-learning areas for students (number of university respondents n=189; multiple choices possible)



Source | (Becker and Stang, 2020b, p.108)

The advancing individualisation of the course of studies, the increasing number of students, the diversity of students, but also changes in the eating and drinking behavior of society mean that students can often be found with coffee mugs or water bottles and they no longer interrupt their studies for lunch. The obvious question is, in which rooms at the university students can eat and drink. 31% of the universities that responded stated that eating and drinking is possible in the independent self-study centers and also 31% said that it is possible in in-between spaces. At 17% of universities this is also possible in the library, at 16% of universities in lecture halls, while in the vast majority of cases it is not possible (i.e. prohibited) in the seminar rooms (Graphic 5).

Graphic 5 | Possibility to eat and drink in university spaces (number of university respondents n=188)



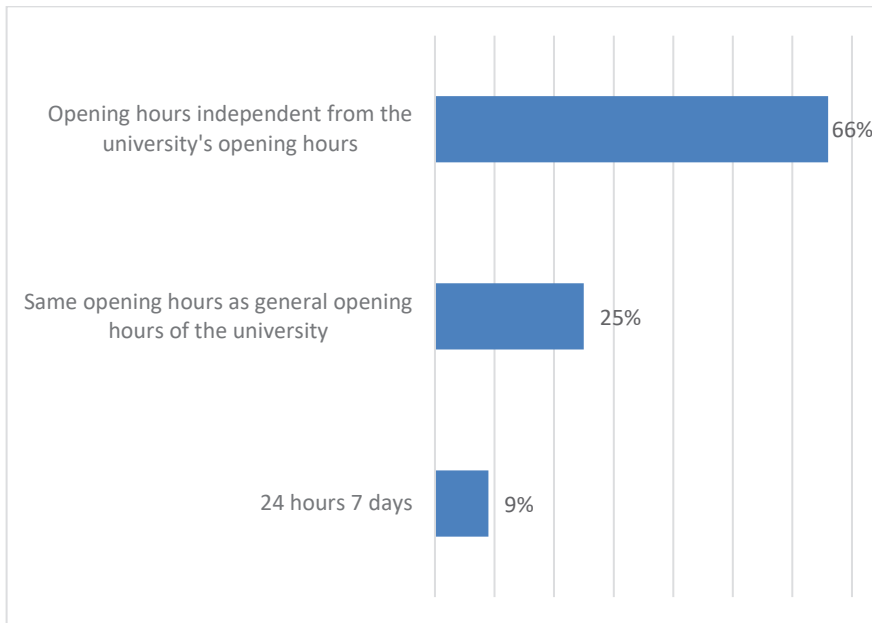
Source | (Becker and Stang, 2020b, p.109)

Schließlich sind die Öffnungszeiten von physischen Bibliotheken (und natürlich auch anderen L&T spaces) ein wichtiger Faktor der Gestaltung der Learning World University. An deutschen Hochschulen haben die meisten Bibliotheken (66%) eigenständige Öffnungszeiten, die von denen der Hochschule abweichen. 25% der Bibliotheken haben die gleichen Öffnungszeiten wie die Hochschule, während (nur) 9% 24/7 Modus fahren (Graphic 6).

In summary, it can be stated that it is important for the planning of university space development in the future,

‘that the various disciplines that deal with the effect of spaces (e.g. design, architecture, IT, pedagogy and psychology, information management) and those who are involved in the implementation (e.g. building management, university management, deans of studies, libraries, media or e-learning centers), merge and jointly take on the planning of future-proof university premises’ (Nissler and Prey, 2018, p.236; translation into English by the author).

Graphic 6 | Opening hours of the (central) library (number of university respondents n=32)



Source | (Becker and Stang, 2020b, p.109)

As already mentioned in Section 4.1, however, restructuring and renovation backlog of university buildings and ambiguities at the legal and executive level also play a role. Actually, it has long been recommended that German universities should become owners of the property and buildings used by them to establish an adequate property management. For that purpose, universities would need an adequate, performance- and needs-based property budget in addition to the standard personnel and material resources budgets (AKIM, 2002).

5.4.2 Good practices

Several examples of good practice of physical L&T spaces of German universities can be identified with respect to the design and implementation of L&T spaces. The following list of good practices is not comprehensive and it is open for further development (also cf. Petschenka *et al.*, 2020, pp.252-253):

- University of Applied Sciences Potsdam (FHP)
Since 2016, the University of Applied Sciences Potsdam (FHP) has a vice president for special tasks – focus: campus development, who is a professor of building physics and building climate and heads the FHP’s building physics laboratory. Among other things, he is responsible for the internal and external coordination of all new building and renovation measures that arise as part of campus development. This also includes coordination with the state authorities and with internal users (FHP, 2020; see also Section 5.1.1).
- The working group Learning Spaces (“Lernräume”) of the German Initiative for Network Information (Deutsche Initiative für Netzwerkinformation: DINI) deals with all questions of planning and designing of learning spaces (DINI, 2020a).

- SRH University Heidelberg

The SRH University Heidelberg²⁷ strategically orients its study programmes at student-centred Competence²⁸ Oriented Research and Education (CORE) (cf. Ninnemann *et al.*, 2020). Within the project *Learning Space Campus* (“Lernraum Campus”; 2015-2016), these teaching-strategic approaches were translated into space concepts and served as a reference point for decisions in the design of L&T spaces. The CORE principle as a new educational concept served as the basis for implementing systematic L&T space development. According to the university, all users were involved in the decision-making processes to achieve the highest possible acceptance for the innovations. Teachers were initially able to deal with the new uses in a protected area. Before decisions were rolled out across the campus, a model faculty was used in which concepts were tried out and evaluated (Prill, 2019, pp.20–21).

In a first step, the change process for novel L&T spaces was based on an inventory of all existing learning areas across the campus according to room sizes. The change process was broadly supported from the start since all important stakeholders were involved already in the conception phase. Specifically, engaged representatives of various disciplines with appropriate practical experience in the context of activating L&T methodologies were involved in feedback sessions in the conceptual phase. In addition, good practice from other universities, opinions of international experts and insights from contemporary research were also consulted for the concept development (Prill, 2019, p.18).

Image 2 | Flexible furniture



Source | Photo: SRH University Heidelberg (Prill, 2019, p.19)

As reported by SRH University Heidelberg, communication, participation and multiple feedback were also core to the implementation phase that did not start in all faculties at the same time, but was first tried out in one faculty – the School of Engineering. The L&T spaces implementation started with preselected products that received feedback

²⁷ The SRH University Heidelberg is a state-recognized private university of the SRH group (Stiftung Rehabilitation Heidelberg).

²⁸ Including self-competences, social competences, subject competences and methodological competences (cf. Leiber, 2016b).

from the user groups in a two-week test. The goals were to improve the coordination with the product manufacturers and to make the decision-making transparent to the user groups. For example, teachers were offered introductory events to try out room scenarios in a protected ‘experimental’ situation that could help them to develop new spatial competences in dealing with the new possibilities. This way, the added value of the new learning space concepts could be shown by using certain teaching methods and learning formats. Critical voices on the part of students, for example with regard to the acquisition costs, were also taken into account (Prill, 2019, pp.18–19).

Image 3 | Learning Space “Arena”



Source | Photo: SRH University Heidelberg (Prill, 2019, p.20)

Image 4 | Research Lab “Learning Cafe”



Source | Photo: SRH University Heidelberg (Prill, 2019, p.20)

In terms of the dimension of physical L&T space, the CORE study model is mainly implemented by using flexible furniture that facilitates or even requires users’ activity (see Images 2-4). For example, tables and chairs are equipped with casters to foster quick switching between different teaching methods and learning types (see Images 2 and 4). This implies higher flexibility of furniture arrangements which in turn requires from teachers and students alike taking (more) responsibility for the usability of the L&T

spaces. One of the flexibility advantages is that different learning workplaces, such as standing and sitting workplaces, can be realised in one learning room (see Image 4). Another advance reported by SRH University Heidelberg was the introduction of a room booking system for self-service for the students (Prill, 2019, p.19).

