

# Impact of the COVID-19 pandemic on the digitalization and strategic development of German universities

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## Abstract

The HIS-Institute of Higher Education Development (HIS-HE) conducted a nationwide survey among Higher Education leaders about the extent to which the push for digitalization at German higher education institutions related to the COVID-19 pandemic has promoted strategic engagement with digitalization and how such experiences have been integrated into concepts for the future of teaching and learning. The findings show that the effects of the pandemic are most evident in the digitalization of teaching formats, while many infrastructural and technical developments had already been initiated before the pandemic and were at most accelerated.

When the COVID-19-related developments of digitalization are analyzed with regard to structural characteristics of the HEIs represented in the sample, it becomes apparent that there are no fundamental differences between universities and universities of applied sciences. Only the universities of arts and music are distinguished by the fact that the pandemic-related changes are generally smaller and fewer innovations are to be expected after the pandemic.

The range of disciplines of the HEIs also proves to be relevant when comparing HEIs with and without STEM subjects, as the former group shows a significantly greater dynamic of change.

Last but not least, differences can also be found with regard to the existence of a digitalization strategy. Universities with a digitalization strategy not only have a head start in terms of experience, since they already offered online teaching or hybrid formats before the pandemic. Rather, they have changed their teaching and examination formats particularly extensively in the course of the pandemic and are planning to a greater extent to use instruments and formats for digital teaching in the future.

# 1 Introduction

To manage the COVID-19 pandemic, universities worldwide have almost immediately switched to “emergency remote teaching” (Hodges et al., 2020), but very soon implemented a more comprehensive digitalization of teaching and learning (Bosse et al., 2020). And it is not only teaching that suddenly has been transformed from face-to-face to online formats. Also, most of the administrative staff at the universities have been working from their home offices, and the university IT departments had to provide the necessary technical infrastructure very rapidly. To what extent has this gigantic digitalization push at the universities promoted the strategic discussion of digitalization? Have the experiences gained during the COVID-19 pandemic been integrated into appropriate future concepts at the universities? To answer these questions, the HIS Institute for Higher Education Development (HIS-HE) conducted an online survey among all leaders of German higher education institutions in September 2021 on behalf of the Hochschulforum Digitalisierung (HFD), in which 126 HEIs, approximately 30% of the existing HEIs in Germany, participated. The HEIs were asked about the general effects of the COVID-19 pandemic as well as specific changes in teaching, learning and assessment, about developments in the spatial and technical infrastructure and about the type and scope of support services for teaching and learning. This article focuses on a comparative analysis of differences in the pandemic-induced digitalization push and its sustainable integration based on selected variables, i.e. type of higher education institution, subject profile and IT governance. The study was completed in January 2022 and is available soon for download in German (Lübcke et al., in print).

