Digital Transformation after Covid-19 and the Balancing Act of Digital Teaching

A Qualitative Study

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***Abstract*—With the Covid-19 pandemic, academic teaching changed fundamentally and university teachers across the board came into contact with the opportunities and challenges of digital teaching. The impact of this change, with both positive and negative consequences, requires adjustments at different levels of the university system, ranging from re-design of learning formats, to the expansion of qualification offers for teachers, to new rules for what is credited towards the teaching load. An exploratory study was conducted to examine the impact of the pandemic on university faculty attitudes toward digital teaching and reflect on the advantages and disadvantages that have arisen as a result of digital teaching and what benefits the independence of location and time as well as the possibilities of digitalization have yielded for teachers and students. Additionally, the study aimed to analyze perceptions of and opinions on digital teaching as well as statements about future teaching. For this purpose, 13 semi-structured interviews with higher education teachers and deans of studies at a large German university were conducted and analyzed using inductive categorization. One result is that teachers describe the use of digital tools and methods as more natural and perceive a digital culture change, also thanks to improved infrastructure. Furthermore, four positions could be identified that describe the different perspectives of higher education teachers on the possibilities of digital teaching and the value of on-site teaching. When assuming a certain degree of heterogeneity among students, this results in a tension field of advantages and disadvantages for students, depending on the chosen teaching formats and preferences of the teachers. In this article, reasons behind these four different perspectives are discussed as well as recommendations given for the future design of post-pandemic teaching.**

Keywords-culture change; digital transformation; digital learning and teaching; higher education; digital accessibility.

I. INTRODUCTION

During the Covid-19 pandemic, academic teaching changed fundamentally and university teachers across the board came into contact with the opportunities and challenges of digital teaching. The impact of this change brought both positive and negative effects [1]. Teaching was largely maintained and many teachers experienced an increase in digital teaching skills, but the dynamics of the transition often led to emergency solutions that only insufficiently exploited the didactic potential of digital media [2]. The question arises whether, beyond this emergency remote teaching [3], teachers today perceive a stronger anchoring as well as more natural use of digital media in teaching. Such a digital culture shift requires instructors to (voluntarily) move away from familiar teaching strategies and practices [4], which many instructors are hesitant towards [5]. Conversely, culture change also requires students to adapt their learning habits [6]. Graf-Schlattmann et al. [7] describe a prerequisite for culture change as social acceptance in the teaching environment. All stakeholders share the conviction that the changes associated with transformation are necessary and are associated with both individual and organizational benefits.

The first reaction of many universities after the end of the full lockdown was to return entirely to on-site teaching. However, as experience reports show, this also has many disadvantages for students and teachers, and especially the aspect of (digital) accessibility [8][9][10]. The (forced) experiences with digital teaching, without the possibility to meet in presence, were perceived very differently on several levels. With regard to study organization, flexibilization, study performance and learning success, communication and interaction, motivation and competencies, both positive and negative experiences were made by students and higher education teachers [8]. During the pandemic, it also became clear that what is a relief for some can be a complication for others [11]. It can be seen that educators must operate in an area of tension with respect to post-pandemic digital teaching. Considering their own needs and the needs of a heterogeneous student body is a particular challenge. Although higher education recognizes the diversity of students as reality in its mission statements, in reality heterogeneous learning situations are rarely taken into account in the conception of teaching scenarios, or are only taken into account by teachers when students articulate individual needs and request support [9].

An explorative, qualitative study was used to investigate the impact of the pandemic on university teachers' attitudes toward digital teaching and whether the experiences during the pandemic have led to a digital culture change in teaching. This involves a more detailed analysis of the patterns of argumentation found among teachers with regard to the selection and design of teaching formats and scenarios and how they justify their decisions for and against digital teaching. Section II describes the conducted qualitative study.