- Media University Stuttgart (Hochschule der Medien (HdM) Stuttgart)

The Media University Stuttgart (HdM) designs and researches L&T environments (“Learning Worlds”) and plans for makerspaces. The HdM’s “Learning World” was opened in 2014 and offers L&T space for 120 students on an area of 400 square meters. According to the university, the Learning World is conceived as both a learning space and a research laboratory. The furnishing of the L&T space was designed in cooperation with a company for special furniture (Prill, 2019, p.10).

Image 5 | Spaces in space and “puzzle tables”



Source | Photo: Richard Stang (Prill, 2019, p.12)

For the HdM Learning World flexibility and multifunctionality are key issues:

‘Tables of different sizes and shapes are available, which can be put together and put apart quickly, for example in a “puzzle-like” manner, because most tables are on castors or are very light. Compared to conventional tables, for example, the “puzzle tables”, due to their curved shapes, can accommodate more people than usual (see Image 5). There are also various functional seating options available to the students. These range from mushroom-shaped ottomans to ordinary height-adjustable swivel chairs to upholstered armchairs or upholstered sofas or beanbags on the floor. All seating and table options therefore also offer different learning settings or convey these to users. Be it concentrated individual or group work at the table, informal exchange in a “lounge” atmosphere or creative brainstorming for a common project. For example, there are also movable screens – which can be quickly connected to laptops and mobile devices –, whiteboards, pin boards and flipcharts, which can also be used as room dividers to shield noise and create smaller private room atmospheres. This form of privacy also enables the central horseshoe-shaped seating set, the backrest of which is raised to a high level, thus protecting it from

glances and noises from the surroundings. In this way, individual rooms in the room are always created. In general, care was taken to ensure that everything can be redesigned as flexibly and quickly and easily as possible. The flexibility and mobility of the furniture is also used intensively by the students, so that the Learning World looks different every day' (Prill, 2019, p.11; translation into English by the author).

The HdM Learning World was also used as a live research laboratory to learn more about the self-organised use of (flexible) L&T space, specifically students' use of learning spaces. To analyse learning activities and their related room settings established by students, three fish-eye cameras were installed that take a picture every ten minutes, whereby pictures of faces were immediately pixelated by a software to guarantee privacy and data protection rights. The produced sequences of pictures give insight into how students arrange the furniture according to their preferences. In addition, the background noise was measured by sound level meters. From several years of observational research, the HdM concludes that individual preferences of students are pronounced with regard to seating and arrangement of workplaces. It can also be assumed that the various individual preferences can be met thanks to the flexible spatial structures of the HdM Learning World. According to the initiators and operators of the HdM Learning World, the (increasing) support of the university leadership and the pedagogical expertise were two decisive success factors for the implementation of the design of the learning spaces (Prill, 2019, p.12).

- Mittelhessen University of Applied Sciences

From 2013 to 2016, the Mittelhessen University of Applied Sciences (Technische Hochschule Mittelhessen – THM) organised the conversion of the existing library at two locations into a service-oriented university learning center including electronic communication and booking systems. In particular, all library borrowing, returning and paying take place in a central self-service area equipped with an electronic ticket system to contact the learning center staff. Bookings of group rooms and appointments (e.g. for writing device) can be realised via online services. As a consequence of the extensive self-service offer, the two locations of the learning center can be opened 24/7. In addition to the advisory services, the learning center offers individual and group workplaces at both locations all of which are divided into zones that allow either silent work at individual workplaces and WLAN-capable PC workplaces or communicative work in groups (see Images 6 and 7). The rules of expected behaviour in each specific area are pointed out on posters and monitors (Prill, 2019, p.23).

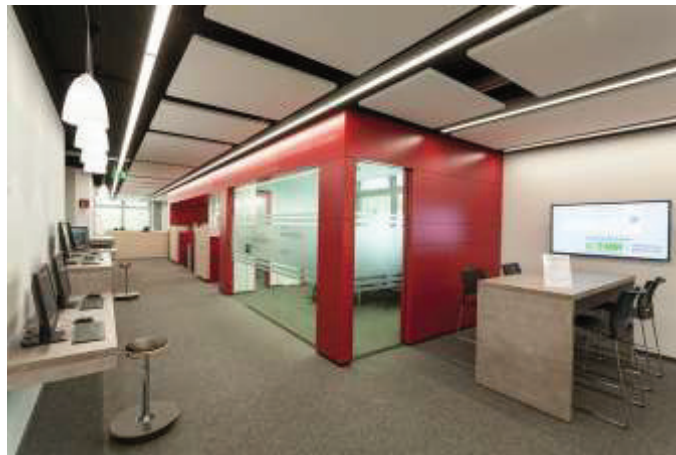
When setting up the new learning and working areas, the THM followed a corporate design approach, which among other things included an structured colour scheme, linguistic regulations and a revised website. Further, a quality assurance system of the equipment and the rooms was developed with the support from and integration of the Facility Management area (Prill, 2019, p.24).

Image 6 | Spaces in space and “puzzle tables”



Source | Photo: Library THM (Prill, 2019, p.24)

Image 7 | Spaces in space and “puzzle tables”



Source | Photo: Library THM (Prill, 2019, p.24)

According to the THM stakeholders engaged in the development of the new university learning center and library concept, this involved an extensive learning process for the library staff and management. This included the insight that there is no single king’s road to the future-proof university library (and learning center) although there exist numerous good practice examples. Therefore, a university-tailored concept had to be developed through the practice and communication of successful solutions to the organisational, pedagogical and spatial requirements. The THM also recognises the need for personnel development and further education of employees with respect to writing advice and support, open access, research information systems and research data management to name a few (Prill, 2019, p.25).

- CODE University of Applied Sciences Berlin

The campus of the (private) CODE University of Applied Sciences Berlin, founded in 2017, is conceived as a community space that is implemented in a former factory

building complex with office spaces and a work environment that brings together established technology companies and international start-ups. The university management follows the strategy of building a “Community of Equals” (instead of silo-building) by further developing the organisation at eye level including the permanent involvement of students.²⁹ Learning space design and development is seen as a permanent strategic task that is oriented at the learning model of curiosity-driven education with the didactic core element of interdisciplinary project work (Prill, 2019, pp.13, 17).

Image 8 | Various seating options for group discussions



Source | Photo: Anne Prill (Prill, 2019, p.16)

The L&T spaces of the CODE University of Applied Sciences comprise two open learning areas available for individual use, with one area being able to work loudly and the other area being quiet. A music corner with instruments has also been set up in the noisy learning area. In addition, there are seminar rooms, lounge areas and sitting areas and rooms for informal exchange (Image 8) and relaxation including a large communal kitchen. Room-in-room areas are set up by means of room subsystems on a learning area for approx. 50-60 people, so that further “team spaces” can be formed. All L&T areas are equipped with movable monitors. Access to the campus areas is available to students around the clock (Prill, 2019, pp.15, 16).

- University of Applied Sciences München (Hochschule München)

The University of Applied Sciences Munich organised a transdisciplinary project *Learning Space of the Future* (“Lehrraum der Zukunft”; 2015-2017) which dealt with the effects of physical space on the quality of L&T success of students (Dürr *et al.*, 2017; HSM, 2020).

- Saxon State Library – State and University Library (SLUB) Dresden

The SLUB Dresden (Sächsische Landesbibliothek – Staats- und Universitätsbibliothek) offers a variety of learning spaces, among them reading rooms, group study rooms, maker spaces, carrels, multi-media places and silent spaces (SLUB, 2020).

²⁹ For some more details of this, see (Prill, 2019, p.15).