## 2 Findings of the study

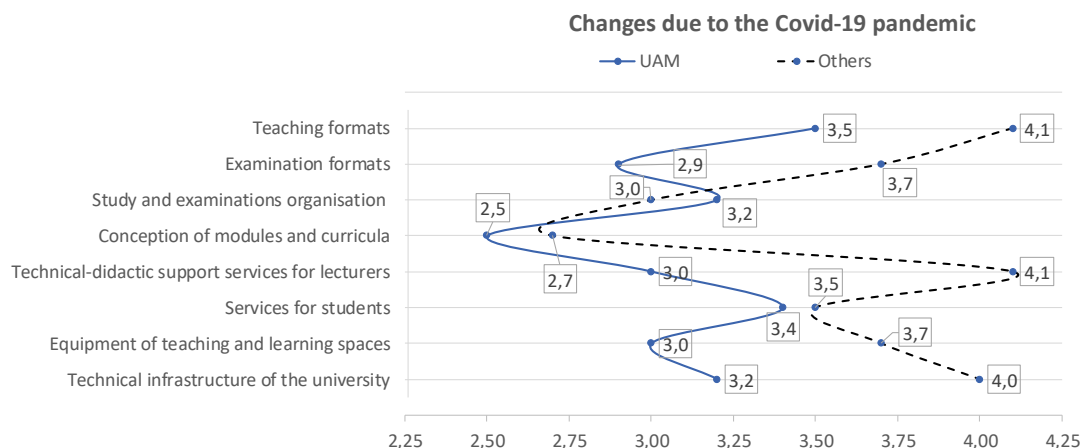
### 2.1 General results

Overall, the study found that the general effects of the COVID-19 pandemic with regard to digitalization are most evident in the change of teaching formats, followed by changes in the technical-didactic support services for teachers as well as the technical infrastructure. Together with the equipment of teaching and learning spaces, these are also the areas in which, according to university leadership, digitalization should continue to progress in the future. In contrast, the pandemic-related changes in the area of examination formats as well as the organization of studies and examinations are limited to the exceptional situation of pandemic at about half of the HEIs or to be maintained only selectively.

However, the results also reveal that not all innovations were first initiated by the pandemic and that developments initiated prior to the pandemic will be maintained. This also applies, for example, to developments in the area of spatial-technical infrastructure such as teaching rooms with video conferencing systems, self-learning areas and group workplaces equipped with digital equipment. In the area of technical infrastructure and support services for teachers and students, the pandemic generally seems to have had less of an effect as a driver, since many measures such as the expansion of computer centers and IT structures and university-wide WLAN were already introduced before the pandemic for a majority of the universities (and further measures are still planned). In line with a trend that has been discernible for some time, however, more than half of the universities state that they want to outsource IT services and cooperate with other universities on IT services. On the other hand, the pandemic is likely to have had a significant influence on the finding that HEIs expect increasing demands on support and infrastructure and that a large majority of HEIs are therefore striving to expand and promote exchange and networking on digital teaching.

## 2.2 Comparison of HEI types

A comparison of the pandemic-related changes with regard to the different types of higher education institutions - universities, universities of applied sciences (UAS) and universities of art and music (UAM) - shows few significant differences between universities and UAS. Thus, minor differences in the development of modules and curricula as well as in services for students can be identified, as the UAS tend to indicate that they have made more changes in this area than the universities. However, these differences are rather small compared to the differences that can be seen between universities and UAS on the one hand, and universities of art and music on the other. At the latter, the pandemic-related changes are less pronounced across almost all areas examined, and only selective or minor adjustments to teaching and examination formats were made at these universities in the majority of cases (see figure 1). In particular, the proportion of face-to-face teaching before and after the pandemic shows a significant difference at the UAM as it is significantly higher compared to the other types of HEIs. The UAM state that they held an average of 93.7% of their teaching face-to-face before the pandemic, and thus an average of 9.2% more than the other HEIs. After the pandemic, the UAM still expect an average of 75.6% face-to-face teaching, which still corresponds to a reduction of 18.1%. In contrast, at the remaining universities, the university leaders expect a decrease of 27.1 %. This is also evident in the status of digitalization and teaching development, as it is noticeable here that digitalization is not a focus of the UAM's teaching mission statement or teaching strategy, and that digitalization in studying and teaching on UAMs is only partially accepted by students and lecturers.



**Figure 1:** Comparison of universities of arts and music (UAM) and other universities with regard to Covid-19 pandemic-related changes: "Please rate how much the pandemic-related change to a digital university has induced changes in the following areas of your university." (Mean values on a scale of 5 from "no change" (=1) to "fundamental change" (=5))