We asked about consequences of the pandemic on teaching, experiences during the pandemic related online semesters, about changing attitudes and possible reservations about digital teaching, and the advantages teachers see in digital teaching, in order to illuminate a possible area of tension caused by different needs and teaching requirements. This results in the following three research questions for analysis:

RQ1: What are the perceived impacts and consequences of the pandemic on academic teaching for higher education teachers in the post-pandemic period?

RQ 2: What reservations do higher education teachers express about digital teaching and how does this impact the future conception of their courses?

RQ 3: What advantages do teachers see in digital teaching and what should be retained after the pandemic induced online semesters?

Section II describes the research design, the data collection methods, the selection of participants and the methodological approach to data analysis. In Section III, the findings from the interviews conducted are presented in detail and discussed in Section IV Some teachers prefer on-site teaching and have concerns about digital methods, while others recognize the benefits, such as increased motivation and organizational ease. It is emphasized that a balance must be found between the advantages and disadvantages of both approaches in order to create inclusive and effective teaching. Finally, the last Section V, conclusion and future work, highlights the four positions that describe the tension between digital and face-to-face teaching. It emphasizes the importance for teachers to consider these different perspectives at both an institutional and individual level.

II. Methodological Approach

In order to answer the research questions, a total of 13 individual interviews were conducted with teachers from a large German university. Eight interview partners were from faculties of the natural sciences and medicine, three from social sciences, and two from the humanities. Among the 13 interview partners, 10 were simultaneously acting deans of studies of their respective faculties. The interviews were carried out in German language and the transcripts of the interviews were translated into English. The guiding questions were slightly modified for this group of persons. The individual interviews were carried out between 07/01/2022 and 08/02/2022 via videocall using Zoom videoconferencing software. To ensure the anonymity of the interviewees, no further personal data was collected.

The interview procedure chosen was the problem-centered interview according to [12]. This method tries to let interview partners speak as freely as possible to come as close as possible to an open conversation. At the same time, however, the interview is oriented toward a previously determined problem, the details of which are compiled in advance in an interview guide. For the study, two guides for research questions were developed (deans of studies and higher education teachers). To avoid the interviewees formulating their assessments of reservations and advantages of digital teaching too broadly or too abstractly, they were asked to describe their experiences and impressions from different phases of the COVID-19 pandemic in each case. This is reflected in the wording of the questions in the interview guides, which respectively refer to the lockdown phase of the pandemic with Emergency Remote Teaching [13] and the post-pandemic phase, in which teaching returned to a "New Normal" [14]. The two interview guides included the following questions:

Interview guiding questions for deans of studies: How did faculty members perceive virtual teaching during the past three online semesters? Are the teaching experiences from this time viewed more positively or negatively? To what extent? / What do you think are the reasons for this?

In your estimation, inasmuch did the Corona pandemic change attitudes toward digital teaching among faculty members, if at all?

What were the reactions of faculty members this semester when the "back to on-site teaching" tendency emerged?

What reservations about digital teaching do you currently perceive on behalf of the faculty? (technical problems, social problems, didactic limitations, etc.). In your estimation, to what extent are these reservations related to the experiences from the Corona semesters?

Interview questions for teachers: How do you assess your experiences with digital teaching during the past Corona semesters? What are the reasons for your assessment?

What negative effects of digitalization processes in teaching do you see? What kinds of downsides emerge from them?

Has your attitude towards digital teaching changed as a result of the pandemic? In what way?

Have you used digital teaching practices, methods and tools from the Corona semesters in this semester? - If not, what are the reasons for this?

The recorded interviews were automatically transcribed with the software Amberscript and completely anonymized so that no more conclusions can be drawn about persons or subject discipline. Subsequently, the material was analyzed in a Qualitative Content Analysis (QCA) according to Mayring [15] with the software QCAMap. An inductive evaluation method was chosen, in which the category system is developed from the material concurrently with the analysis and evaluation process, guided by the research questions. The coding of the interviews was done in an inter-coder procedure with two coders each. The reliability of the overall result was ensured by checking all codes during an evaluation conference with all four coders. In this session, major

categories were also formed from the individual categories, which are described in the following section.