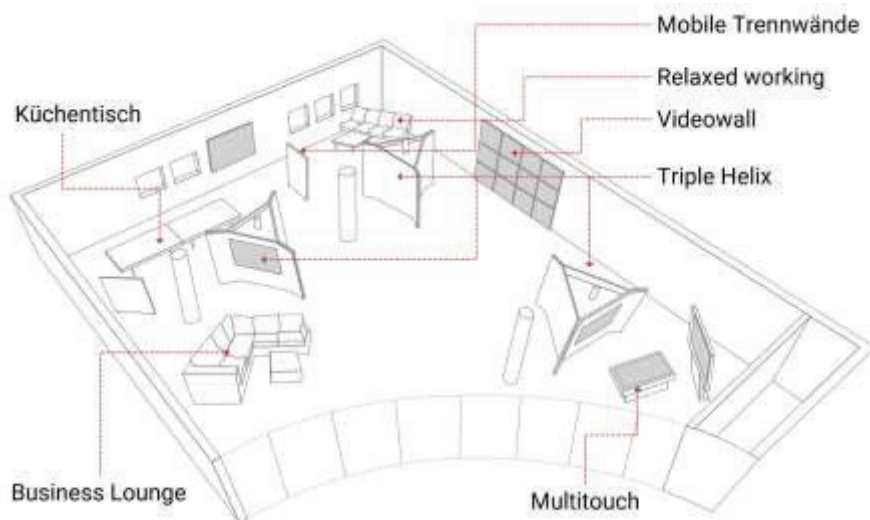
- The Technical University Munich (TUM) established an individual building on two of its campuses, the StudiTUM Houses; further two StudiTUM Houses are planned. The houses offer L&T space for individual and group work, for inter-faculty projects, for spontaneous exchange and for cultural activities. In all houses, the focus is on variable use, so that even with limited space, there are places to study and exchange, as well as student groups in the houses can be creative and productive (StudiTUM, 2020).
- University of Bamberg

The University of Bamberg offers 24/7 learning spaces, particularly 200 work places that are integrated in the library and partially equipped with internet access. Among these work places are individual work spaces and group work spaces which are equipped with interactive whiteboards and screens. Some of the work places can be reserved online (UB, 2020).
- University of Bielefeld

The University of Bielefeld offers various learning spaces including spaces for individual learning, group learning, computer spaces, PC pools, media rooms, discussion rooms, foreign language center, student peer-learning, childcare, relaxing spaces (UBI, 2020).
- University of Göttingen

Since 2019, the University of Göttingen offers an open co-working space called Digital Creative Space which defines a flexible and hybrid co-working zone (Image 9) (UGOE, 2020).

Image 9 | Digital Co-Working Zone – Prototype Room Division



Source | (UGOE, 2020)

- University of Hannover

The University of Hannover is generating a learning space map with an option for booking learning spaces for the whole university. The focus of this learning room

concept is self-directed (student) learning (SDL), taking into account available (new) media and spatial conditions. Learning space coordination understands learning space as an interactive combination of three components that support modern learning and working methods: physical spaces; integration of digital and virtual platforms and provision of technical equipment; counseling to support learning (UHN, 2020).

- University of Kassel

The University of Kassel provides the functional learning space LEO, where students from the University of Kassel will find 950 m² of space to study and work, to relax and to be together in a relaxed atmosphere. The students have a total of 350 seats available, from hanging balls for relaxation to lounge furniture and bar stools to learning boxes as well as individual and group tables. On the learning level on the upper floor, individual work tables, group tables and work boxes offer versatile possibilities for concentrated learning and working (Image 10). At the learning stand you will find the LeoS, who offer student learning and writing advice every day. On the ground floor, the LernBar provides delicious food and drinks for the necessary healthy energy supply (UKS, 2020).

Image 10 | LEO – Individual work tables, group tables and work boxes



Source | (UKS, 2020)

- Leuphana University of Lüneburg

In the Media and Information Center, the Leuphana University of Lüneburg offers various learning spaces, among them Workplaces in the library, edulabs, photo labs, group work rooms, PC workplaces, scanners / printers / copiers, individual work rooms, video production rooms (Leuphana, 2020).

- University of Mannheim

In May 2014 the Learning Center of the University of Mannheim was put into operation, following the aim of creating a university space for collaborative learning and work that also offers the opportunity to hold training courses. The Learning Center was created by zoning the former reading room in order to meet the growing need for group workplaces

and it has 180 workplaces extending over 620 m² (Image 11).³⁰ The Learning Center integrates different areas such as “room-in-room” areas, training areas, relaxation zones and a lounge area (Image 12). Both soundproofing aspects and the subject of flexible furnishing are considered; most of the furniture is equipped with castors. The “room-in-room” concept is implemented by setting up sitting bunks that offer space for 4-6 people and are mostly equipped with screens (Image 13). They are designed in strong colors (Wertz, 2020, p.34, 35).

Image 11 | Learning Center University of Mannheim



Source | (UBMA, 2020)

Image 12 | Learning Center University of Mannheim: Lounge area



Source | (UBMA, 2020)

When setting up the Learning Center, the focus was on the technical equipment from the start, including WiFi and sockets and USB connections at all workstations. The team monitors in the sitting bunks enable the simultaneous wireless transmission of data from several mobile devices to a large shared monitor. That way, learning groups can work on presentations or files together and transfer them between their mobile devices.

³⁰ The University of Mannheim has around 12,000 students.

Further, a large, centrally positioned touch monitor gives access to printed and electronic textbooks according to subject area. e-books can be directly accessed via own mobile devices by scanning the QR codes displayed. The concept of the Learning Center also includes a range of services from the library that support students in learning and scientific work, including courses, a special advisory service and “Coffee Lectures”: half-hour lectures that deal with various topics such as plagiarism prevention and open access publishing. Advice on scientific writing is also offered on site . Currently, the university plans to enhance the Learning Center by including areas for creative work that should support interdisciplinary design thinking and an experience room that builds on virtual reality components (Wertz, 2020, pp.36, 38).

Image 13 | Learning Center University of Mannheim: Sitting bunk with team monitor



Source | (UBMA, 2020)

Obviously following aesthetic considerations based on insights into how spatial colour schemes affect well-being and motivation to learn, the design of the sitting bunks and workplaces was deliberately kept in strong and different colours which give learners a choice to flexibly select the colour environment that might be individually adequate for them. For example, there are soothing shades of green and blue as well as activating red.

- Research Association FAB101

In the BMBF-funded research association FAB101, the University of Siegen, the RWTH Aachen University, the University of Bremen and the Folkwang University of the Arts were dealing with Fab Labs at universities between 2017 and 2020. Fab Labs are manufacturing laboratories in which, among other things, 3D printers, laser cutters, plotters, CNC milling machines and microcontrollers are used to learn, work and research together.

The FAB101 association researched concepts for interdisciplinary L&T cooperation across study programmes in laboratories for digital manufacturing in a practical way. The project was part of the digitalisation strategies of the respective universities. In addition, the structural framework conditions of Fab Labs were examined in the project,

such as the organisational and security-related embedding of such facilities at universities and the creation of recommendations for their equipment (FAB101, 2020).

6. Conclusions and recommendations for the design and implementation of L&T space in German higher education

The investigation and analysis shows that many of the challenges for higher education institutions concerning the design and implementation of L&T space or University Learning Worlds are treated by universities of the German higher education system (and others as well). However, at least in the German context often individual activities are undertaken which are frequently based on project funding and usually come to a standstill after the end of the project funding period. Project-transcending and structurally anchored funding is largely lacking. In addition, problems arise from the federal structure of Germany. Although the federal structure has its strengths in the better fit between regional needs and the governance of the regions, the federal heterogeneity of the legislation in the field of education and the agreements between the federal states and the universities make it difficult to compare universities and to transfer good practice. Not to mention the pronounced practical autonomy of universities that are not centrally governed.

Some further characteristics of the German higher education system that are related to the design and implementation of L&T space are the following:

- Together with the renovation backlog that ran up to 2016, assuming an area expansion of a moderate 1.2% annually for teaching and research, there will be a funding gap for university construction of around € 35 billion by 2025 (KMK, 2016, p.4).
- Education in sustainability is a topic in Germany's teacher (higher) education.
- At many places, there is a need for (more) learning spaces that (better) support students' active engagement with content and include technology options to support multiple and flexible modes of L&T.
- At many places, there is a need for (more) learning spaces that (better) enable students' work on an individual base as well as in collaboration with one another.
- The expansion of universities in the field of lifelong learning and continuing education recommended by the German Science Council (WR, 2019) may also require modernised and new offers of L&T spaces.