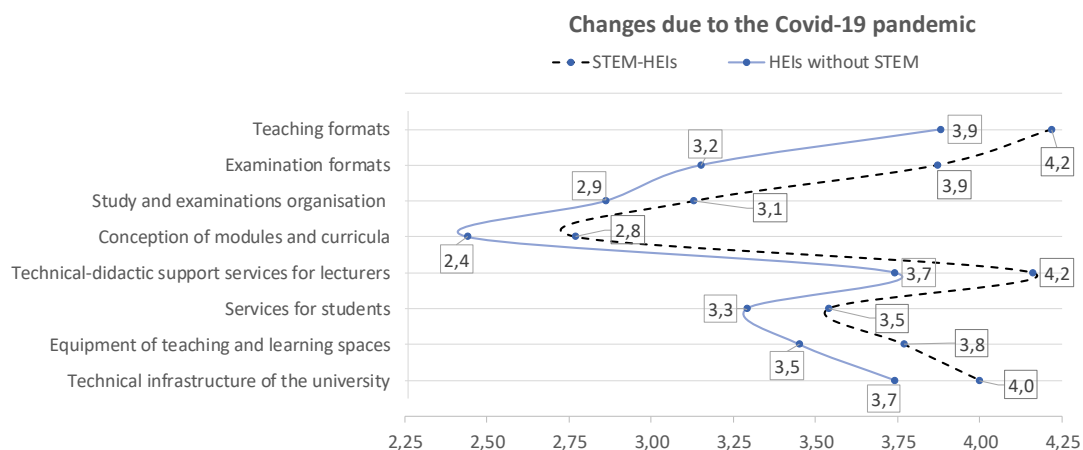
## 2.3 Comparison by spectrum of disciplines

It has been shown that the UAM have significantly more difficulties in implementing digitalized teaching and learning services, as these with their very specific range of disciplines, are apparently the HEI type for which digitalization activities are the most distant. This suggests to further analyze discipline-specific differences. In the following, HEIs that offer either science/mathematics or technology/engineering or mathematics or both (STEM) as a structural feature in their subject portfolio are therefore distinguished from HEIs that offer neither of the two subject groups. As the following

findings show, the difference between the two groups is so distinctive that it can be concluded that the degree of digitalization at a HEI is also subject-driven.

Even though, at least in engineering sciences at universities, considerable efforts seemed to be necessary in previous years to align studies and teaching more strongly with the new challenges in the area of digitalization (Gottburgsen et al., 2019), the pandemic-driven transition to digital university operations has led to significantly more changes at HEIs that have STEM subjects than at HEIs that do not have STEM courses (see Figure 2). Across all areas surveyed, the STEM HEIs show greater changes on average than the HEIs without STEM subjects. Particularly with regard to examination formats, the mean value for the STEM universities is 3.9, i.e. almost at (4) "comprehensive changes", while the universities without STEM subjects have made more selective changes (mean value 3.2). The differences with regard to changes in the area of teaching formats, examination formats as well as technical-didactic support services for lecturers also prove to be significant.

With regard to the question of which of these changes will also be important in the future, the STEM universities show more clearly across all areas that they want to continue or enhance their innovations. The significant differences are most evident in the examination formats and the development of modules and curricula. The mean value of the STEM universities for the changes in examination formats as well as for the changes in the development of modules and curricula is 3.4, i.e. between (3) "digitalization is largely maintained" and (4) "digitalization should be further advanced", while the mean value of the universities without STEM subjects is 2.6 in both areas and thus lies between (2) "digitalization is selectively maintained" and (3) "digitalization is largely maintained".



**Figure 2:** Comparison of STEM and NON-STEM universities with regard to Covid-19 pandemic-related changes: "Please rate how much the pandemic-related change to a digital university has induced changes in the following areas of your university."  
(Mean values on a scale of 5 from "no change" (=1) to "fundamental change" (=5))

There is also a clear difference between HEIs with STEM subjects and HEIs without STEM when the timing of the initiation of measures with regard to teaching and learning is in question. For example, the combination of face-to-face and online teaching and the promotion of cross-university cooperation in the area of teaching and examination development was only initiated by most non-STEM HEIs in the course of the pandemic and is planned to be further advanced in the future, while STEM-related HEIs initiated these developments before the pandemic. The differences between the two groups of HEIs are even more apparent with regard to the use of OER and experimental spaces for innovative

teaching and examination concepts. Both were initiated at the majority of the STEM universities before the pandemic and are also to be continued; the majority of the other universities cannot yet assess this development. The use of augmented or virtual reality in teaching is not planned by the majority of the group of HEIs without a STEM profile, while the group of HEIs with a STEM profile had already introduced these technologies before the pandemic. At the time of the survey, the group of HEIs without STEM subjects ruled out the future use of learning analytics and AI algorithms for study guidance and adaptive learning, as well as the introduction of new modular degrees. The majority of HEIs with STEM subjects, on the other hand, did not initiate the topic area of AI and learning analytics before the pandemic, but are planning to use it in the future. The role of modular degrees is not ruled out by the majority, but is rated as "not yet assessable".