III. RESULTS OF THE QUALITATIVE CONTENT ANALYSIS

The qualitative content analysis of the transcripts was conducted along the three research questions RQ1, RQ2 and RQ3 (see Section I) and the results are presented separately below.

A. *Perceived impacts and consequences of the pandemic on academic teaching for higher education teachers in the post-pandemic period (RQ1)*

With regard to the perceived impact on post-pandemic teaching (RQ1), a total of 32 categories were identified during the analysis of the interviews, which could be assigned to five superordinate categories (cf. Tab. I). Along these upper categories, a selection of the most relevant categories will be discussed in more detail below.

1) Digital Normality

Nearly all interview partners (12 of 13) describe that in the course of the pandemic distance learning, a new normality of using digital media in teaching has emerged. This digital cultural shift toward a New Normal [14] has led to changes in the design of teaching that are currently still ongoing and have lingering effects. In particular, faculty cite the decreased skepticism toward digital teaching due to the growth in experience (RQ1-01) during the pandemic. Even if the turn to online-supported teaching was not entirely voluntary, in retrospect it is seen as valuable, as described by interviewee 8, for example:

> *"So that has definitely been a positive side effect of the fact that you were forced to teach digitally. That one has acquired the techniques and then also seen the advantages, which of course also exist." (IP08)*

In the course of the positive experiences, the willingness of the interviewed teachers to increasingly use digital elements in teaching grew (RQ1-19) and to offer events hybrid, i.e., both synchronously and asynchronously (RQ1-17). The fact that the use of digital media has become more natural for the lecturers and that the initial skepticism has decreased is also observed by interviewee 9. In his function as Dean of Studies, he describes the development thus:

> *"I think it was an experience and development work for many lecturers. So, I perceived that as a dean of students, [there] was a lot of rejection in the beginning. So, people wanted to stick close to their usual format, the lecture or seminar. So, in the beginning, people didn't get along well with asynchronous, but thought that if anything, then synchronous. And at that time I'm standing in my lecture hall as usual and well, then a camera is running if it has to be. And that was, that was a lot of voices at the beginning. And then in the three semesters, already in the second semester, I noticed that there was a development that people got involved in offering more and more asynchronous lectures. This means that lectures and seminars are first recorded and then made available at another time. So, all in all, after the three semesters, I would say that the overwhelming majority or the vast majority of the faculty have found this to be an enrichment." (IP09)*

As faculty became more willing to engage in teaching with digital media, interviewees also became more eager to try out new technologies and experiment with digital elements and tools (RQ1-21). At the same time, faculty reported how the new digital normal emerged outside the teaching context as well. For example, videoconferencing became a natural means of communication (RQ1-24) even beyond the Covid19 pandemic. As further evidence of the incipient cultural change towards a new digital normality, attitudes of lecturers towards their own digital teaching actions can be seen: The respondents are very satisfied with their own digital teaching (RQ-3) and, as individual teachers report, would also like to continue using digital elements (RQ-8). Even if these teachers are still a minority at the moment, interviewee 6 nevertheless emphasizes

> *"[...] that it's still a minority, but maybe not a very small one, that would say 'Well, even if it's not required at all because of the pandemic, I'll definitely turn on online elements.'" (IP06)*

Instructors also observe the newly normalcy of digital university teaching in changing and continuing student behavior. For example, faculty report that students increasingly view face-to-face and online teaching as equally valid alternatives. On the one hand, while instructors note a decreased willingness of students to be mobile due to the pandemic (RQ1-6), as well as an increased expectation among students that content be additionally offered digitally (RQ1-27). Students would also prefer to use recordings instead of attending face-to-face lectures (RQ1-9) and would be more likely to stay away from face-to-face lectures if digital alternatives were offered (RQ1-20). On the other hand, students do not seem to want the digital normality of university teaching to be complete digitization. Rather,

students expect digital offerings to be available as a matter of course in order to be able to adapt their studies as flexible as possible to individual circumstances, as interviewee 9 notes:

> *"I think it looks different for students than for teachers, yes. With students, you hear more often that they really want to have a choice, presence or digital. For different reasons, personal reasons." (IP09)*

TABLE I.
EFFECTS OF COVID 19 REGARDING DIGITAL TEACHING (RQ1)

CATEGORY ID	CATEGORY NAME	ABSOLUT COUNT
Digital becomes normal - cultural change		53
RQ1-1	Increased experience and less scepticism towards digital teaching	19
RQ1-3	High satisfaction with own digital teaching during C19 among teachers	4
RQ1-6	Students less willing to move after C19	2
RQ1-8	Teachers would like to continue teaching digitally	3
RQ1-9	Students want to make more use of recordings instead of attending face-to-face lectures as a result of their experience during the pandemic	3
RQ1-17	Teachers offer hybrid courses (synchronous & asynchronous)	5
RQ1-18	Students use face-to-face courses despite online offers	2
RQ1-19	Teachers more willing to use digital elements	7
RQ1-20	Students stay away from face-to-face courses if digital alternatives are available (e.g., recording, streaming etc.)	2
RQ1-21	Teachers start experimenting with digital elements and tools	2
RQ1-24	Video conferencing has become normal and is no longer a hurdle	1
RQ1-27	Adoption of digital teaching practices and methods in face-to-face teaching	2
RQ1-30	Students increasingly use digital devices in the courses	1
Experience gain		21
RQ1-4	Increased experience and more scepticism towards digital teaching	3
RQ1-10	Teachers more willing to make content available digitally	4
RQ1-14	Teachers felt confirmed in their opinion regarding digital teaching	3
RQ1-15	Teachers are positively surprised by the possibilities of digital teaching	2
RQ1-16	Teachers could gain experience with digital teaching	6
RQ1-22	Teachers feel prepared for future disruptions to face-to-face teaching	2
RQ1-31	Students increasingly work with digital tools (e.g., for seminar recordings etc.)	1
Establishment of new organisational structures and digital infrastructure		8
RQ1-12	Contributes to learning success	1
RQ1-25	Is popular among students	3
RQ1-26	Good online offers are used and replace face-to-face offerings	4
Improvement of teaching		7
RQ1-11	More care in the creation of teaching-learning materials	1
RQ1-13	Teachers are more concerned with the needs of students	2
RQ1-23	Increased student participation and collaboration	1
RQ1-28	Establishment of innovative teaching formats (e.g., flipped classroom)	2
RQ1-29	Teachers were happy to return to face-to-face teaching	1
Lowered motivation and willingness to perform		6
RQ1-2	Students have agreed on online examinations	1

RQ1-5	Drop in student performance due to C19	3
RQ1-7	Corona used as an excuse by students for poor academic performance	1
RQ1-32	Indiscipline of students with digital teaching	1
		95

2) Increase in experience of Teachers in Higher Education

As a further effect of the pandemic on university teaching, an increase in experience can be identified in the interviews. The interviewees observe this increased experience in dealing with digital teaching (RQ1-16) primarily in themselves as well as in their colleagues. In this context, they report on the special circumstances of the pandemic, which led them to methodological-didactic experiments that they would not have attempted in normal face-to-face operations:

> *"A lot of things during that time, from a didactic point of view, were also exciting at times, because we had to try things that we might never have taken on otherwise, or might not have even dared to try." (IP11)*

The teachers interviewed would like to continue to use the skills they acquired during the pandemic in dealing with digital media. This is expressed, for example, in a greater willingness to provide content in digital form in addition to traditional classroom teaching (RQ1-10):