6.1 Federal states' politics

On the federal states' politics level, respectively, the following possible recommendations for action can be suggested with respect to the improvement of the University Learning World, or the design and implementation of L&T space (also cf. Petschenka, 2020, pp.216ff.):

- Since the subject of L&T space has so far been addressed only slightly or not at all in the higher education laws of the 16 German federal states, it could be integrated including at least its most important basic dimensions. Among them are, for example, the topics of student centredness and incentive structures for L&T outcomes orientation.
- The higher education legislation of the individual federal states could be more closely aligned, which would improve the comparability of the 16 university systems and

therefore the concerted strategy development in the federal system. This could imply the implementation of a federal orientation framework for the design of L&T space including the alignment of the design and structure of development and structure plans and goal agreements as well (also cf. Petschenka, 2020, p.216).³¹ Such framework would rely on a shared data base on student orientation, structure and development plans, goal agreements, university didactics, digital structures (e.g. information and learning management systems) and physical L&T spaces.

- Particularly to do justice to the shift from teaching to learning (Barr and Tagg, 1995), the financial resources and financing concepts of higher education should be improved with respect to design and implementation of L&T space. This also includes securing the financing in the medium and long term.

These recommendations for action cannot be addressed at the typical university actors such as university leadership, organisational units, teachers and students. Instead, these recommendations are oriented at higher education politics represented, for example, by the German University Rectors Conference, federal states parliaments, federal states ministries and federal-state and republic research and development programmes.

6.2 University strategy and organisation

On the individual university level of strategy and organisation, the following recommendations for action can be suggested with respect to the design and implementation of L&T space (also cf. Petschenka, 2020, p.216ff.):

- Since the subject of L&T space has so far been addressed only vaguely or not at all on the various strategic levels of higher education institutions³², it is time to integrate it into universities' strategies. Basic dimensions that need to be considered are issues of organisation of (the design and implementation of) L&T space including digitalised L&T space (digital structures) and physical L&T space as well as the meaning and status of university didactics.
- The higher education institutions' strategies including their operationalisation could be more closely aligned, which would improve the comparability of German universities and therefore their concerted strategy development. This could imply the implementation of an inter-university orientation framework for the design of L&T space including the alignment of the design and structure of development and structure plans and goal agreements as well. Again, such framework would rely on a shared data base on student orientation, structure and development plans, goal agreements,

³¹ These are intentions and wishes that are unlikely to be fulfilled in the foreseeable future, since they affect the basis of the federal structure of the Federal Republic of Germany and imply the abandonment of the educational independence of the federal states. By the way, it is also not clear whether such "unification" and "centralisation" would be a clear advantage for (the improvement of) (higher) education politics and (higher) education in Germany.

³² Such as mission statements; structure and development plans; goal agreements; other policy documents.

university didactics, digital structures (e.g. information and learning management systems) and physical L&T spaces.

- Particularly to do justice to the shift from teaching to learning, the financial resources and financing concepts of the university should be improved with respect to design and implementation of L&T space. This also includes securing the financing in the medium and long term.
- Reliable and adequate data on student orientation (e.g. student centredness; incentive structures for L&T outcomes orientation; students' staff and research access) should be made available to support an operationalisable strategy of L&T space and the implementation of Deming cycles (plan – do – check – act) of quality management.
- L&T spaces, physical and virtual and hybrid, should be mapped at least university-wide to improve organisation/logistics, use and improvement.
- All relevant university actors and stakeholder groups, particularly students, should be integrated in the design and implementation of L&T space (participation). This would be facilitated by appropriate internal models of cooperation.³³

These recommendations for action can be addressed at specific university actors. In particular, the following attribution of tasks to actors can be made (also cf. Petschenka, 2020, pp.219-220):

- Tasks for university leadership
 - Anchor the university strategy for L&T spaces in the network of actual and potential relevant stakeholders.
 - Develop mission statement for (design and implementation of) L&T space.
 - Establish integration of students in strategic decision-making on (design and implementation of) L&T space.
 - Develop adequate financing concepts and secure adequate financing in the medium and long term with respect to design and implementation of L&T space.
- Tasks for university organisational units
 - Operationalise the university strategy of (design and implementation of) L&T space, i.e. provide reliable and adequate data on student orientation to make the Deming cycle of quality management work.
 - Establish a university-wide mapping of L&T spaces, physical and virtual and hybrid.

³³ Generally speaking, this is not an easy task because higher education institutions are multi-dimensional, multiple-hybrid organisations which are extremely complex with respect to job structures and competences related to the different logics and cultures of governance, administration, research, teaching, ICT units, infrastructure units etc. (also cf. Leiber, 2019a). Particularly, the fluctuation of students is usually high ('fluid participation': Cohen *et al.*, 1972, p. 1) which calls for adequate participation models of students in addition to being engaged in usual committees and organisational units' groups.

- Establish a university-wide booking system for digital and physical L&T spaces.
- Implement cooperative and participative strategies about the design and implementation of L&T space.
- Tasks for university teachers
 - Develop a mission statement for (design and implementation of) L&T space.
- Tasks for students
 - Develop interest in strategic decision-making on (design and implementation of) L&T space.

6.3 University didactics

Concerning issues of university didactics, the following general recommendation for action can be suggested with respect to the design and implementation of L&T space:

- The design and implementation of L&T space should be (more) didactics-informed and didactics-oriented. For example, the design and implementation of L&T spaces should take into account that collaborative learning, self-directed learning (SDL) and experimental spaces for innovative L&T are increasingly important (e.g. problem-based learning; project-oriented learning; research-oriented learning).

This recommendation for action can be addressed at specific university actors. In particular, the following attribution of tasks to actors can be made (also cf. Petschenka, 2020, pp.221-222):

- Tasks for university teachers, specifically didactics experts
 - University teachers should contribute to the didactically sound design and implementation of L&T spaces, i.e. design L&T spaces in such a way that innovative L&T scenarios can be implemented, teachers can act as learning companions and SDL, collaborative learning, knowledge-generating and competence-building forms of communication can be implemented.
- Tasks for students
 - Students should contribute feedback on benefits and desiderata of existing L&T spaces and future expectations to complement didactics-informed design and implementation of L&T space.

6.4 University digital structures

Concerning issues of university digital structures, the following possible recommendations for action can be suggested with respect to the design and implementation of L&T space:

- Since the subject of digital structures (as basic component of digitalised L&T space) has so far not been addressed on the various strategic levels³⁴ of higher education

³⁴ Such as mission statements; structure and development plans; goal agreements; other policy documents.

institutions in Germany, it should be integrated into universities' (digital) strategies for the design and implementation of L&T spaces and should be clearly formulated and implemented.

- Digitalised L&T spaces should be designed to allow for use and integration of digital mobile media (BYOD).
- Financing of digital structures should be adequate, enduring and sustainable.

These recommendations for action can be addressed at specific university actors. In particular, the following attribution of tasks to actors can be made (also cf. Petschenka, 2020, p.225):

- Tasks for university leadership
 - Leadership should take care to include and make precise the plans for digital structures for L&T spaces (e.g. CMS, LMS, hybrid L&T spaces, integrated digital devices) in mission statements; structure and development plans; goal agreements; other policy documents.
 - Leadership should coordinate common (university-wide) digitalisation processes (in L&T) with all actors involved.
- Tasks for university organisational units including ICT experts
 - University organisational units must provide hardware and software infrastructure for digitalised and hybrid L&T.
 - Care, maintenance and ongoing modernisation of digital structures for L&T must be prioritised.
 - Support structures (e.g. technical support; university members' training) must be established and continuously developed.
 - It is important to have manageable conceptions for access to digital services and offers, including those related to L&T spaces (e.g. different access and registration procedures for different services of the same university should be avoided).
 - Expectations and requirements of users of digital structures – students and teachers – must be taken into account.
- Tasks for university teachers
 - Teachers should develop their openness and willingness to use digital structures.
 - Due to their direct contact and engagement in the students' L&T process, teachers should play a responsible role in integrating student interests and needs in connection with innovations in digital structures.
- Tasks for students

- Students should engage in understanding digital structures and their use and develop competences in dealing with innovative L&T methods.
- Students should engage in participating in the design of digitalised L&T processes.