Differences also emerge with regard to the use of different forms of examination. For example, the majority of HEIs without a STEM profile have not yet initiated any written distance examinations without supervision and are not planning to use them. The majority of universities with STEM subjects, on the other hand, have opened up this option during the pandemic and intend to continue doing so. Even before the pandemic, the majority of them enabled digital examinations on site and want to expand this further, while the HEIs without STEM subjects do not want to offer this option in the future. With regard to innovative teaching and learning spaces, there is still a greater need for clarification at the HEIs without STEM subjects. The establishment of creative spaces, maker and innovation spaces, but also learning centers with workplaces and support services is not yet foreseeable for a majority of this group of HEIs, while the majority of STEM-related HEIs already offered these services before the pandemic and plan to continue to do so.

Compared to HEIs without a STEM focus, the leaders of STEM HEIs state somewhat more frequently that digitalization is a focus of the teaching mission statement and is one of the explicitly mentioned profile characteristics in the mission statement of the HEI. On average, STEM universities rate the fact that digitalization is a focus of the mission statement as "rather true" (mean value 3.9). HEIs without STEM subjects have an average of 3.1 ("partly true"). STEM universities also rate the fact that digitalization is one of the explicitly mentioned profile characteristics in the mission statement of the university as "somewhat true" (mean value 4.0), while universities without STEM subjects only partially agree with this statement.

In the information provided by the HEIs' management as to whether their HEIs has teaching or digitalization strategies in the form of written, published concepts (see the following chapter), it becomes clear that STEM universities have a digitalization or teaching strategy significantly more often than HEIs without STEM subjects. The mean value for digitalization strategies at STEM universities is 3.0, which means that a strategy exists but is currently being revised. For HEIs without STEM subjects, the average is 2.4, which means, on the other hand, that there is predominantly no digitalization strategy, but that it is being planned. For teaching strategies, with a mean value of 3.6, STEM universities range between (3) "Yes, [teaching strategy exists, but is] currently being revised" and (4) "Yes, [teaching strategy] exists and is partially implemented", while universities without STEM subjects are at 2.7.

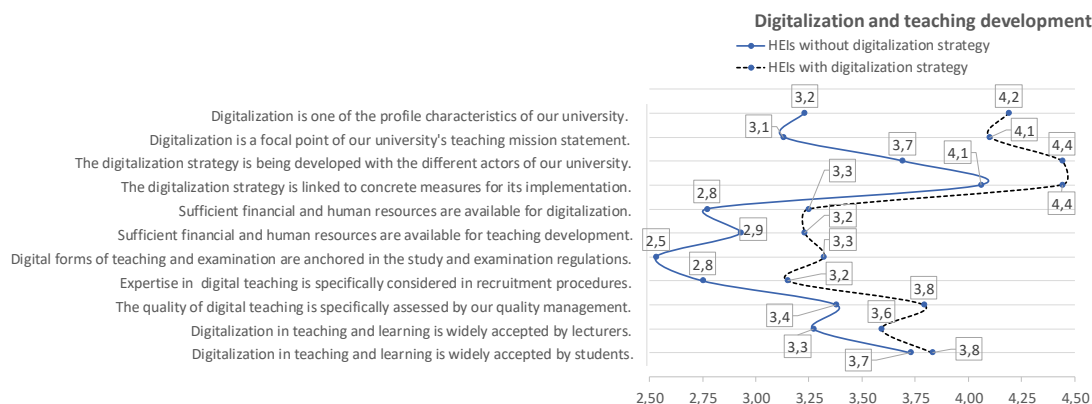
## 2.4 Comparison by digitalization strategy

Another dimension of comparison that has been analyzed is the existence of a digitalization strategy. About half of the universities surveyed report that they have a digitalization strategy. This group is mainly composed of the participating universities and UAS and only to a small extent of the universities of arts and music.