> *"I have learned something and I am very happy about that because I can now continue to use it. So now I know how to make videos and I will certainly continue to do that, offer videos or Yes, you can also do that for exercises. So that's definitely been a positive side effect of being forced to teach digitally." (IP08)*

The assessments of the teachers regarding the possibilities of digital teaching differ greatly. Some teachers report in the interviews that they are positively surprised by the didactic possibilities of digital teaching (RQ1-15), whereas others feel rather confirmed in their opinion of digital teaching (RQ1-14). This assessment is shared especially by those interviewees who already had a positive attitude towards digital teaching before the pandemic, such as interviewee 10:

> *"[...] I would say I was open-minded about it before. I am now, too. In that respect, the real attitude has not changed." (IP10)*

However, individual teachers also repeatedly express their skepticism about the possibilities of digital teaching in the interviews (RQ1-4). Based on their experiences during the pandemic, these teachers have a rather negative assessment of the effectiveness of digital teaching and, like interviewee 4, are rather disillusioned:

> *"[...] the reservations have become greater. [...] we know how it works, but it works badly." (IP04)*

Even if the instructors have different assessments of the potential of digital media for university teaching, most of the interviewees see themselves as well prepared for future interruptions of face-to-face teaching at the university (RQ1-22), as interviewee 6 also states:

> *"And there I would say, however, so even if there is once again, let's say, forced, a considerable transition is necessary, there I would already say, based on the experience we have gained there, we should actually be quite well equipped." (IP06)*

3) Establishment of new organizational structures and digital infrastructure

The perception of a common usage of digital tools and methods is accompanied by the perception of a surge in digitalization that has facilitated the uncomplicated and low-threshold use of digital tools due to an improved infrastructure (RQ1-25). The establishment of this infrastructure enables straightforward digital working for students as well as instructors, as an example statement shows.

> *"I cannot remember bringing printed-out slides either; rather the students bring their tablets and practically take notes on my slides. That is very noticeable for me. It seems like there was a technology boom among the students." (IP13)*

Moreover, since the onset of the pandemic, digitalization services are available at the university, for example at the library or in laboratories, making the production and distribution of digital materials easier (RQ-26).

> *"Using the university library for very quickly available scans, for example, as digital data. You know, after the university library was closed down. Everybody perceived that very positively." (IP12)*

These digital materials are then made available asynchronously online or used for on-site teaching (RQ1-26). As an example of application, interviewee 12 goes on pointing out:

"And of course, at least that is also the case at our department, there has been a bit of a shift towards […] well, we developed teaching elements, developed digital elements, that can then be used in on-site teaching." (IP 12)

However, an improved infrastructure and the provision of digital services are not the sole outcome of this surge in digitalization. It has also had an impact on the establishing of new organizational structures, such as working groups at departments that function as Communities of Practice and provide cooperative support for the use of digital tools and methods (RQ1-12).

"So, in early April we already established a working group on digital teaching that I was a member of." (IP05)

4) Improvement of teaching

Beyond the infrastructural and organizational changes, faculty members also perceive a qualitative improvement of teaching to be a result of the pandemic. Firstly, instructors report being more diligent in creating teaching-learning materials for digital scenarios (RQ1-11). Secondly, also during the pandemic, they thoroughly attended to the students' concerns (RQ1-13).

"During the Corona times, many instructors engaged with their students quite intensively, so that the social aspects were never fully lost." (IP05)

That intensive interaction between instructors and students is also possible during asynchronous learning phases and results in high quality teaching (RQ1-23) can be seen in a statement of interviewee 11.

"So, we've reached a higher level, which we noticed in the students' inquiries, in the participation and the joint work on the material that was previously provided online." (IP11)

Instructors also acknowledge the increased flexibility of their day-to-day business due to the possibilities opened up by digitalization (RQ1-29). As an example, interviewee 12 mentions the practical and flexible option to digitally communicate with students via video conferencing.