In addition to the above listed recommendations, the consequences of the Covid-19 pandemic have shown that there exist some key challenges of digitalised L&T for German universities, at least in the near future:

- Basic requirements for participating in digital L&T are not fully available nationwide because some students lack technical infrastructure (e.g. a well-functioning Internet from home; study spaces that enable concentrated learning).
- The multitude of competing and new digital formats requires a lot of knowledge and software-practice skills and complicated decision-making that lead to increased workload for teachers and students.
- The support structures (data centers, HelpDesks etc.) at the universities are currently not designed so that all teachers and students can be supported for comprehensive digitalised L&T (CHE, 2020b).

6.5 University physical L&T spaces

Concerning issues of university physical L&T spaces, the following possible recommendations for action can be suggested with respect to the design and implementation of physical L&T spaces:

- Since the subject of the design and implementation of physical L&T space has so far not been addressed prominently in most university strategies³⁵, it should be (further) integrated and clearly formulated.
- Expert assessments about room qualities for well-being and aesthetic qualities of spaces should be taken into account when designing and implementing physical L&T spaces.
- L&T spaces design should be sufficiently flexible (e.g. use flexible room and furniture elements; allow for innovative and explorative uses such as Makerspaces and Learning Labs). In particular, physical L&T spaces should be designed to allow for adequate hybrid, face-to-face and virtual, L&T processes.
- Financing of physical L&T space should be adequate, enduring and sustainable.

These recommendations for action can be addressed at specific university actors. In particular, the following attribution of tasks to actors can be made (also cf. Petschenka, 2020, p.225):

- Tasks for university leadership

³⁵ Such as mission statements; structure and development plans; goal agreements; other policy documents.

- Leadership should take care to include and make precise the plans for physical L&T spaces in mission statements; structure and development plans; goal agreements; other policy documents.
- Tasks for university organisational units including ICT experts
 - University organisational units must provide hardware and software infrastructure for digitalised and hybrid L&T.
 - Care, maintenance and ongoing modernisation of physical L&T spaces must be prioritised.
 - Expectations and requirements of users– students and teachers – of physical L&T spaces must be taken into account.
 - Organisational units should implement 24/7 learning spaces.
- Tasks for university teachers
 - Teachers should develop their openness and willingness to use innovative physical L&T spaces (e.g. for SDL; Learning Labs; Makerspaces).
 - Due to their direct contact and engagement in the students’ L&T process, teachers should play a responsible role in integrating student interests and needs in connection with innovations in physical L&T spaces.
- Tasks for students
 - Students should engage in participating in the design of physical L&T spaces (e.g. participate in committees and projects on L&T space development).

6.6 Overarching cross-sectional aspects

In addition, the analysis of this study supports the following statements: Aesthetic demands on design and implementation of physical (and digital) L&T spaces (e.g. aesthetic aspects of L&T space arrangements and furniture) are permanently taken into account during design and implementation processes (in German higher education). Implications of massification on the design and implementation of L&T spaces could not be identified as explicit themes in the sources that were available for this study, although it is clear that the fact of increasing student numbers must always be taken into account, at the level of the university strategy and organisation, university digital structures and university physical L&T spaces. Safety demands, requirements because of monument protection and accessibility demands on design and implementation of L&T spaces are taken into account in accordance with the law, often without very much ado, i.e. the themes do not show up on the more general levels of strategy and design and could not be identified as explicit themes in the sources that were available for this study.

6.7 Some further theses and principles of design of L&T space in higher education

In the framework of the HFD (“Hochschulforum Digitalisierung”) a number of theses about digitalised L&T in higher education was developed that might be seen as (containing) tentative

principles of design of higher education L&T space(s). Some of these that are considered relevant in the present context are listed here:

- Corporeality and spatial relations are basic characteristics of human beings. Sustainable learning architectures must therefore take human space requirements into account in order to support L&T processes (Günther *et al.*, 2019, p.33).
- In the interaction between learners among themselves and with teachers, L&T space plays a role as a “third pedagogue”. The participants need spatial competence in order to set up and use L&T spaces in such a way that the quality of L&T increases. Therefore, the design of learning architectures at universities with regard to physical and virtual learning spaces should be seen as a strategic core area (Günther *et al.*, 2019, pp.20, 26).
- To meet the diverse requirements of all the different stakeholders at the university, the design of university learning architectures requires a multi-perspective, inter- and transdisciplinary access taking into account strategic, structural, cultural, subject field-specific and individual aspects (Günther *et al.*, 2019, p.18).
- To meet pedagogical requirements, the university strategy for the design of L&T architecture – the mission, vision and values of L&T spaces – should be informed by knowledge and critical reflection of L&T theories. In particular, a new understanding of teaching with new role models is required, so that students leave the university with a future-oriented knowledge and competence profile. In such role models, students act as co-creators instead of passive receivers and teachers as initiators of individual learning processes instead of monologising lecturers. By integrating digital media into the L&T process, learning content can be presented more clearly and enriched with new experience and action spaces. In connection with a flexibilisation of the learning modes, which enables the students to design their learning paths more individually, a recognisable added value can be created (Günther *et al.*, 2019, pp.19, 27, 29).
- In order to meet the diverse needs for the design of learning architectures, a digital infrastructure is required that guarantees the necessary flexibility and modularity of L&T space(s) (Günther *et al.*, 2019, p.21).
- Educational paths increasingly cross the institutional and physical boundaries and take place in expanded and digitalised learning spaces that connect different areas of life with each other. In order to promote the growing together of diverse (formal and informal) learning and experience spaces, the L&T spaces of the university of the future must become more permeable (Günther *et al.*, 2019, p.30).
- To create future-oriented learning worlds, the space concepts must be user-centered (“User Centered Design”), so that users can intuitively understand the spaces, use them and experience them in a multi-sensory way (Günther *et al.*, 2019, p.34).
- In general, L&T spaces should be adaptable to changing needs which arise from the further development of technical possibilities and new educational formats to name only two (Günther *et al.*, 2019, p.35).

- Future-oriented learning worlds, L&T spaces should not be conceived as either physical or virtual: They are “both-as-well” and are perceived by users as a whole. Accordingly, they have to be designed so that they can be consistently integrated (Günther *et al.*, 2019, p.38).

Bibliography

AKIM [Arbeitskreis "Immobilienmanagement" der deutschen Universitätskanzler], eds. 2002. Effizientes Immobilienmanagement als Element der selbstgesteuerten Universität. Bericht des Arbeitskreises "Immobilienmanagement" zur Jahrestagung der deutschen Universitätskanzler vom 25.-27. September 2002, Halle.

Aschinger, F., 2020. Konzeption und Management der Lernwelt Hochschule. Herausforderungen und Good Practice aus Sicht der Hochschulakteurinnen und -akteure. In: A. Becker and R. Stang, eds. 2020a. *Lernwelt Hochschule. Dimensionen eines Bildungsbereichs im Umbruch*. Berlin: de Gruyter Saur, pp.123–149.

Bachmann, G., Brandt, S., Kaufmann, H., Röder, H., Schwander, U. and Škerlak, T., 2014. Moderne Lernumgebungen für den Campus von morgen. Das Projekt ITS1. In: T. Škerlak, H. Kaufmann and G. Bachmann, eds. 2014. *Lernumgebungen an der Hochschule*. Münster: Waxmann, pp.17–52.

Barr, R.B. and Tagg, J., 1995. From teaching to learning. A new paradigm for undergraduate education, *Change*, 27(6) November/December, pp.13–23.

Becker, A. and Stang, R., eds. 2020a. *Lernwelt Hochschule. Dimensionen eines Bildungsbereichs im Umbruch*. Berlin: de Gruyter Saur.