With regard to the pandemic-related changes in various higher education areas and also with regard to which changes should be retained, there are hardly any differences between HEIs with a digitalization strategy ("HEIs-with") and HEIs without such a strategy ("HEIs-without"). Only with regard to the changes in the area of examination formats the HEIs-with show, that comprehensive changes have been

made, while HEIs-without have rather only made selective changes. The difference with regard to maintaining the digitalization of teaching formats is also significant. The mean value of 3.3 at HEIs-without means that the digitalization of teaching formats is to be largely retained. HEIs-with, on the other hand, state more frequently (mean value 3.7) that the digitalization of teaching formats should not only be maintained, but should be further advanced.

With regard to the anchoring of digitalization and teaching development, it should be noted that HEIs-with are also more likely to have a teaching strategy or to have already implemented their teaching strategy further than HEIs-without. As expected, and across almost all items at a statistically significant level, this difference is also reflected in the findings on the status quo of digitalization and teaching development (see figure 3). In the first group, digitalization is a focal point of the teaching mission statement and is one of the profile characteristics explicitly mentioned in the university's mission statement. The anchoring of digitally supported forms of teaching and examination in the study examination regulations is more strongly pursued by HEIs-with. The availability of financial and human resources for digitalization is also rated better by the management of HEIs-with. Interestingly, digitalization is more widely accepted by lecturers at HEIs-with, while there are hardly any differences between the two groups in terms of acceptance by students.



**Figure 3:** Comparison of HEIs with and without digitalization strategy: "Please rate how much the following statements on digitalization and teaching development apply to your university." (Mean values on a scale of 5 from "not applicable at all" (=1) to "very applicable" (=5))

With regard to the involvement of persons (groups) and committees in the strategic discussion of the effects of the COVID-19 pandemic, it becomes clear that HEIs-with involve slightly more actors overall than HEIs-without. It is noticeable that the crisis team/task force, the management of central service facilities for (digital) teaching and learning and the deans, faculties or departments are more involved in the strategic debate at many HEIs-with and are also planned as driving forces for future changes. At many HEIs-without, these groups have also been involved in the strategic debate to date, but are not planned to play a central role for future changes. Many HEIs-with also state that the CIO is involved in the debate and is also planned as the lead for future changes, while many HEIs-without cannot yet assess the involvement of the CIO. With regard to the IT committee/commission, many HEIs-with state that it is involved in the debate but is not scheduled to take the lead for future changes, while many HEIs-without cannot yet estimate the involvement of the IT committee/commission. Last but not least, there is also a difference in the use of internal university data, which is classified as "rather relevant" at HEIs-with (mean value 3.8), while at HEIs-without the assessment that it is "partly relevant" prevails (mean value 3.2).

### 3 Conclusion

HIS-HE has analyzed the extent to which the push for digitalization at higher education institutions related to the COVID-19 pandemic has promoted strategic engagement with digitalization and how such experiences have been integrated into future concepts for teaching and learning. While a preceding nationwide survey among German universities had shown in 2018/2019 that digitalization was of great importance for teaching and learning in general, but that the actual implementation status of digitalization at German universities was much more restrained (Gilch et al., 2020), the present study reveals that extensive effects of the pandemic are most evident in the digitalization of teaching formats, while many infrastructural and technical developments had already been initiated before the pandemic and were at most accelerated.

If the COVID-19-related developments of digitalization are analyzed with regard to structural characteristics of the HEIs represented in the sample, it becomes apparent that there are no fundamental differences between universities and universities of applied sciences. Only the universities of arts and music are distinguished by the fact that the pandemic-related changes are generally smaller here and fewer innovations are to be expected after the pandemic.

The range of disciplines of the HEIs also proves to be relevant when comparing HEIs with and without STEM subjects, as the former group shows a significantly greater dynamic of change.

Last but not least, differences can also be found in the existence of a digitalization strategy. Universities with a digitalization strategy not only have a head start in terms of experience, since they already offered online teaching or hybrid formats before the pandemic. Rather, they have changed their teaching and examination formats particularly extensively in the course of the pandemic and are planning to a greater extent to use instruments and formats for digitally supported teaching in the future.

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