Becker, A. and Stang, R., 2020b. Lernwelt Hochschule im Aufbruch. Zentrale Ergebnisse einer Befragung. In: A. Becker and R. Stang, eds. 2020a. *Lernwelt Hochschule. Dimensionen eines Bildungsbereichs im Umbruch*. Berlin: de Gruyter Saur, pp.71–122.

BMBF [Bundesministerium für Bildung und Forschung], 2019a. *Die Hochschulen im Qualitätspakt Lehre*. Available at: <https://www.qualitaetspakt-lehre.de/de/die-hochschulen-im-qualitaetspakt-lehre-1736.php> [accessed 28 July 2020].

BMBF [Bundesministerium für Bildung und Forschung], 2020. Projektdatenbank – Qualitätspakt Lehre. Available at: <https://www.qualitaetspakt-lehre.de/de/projekte-im-qualitaetspakt-lehre-suchen-und-finden.php> [accessed 3 August 2020].

BRIDGING, 2020. Transfer digitaler Hochschulbildungskonzepte. Ein empirischer Zugang. Technical University of Hamburg. Available at: <https://bridging.rz.tuhh.de/> [accessed 8 August 2020].

Byers, T., Imms, W. and Hartnell-Young, E., 2014. Making the case for space: The effect of learning spaces on teaching and learning, *Curriculum and Teaching*, 29 (1), pp.5–19.

CHE [Centrum für Hochschulentwicklung], 2020a. Available at: <https://www.che.de/> [accessed 4 August 2020].

CHE [Centrum für Hochschulentwicklung], 2020b. CHECK – Digitalisierung an deutschen Hochschulen im Sommersemester 2020; Stand Juli 2020. Available at: <https://www.che.de/download/digitalisierung-hochschulen-2020/?wpdmdl=15118&ind=1594986398076> [accessed 4 August 2020].

Cohen, M.D., March, J.G. and Olsen, J.P., 1972. A garbage can model of organisational choice, *Administrative Science Quarterly*, 17(1), pp.1–25.

Dahlinger, S., 2008. *Der Raum als dritter Pädagoge*. München: GRIN.

DHB [Digitale Hochschulbildung], 2020. Digitale Hochschulbildung. Berlin: BMBF. Available at: <https://www.bmbf.de/de/digitale-hochschullehre-2417.html> [accessed 7 August 2020].

DINI [Deutsche Initiative für Netzwerkinformation e.V.], 2020a. Lernräume. Available at: <https://dini.de/ag/lernraeume/> [accessed 4 August 2020].

DINI [Deutsche Initiative für Netzwerkinformation e.V.], 2020b. DINI Atlas. Available at: <https://intern.dini.de/confluence/display/LEHO> [accessed 4 August 2020].

DLM [Digital Learning Map], 2020. Digital learning map. Available at: <https://www.e-teaching.org/community/digital-learning-map/> [accessed 7 August 2020].

Dürr, P., Spier, P.E., Nissler, A., Lödermann, A.-M. and Angel, S., 2017. *Konzeptstudie Lehrraum der Zukunft*. Hochschule München. Available at: https://w3-mediapool.hm.edu/mediapool/media/dachmarke/dm_lokal/bologna/lehrraum_der_zukunft/Konzeptstudie_Lehrraum-der-Zukunft.pdf [accessed 6 August 2020].

Du Troit-Brits, C., 2018, 'Towards a transformative and holistic continuing self-directed learning theory', *South African Journal of Higher Education*, 32(4), pp. 51–65.

Duvivier, R.J., 2019. How to 'future-proof' the use of space in universities by integrating new digital technologies, *Perspectives: Policy and Practice in Higher Education*, 23(1), pp.18–23.

Ellis, R.A. and Goodyear, P., 2016. Models of learning space: Integrating research on space, place and learning in higher education, *Review of Education*, 4(2), pp.149–191.

Ellis, R.A. and Goodyear, P., eds. 2018. *Spaces of teaching and learning. Understanding teaching-learning practice*. Singapore: Springer.

ETO [e-teaching.org], 2020. E-teaching.org. Available at: <https://www.e-teaching.org/> [accessed 7 August 2020].

FAB101, 2020. Das Projekt FAB101. Available at: <https://fab101.de/> [accessed 6 August 2020].

FHB, 2020a. Programm "Digitalisierung" (2016–2021). Fachhochschule Bielefeld. Available at: <https://www.fh-bielefeld.de/hochschule/organisation/hochschulverwaltung/dezernat-qi/programm-digitalisierung> [accessed 8 August 2020].

FHB, 2020b. MIND. Fachhochschule Bielefeld. Available at: <https://www.fh-bielefeld.de/mind> [accessed 8 August 2020].

FHP [University of Applied Sciences Potsdam], 2020. FH Potsdam wählt neuen Vizepräsidenten für besondere Aufgaben – Campusentwicklung. Available at: <https://www.fh-potsdam.de/informieren/aktuelles/news-detailansicht/artikel/fh-potsdam-waehlt-neuen-vizepraesidenten-fuer-besondere-aufgaben-campusentwicklung/> [accessed 5 August 2020].

Finkelstein, A., Ferris, J., Weston, C. and Winer, L., 2016. Research-informed principles for (re)designing teaching and learning spaces. *Journal of Learning Spaces*, 5(1), pp.26–40.

Fisher, K., 2005. Linking pedagogy to space: proposed planning principles. Victoria, Australia: Department of Education and Training Victoria. Available at: <https://www.education.vic.gov.au/Documents/school/teachers/teachingresources/interdisciplinary/ict/pedagospace.pdf> [accessed 1 September 2020].

FMJCP [Federal Ministry of Justice and Consumer Protection], 2019. Basic law for the Federal Republic of Germany. Berlin: Federal Ministry of Justice and Consumer Protection. Available at: https://www.gesetze-im-internet.de/englisch_gg/englisch_gg.pdf [accessed 12 June 2020].

GEW [Gewerkschaft Erziehung und Wissenschaft], 2020. Analyse der Verpflichtungserklärungen der Länder. Available at: <https://www.gew.de/aktuelles/detailseite/neuigkeiten/analyse-der-verpflichtungserklaerungen-der-laender0/> [accessed 3 August 2020].

GG [Grundgesetz], 2019. *Grundgesetz für die Bundesrepublik Deutschland*. Bonn: Parlamentarischer Rat (1949). Available at: <https://www.gesetze-im-internet.de/gg/GG.pdf> [accessed 30 July 2020].

Granito, V.J. and Santana, M.E., 2016. Psychology of learning spaces: Impact on teaching and learning, *Journal of Learning Spaces*, 5(1), pp.1–8.

Günther, D., Kirschbaum, M., Kruse, R., Ladwig, T., Prill, A., Stang, R. and Wertz, I., 2019. *Zukunftsfähige Lernraumgestaltung im digitalen Zeitalter*. Thesen und Empfehlungen der Ad-hoc Arbeitsgruppe Lernarchitekturen des Hochschulforum Digitalisierung. Arbeitspapier Nr. 44. Berlin: Hochschulforum Digitalisierung (HFD). Available at: https://hochschulforumdigitalisierung.de/sites/default/files/dateien/HFD_AP_44-Zukunftsaehige_Lernraumgestaltung_Web.pdf [accessed 3 August 2020].

GWK [Gemeinsame Wissenschaftskonferenz], 2019. Verwaltungsvereinbarung zwischen Bund und Ländern gemäß Artikel 91b Absatz 1 des Grundgesetzes über Innovation in der Hochschullehre. Bonn. Available at: https://www.gwk-bonn.de/fileadmin/Redaktion/Dokumente/Papers/Verwaltungsvereinbarung-Innovation_in_der_Hochschullehre.pdf [accessed 3 August 2020].

GWK [Gemeinsame Wissenschaftskonferenz], 2020. *Zukunftsvertrag Studium und Lehre stärken*. Available at: <https://www.gwk-bonn.de/themen/foerderung-von-hochschulen/hochschulpakt-zukunftsvertrag/zukunftsvertrag/> [accessed 3 August 2020].

Höfler-Hoang, B., Röder, D. and Ertz, F., 2020. Digitalisierung als Teil der Universitätsentwicklung. Strukturen, Angebote und Ziele der Universität Trier. In: R. Stang and A. Becker, eds. 2020. *Zukunft Lernwelt Hochschule. Perspektiven und Optionen für eine Neuausrichtung*. Berlin: De Gruyter Saur, 35–43.

HOOU, 2020. Hamburg Open Online University. Available at: www.hoou.de [accessed 8 August 2020].

HSM [Hochschule München], 2020. *Lehrraum der Zukunft*. Available at: https://www.hm.edu/allgemein/lehren/lehrraum_der_zukunft/index.de.html [accessed 6 August 2020].

Huang, R., Spector, J.M. and Yang, J., 2019. *Educational technology. A primer for the 21st century*. Singapore: Springer.

IWM [Leibniz Institut für Wissensmedien], 2020. Leibniz Institut für Wissensmedien. Available at: <https://www.iwm-tuebingen.de> [accessed 7 August 2020].

Kariippanon, K.E., Cliff, D.P., Lancaster, S.J., Okely, A.D. and Parrish, A-M., 2019. Flexible learning spaces facilitate interaction, collaboration and behavioural engagement in secondary school, PLoS ONE 14(10): e0223607. Available at: <https://doi.org/10.1371/journal.pone.0223607> [accessed 13 August 2020].

KMK [Kultusministerkonferenz], 2016. Solide Bauten für leistungsfähige Hochschulen. Wege zum Abbau des Sanierungs- und Modernisierungsstaus im Hochschulbereich [Solid buildings for efficient universities. Ways to reduce the renovation and modernisation backlog in the higher education sector]. Decision of the Standing Conference of Ministers of Education and Cultural Affairs on 11 February 2016. Available at: https://www.kmk.org/fileadmin/Dateien/veroeffentlichungen_beschluesse/2016/2016_02_11-Abbau-Sanierungsstau.pdf [accessed 22 June 2020].

KMK [Kultusministerkonferenz], 2020. Beschlüsse und Veröffentlichungen – Wissenschaft/Hochschule [Decisions and publications – Science/Higher education institutions]. Available at: <https://www.kmk.org/dokumentation-statistik/beschluesse-und-veroeffentlichungen/wissenschaft-hochschule.html> [accessed 30 July 2020].

LABU [Laboratory University], 2020. Die LaborUniversität der Universität Leipzig. Leipzig. Available at: <https://www.stil.uni-leipzig.de/teilprojekte/laboruniversitat/> [accessed 7 August 2020].

Leiber, T., 2016a. Mission statements and strategic positioning of higher education institutions: A case study of 29 German universities. In: Rosalind Pritchard, Attila Pausits and James Williams, eds. 2016. *Positioning Higher Education Institutions. From Here to There*. Dordrecht: Sense Publishers, pp.99–124.

Leiber, T., 2016b. Persönlichkeitsentwicklung als elementares Bildungsziel. Methodische Optionen der Umsetzung und Bewertung im Hochschulbereich, *die hochschullehre. Interdisziplinäre Zeitschrift für Studium und Lehre*, 2, 21 S. Available at: http://www.hochschullehre.org/wp-content/files/diehochschullehre_2016_leiber.pdf [accessed 5 August 2020].

Leiber, T., 2019a. Organizational change and development through quality management in higher education institutions: theory, practice and recommendations for change agents. In: Robert G. Hamlin, Andrea D. Ellinger and Jenni Jones, eds. 2019. *Evidence-based initiatives for organizational change and development*. Hershey (PA): IGI Global, pp.316–341.

Leiber, T., 2019b. Responsibility and the future mission(s) of the University. Exploration of sustainable core strategies and competencies and a plea for the strategic open republic of scholars and students. Presentation, EAIR 41st Annual Forum “Responsibility of Higher Education Systems: What? Why? How?”, LeidenUniversity, Leiden, The Netherlands, 25-28 August 2019. Available at:

https://www.evalag.de/fileadmin/dateien/pdf/medien/2019/leiber_eair_leiden_190826_act.pdf [accessed 27 July 2020].

Leiber, T., 2019c. A general theory of learning and teaching and a related comprehensive set of performance indicators for higher education institutions, *Quality in Higher Education*, 25 (1), pp.76–97.

Leuphana, 2020. Lernen und Arbeiten. Available at: <https://www.leuphana.de/services/miz/lernen-arbeiten.html> [accessed 6 August 2020].

LIV [Lehrideen vernetzen], 2020. Lehrideen vernetzen. Ein hochschulübergreifendes Vernetzungsprojekt. Mainz. Available at: <https://lehrideen-ernetzen.de/> [accessed 7 August 2020].

LLZ [Zentrum für multimediales Lehren und Lernen], 2020. Zentrum für multimediales Lehren und Lernen. Halle-Wittenberg. Available at: <https://www.llz.uni-halle.de/> [accessed 7 August 2020].

Lutz, S., 2016. Kommentierungen zu den Landeshochschulgesetzgebungen. Ein Überblick, *Ordnung der Wissenschaft*, 2, pp.131–134.

LWH [Lernwelt Hochschule], 2020. Zukunft der Hochschule gestalten – Lernwelt Hochschule 2030. Available at: <https://zukunfmlernwelthochschule.de/> [accessed 4 August 2020].

Mayring, P., 2019. Qualitative content analysis: Demarcation, varieties, developments, *Forum: Qualitative Social Research*, 20(3), Art. 16. Available at <http://www.qualitative-research.net/index.php/fqs/article/view/3343/4558> [accessed 13 August 2020].

ML [Multimedia-Leitbild], 2020. Multimedia-Leitbild der Martin-Luther-Universität Halle-Wittenberg. Halle-Wittenberg. Available at: <https://www.llz.uni-halle.de/multimedia-leitbild/> [accessed 7 August 2020].

Ninnemann, K., 2018. *Innovationsprozesse und Potentiale der Lernraumgestaltung an Hochschulen. Die Bedeutung des dritten Pädagogen bei der Umsetzung des Shift from Teaching to Learning*. Münster: Waxmann.

Ninnemann, K., Rózsa, J. and Sutter, C., 2020. Zur Relevanz der Verknüpfung von Lernen, Raum und Organisation. Paradigmenwechsel vom Lehren zum Lernen an der SRH Hochschule Heidelberg. In: R. Stang and A. Becker, eds. 2020. *Zukunft Lernwelt Hochschule. Perspektiven und Optionen für eine Neuausrichtung*. Berlin: De Gruyter Saur, pp.176–187.

Nissler, A. and Prey, G., 2018. Neue Lehre – neue Räume? In: A. Weich, J. Othmer, and K. Zickwolf, eds. 2018. *Medien, Bildung und Wissen in der Hochschule*. Wiesbaden: Springer, pp.225–239.

OML [openMINTlabs], 2020. openMINTlabs – Virtual laboratories for greater learning success. Available at: <https://www.openmintlabs.de/#top> [accessed 9 August 2020].

Petschenka, A., Stang, R., Becker, A., Franke, F., Gläser, C., Weckmann, H.-D. und Zulauf, B., 2020. Die Zukunft der Lernwelt Hochschule gestalten. Ein Baukasten für Veränderungsprozesse. In: R.

Stang and A. Becker, eds. 2020. *Zukunft Lernwelt Hochschule. Perspektiven und Optionen für eine Neuausrichtung*. Berlin: de Gruyter Saur, pp.213–256.

Prill, A., 2019. *Lernräume der Zukunft. Vier Praxisbeispiele zu Lernraumgestaltung im digitalen Wandel*. Arbeitspapier Nr. 45. Berlin: Hochschulforum Digitalisierung. Available at: https://hochschulforumdigitalisierung.de/sites/default/files/dateien/HFD_AP_45-Lernraeume_der_Zukunft_Praxisbeispiele_Web.pdf [accessed 23 June 2020].

ProLehre, 2020. ProLehre | Media and Didactics. Technical University Munich. Available at: <https://www.prolehre.tum.de/home/> [accessed 7 August 2020].

Radcliffe, D., Wilson, H., Powell, D. and Tibbetts, B., eds. 2009. Learning spaces in higher education. Positive outcomes by design. *Proceedings of the Next Generation Learning Spaces 2008 Colloquium*. Queensland: The University of Queensland.

Ruiz, M. and Schwanck, A., 2015. *Allokation und Steuerung von Flächenressourcen in Hochschulen (FLHO): Abschlussbericht zum Forschungsprojekt*. Schriftenreihe der Professur für Betriebswirtschaftslehre im Bauwesen, No. 22. Weimar: Bauhaus-Universitätsverlag. Available at: <https://www.econstor.eu/bitstream/10419/107706/1/819846309.pdf> [accessed 12 August 2020].

Seitter, W. and Feld, T.C., 2019. Räume in der wissenschaftlichen Weiterbildung: Zur Einleitung in den Band. In: W. Seitter and T.C. Feld, eds. 2019. *Räume in der wissenschaftlichen Weiterbildung*. Wiesbaden: Springer, pp.1–17.

SLUB, 2020. Arbeitsplätze und Arbeitsräume. Available at: <https://www.slub-dresden.de/service/arbeitsplaetze-arbeitsraeume/> [accessed 6 August 2020].

SQELT, 2020. *Sustainable quality enhancement in higher education learning and teaching*. Erasmus+ Strategic Partnership. Available at: <https://www.evalag.de/sqelt/> [accessed 29 July 2020].

Stang, R., 2017. Lernraumgestaltung an Universitäten. Zur Relevanz physischer Lernräume im Kontext der Digitalisierung, *Erziehungswissenschaft*, 28(55), pp.29–36.

Stang, R. and Becker, A., eds. 2020. *Zukunft Lernwelt Hochschule. Perspektiven und Optionen für eine Neuausrichtung*. Berlin: de Gruyter Saur.

Stang, R., Becker, A., Franke, F., Gläser, C., Petschenka, A., Weckmann, H.-D. and Zulauf, B., 2020. Herausforderung Lernwelt Hochschule. Perspektiven für eine zukünftige Gestaltung. In: A. Becker and R. Stang, eds. 2020a. *Lernwelt Hochschule. Dimensionen eines Bildungsbereichs im Umbruch*. Berlin: de Gruyter Saur, pp.182–210.

Stibbe, J., 2018. Die Rollen der Landesbaubetriebe und Hochschulen im Spannungsfeld Sanierungsstau. Zwischen dynamischen Gebäudeanforderungen und begrenzten Mitteln im Hochschulbau. HIS-HE:Medium, 1. Available at: https://his-he.de/fileadmin/user_upload/Publikationen/Medium/Medium-1-18_Sanierungsstau.pdf [accessed 12 August 2020].

Stibbe, J., Stratmann, F. and Söder-Mahlmann, J., 2012. Distribution of the responsibilities of property management of the universities of the federal states [Verteilung der Zuständigkeiten

des Liegenschaftsmanagements für die Universitäten in den Ländern], *Forum Hochschule*, vol. 9, 2012.

StudiTUM, 2020. StudiTUM – Häuser der Studierenden. Available at: <https://www.sv.tum.de/themen-projekte/studitum-haeuser-der-studierenden/> [accessed 6 August 2020].

Talbert, R. and Mor-Avi, A., 2019. A space for learning: An analysis of research on active learning spaces, *Heliyon*, 5, 19 pages. Available at: <https://doi.org/10.1016/j.heliyon.2019.e02967> [accessed 13 August 2020].

Temple, P., 2007. *Learning spaces for the 21st century. A review of the literature*. London: The Higher Education Academy.

THW [Technische Hochschule Wildau], 2020. Digital Competence Center. Available at: <https://www.th-wildau.de/hochschule/zentrale-einrichtungen/digital-competence-center/> [accessed 9 August 2020].

UB [University of Bamberg], 2020. Teilbibliotheken. Available at: <https://www.uni-bamberg.de/ub/teilbibliotheken/> [accessed 6 August 2020].

UBI [Universität Bielefeld], 2020. Lernorte. Available at: <https://www.uni-bielefeld.de/studium/studierende/start-ins-studium/lernorte/> [accessed 9 August 2020].

UBMA [Universitätsbibliothek Mannheim], 2020. Learning center. Available at: <https://ukw-innenarchitekten.de/ub-mannheim-learning-center/> [accessed 10 August 2020].

UCISA [Universities and Colleges Information System], 2016. *The UK Higher Education Learning Space Toolkit*. Available at: <https://www.ucisa.ac.uk/resources/the-uk-higher-education-learning-space-toolkit> [accessed 23 June 2020].

UDE, 2017. Strategy for digitisation in teaching and learning. Available at: https://www.uni-due.de/imperia/md/images/e-learning/strategie/e-learning-strategiepapier_englisch_neu.pdf [accessed 7 August 2020].

UDE, 2020. Digitalisierungsstrategie der Universität Duisburg-Essen. Available at: <https://www.uni-due.de/e-learning/digitalisierungsstrategie.php> [accessed 7 August 2020].

UGOE [Universität Göttingen], 2020. Digital creative space. Available at: <https://www.uni-goettingen.de/de/digital+creative+space/603458.html> [accessed 9 August 2020].

UH [Universität Hamburg], 2020. Online-Self-Assessment des Projektbereichs “Hochschule und studentische Partizipation”. Available at: <https://studpart.check.uni-hamburg.de/> [accessed 6 August 2020].

UHN [University of Hannover], 2020. Projekt Lernraum- Lernorte, Beratung, IT & Medien. Available at: <https://www.zqs.uni-hannover.de/de/qs/lernraum/> [accessed 9 August 2020].

UKS [Universität Kassel], 2020. LEO – Lernort. Available at: <https://www.uni-kassel.de/einrichtung/servicecenter-lehre/besser-studieren/leo-lernort> [accessed 9 August 2020].

UNSW [University of New South Wales], 2016. Design Principles for Learning Environments. Available at: https://www.learningenvironments.unsw.edu.au/sites/default/files/documents/UNSW_design_principles_learning_environments_Aug_2016.pdf [accessed 23 June 2020].

VHB [Virtuelle Hochschule Bayern], 2020. Virtuelle Hochschule Bayern. Bamberg. Available at: <https://www.vhb.org/> [accessed 7 August 2020].

Vogel, B., Willige, J., Grützmacher, J. and Sudheimer, S., 2019. Orte des Selbststudiums 2018. Forum Hochschulentwicklung, 1. Available at: https://his-he.de/index.php?eID=tx_securedownloads&p=131&u=0&g=0&t=1596132016&hash=fa0b5f1c7991ce8a1cfe69b05fcd2809b7ee9ddf&file=/fileadmin/user_upload/Publikationen/Forum_Hochschulentwicklung/fh-012019.pdf [accessed 29 July 2020].

Weichert, H., 2020. Dimensionen gesetzlicher Rahmungen. Perspektiven deutscher Hochschulgesetzgebung. In: A. Becker and R. Stang, eds. 2020a. *Lernwelt Hochschule. Dimensionen eines Bildungsbereichs im Umbruch*. Berlin: de Gruyter Saur, pp.47–58.

Wertz, I., 2020. Zukunftsorientierte Lernräume. Kompetenzorientierung im Fokus. HIS-HE:Medium 2/2020. Hannover: HIS-Institut für Hochschulentwicklung e.V. Available at: <https://his-he.de/publikationen/detail/zukunftsorientierte-lernraeume> [accessed 10 August 2020].

WR [Wissenschaftsrat], 2019. Empfehlungen zu hochschulischer Weiterbildung als Teil des lebenslangen Lernens. Vierter Teil der Empfehlungen zur Qualifizierung von Fachkräften vor dem Hintergrund des demographischen Wandels [Recommendations on higher education as part of lifelong learning. Fourth part of the recommendations for the qualification of specialists against the background of demographic change]. Drs. 7515-9. Available at: <https://www.wissenschaftsrat.de/download/2019/7515-19.pdf;jsessionid=BF9F8A3A8801A370E25A51415EF94290.delivery1-master?blob=publicationFile&v=7> [accessed 22 June 2020].