"And right now I find that, I don't find that inconvenient or impractical at all, the scheduling of, of appointments and of supervision meetings, I have in fact held several of those via zoom, of course also during the past semesters after the pandemic. And I believe that this is well-received, if you're just a bit flexible." (IP12)

5) Decreased motivation and willingness to perform

In addition to the aforementioned improvements, instructors also perceive negative impacts of the pandemic on teaching and learning in higher education. Some instructors report a drastic decrease in student performance during the pandemic (RQ1-5), which manifests in a higher percentage of weak exam performances and a lacking willingness to perform (RQ1-7). Instructors also observe that some students struggle with bridging gaps and making up for deficits as they have difficulty motivating themselves to resume their studies, thus widening the gap between high- and low-performing students.

"But the low-performing students don't read anymore at all. And then you notice, it's drifting apart." (IP05)

Furthermore, individual instructors reported negative behavior on behalf of the students during the pandemic. They mentioned students colluding during online exams (RQ1-2) as well as how some students' lack of discipline impaired their teaching.

„First you turn off the video, to still keep the sound, which keeps working. But once it is sound only, suddenly there is no reply anymore […] or then the mobile phone rings. You know these effects. And of course we can always attribute this to a lack of discipline. We can say, okay, he should come to Frankfurt, given that being a student is his main occupation, he should already get proper equipment and a proper DSL connection and so on. That's something you can expect, it doesn't cost much these days. But sadly we also always have to deal with the students' lack of discipline." (IP04)

B. Reservations about digital teaching (RQ2)

The reservations about digital teaching expressed by the teachers in the interviews address social, didactic, organizational and technical aspects. The statements of the teachers were assigned to a total of 56 different subcategories, which in turn can be summarized in 10 main categories (See Tab. II). A selection of the most relevant categories will be discussed in more detail in the next section.

1) Social aspects: Lack of contact and absence

Frequent concerns expressed by teachers about digital teaching relate to social aspects of the teaching-learning process, such as a lack of social contact, insufficient contact with the subject and also (physical) absence from the learning

location. The interviewees complain that there is no direct contact in online scenarios (RQ2-1) and thus no real discourse and dialogue as well as no sufficient interaction (RQ2-2). Interview partner 3 (IP03) describes it like this:

> *"Even in the lectures we try to include as many practical elements as possible. And even if it's just a matter of discussing problems and getting the students involved in the dialogue, so to speak, so that they have to think about it and follow the train of thought and not just sit there and let it wash over them. Of course, that doesn't work in the digital world." (IP03)*

Digital teaching would also lack the spontaneous small talk before and after the lecture (RQ2-23). As online lectures end abruptly, student communication is assumed to suffer (RQ2-39) due to a lack of opportunities for exchange, discussion and reflection (RQ2-24, RQ2-25). This is regretted by interview partner 5:

> *"On the way to the seminar, they talk about the content of the seminar, as well as about the lecturer. But they reflect in the process. This reflection is lost." (IP05)*

2) Pedagogical-didactical reservations and motivational aspects

Some of the reservations expressed in the interviews relate to the didactic design possibilities of digital teaching. In the eyes of some interview partners, these are less effective than those available in face-to-face teaching (RQ2- 36). Likewise, the willingness and ability of students to perform presumably decreases in online teaching (RQ2-22). Several of the interviewees also point out that digital teaching- learning formats are didactically flawed and generally do not correspond to their ideas of "good" teaching (RQ2-11). Interview partner 6 says, for example, videos would tend to prevent engagement with texts (RQ2-38):

> *"To understand the digitization of teaching as a bit of an alternative to text-based teaching, so to speak, in the direction of, let's say, video or audio content, that would also be a problem from our specialist point of view" (IP06)*

Teachers are also dissatisfied with the didactic possibilities of the existing systems. In their opinion, the systems and tools are not very appealing in design and could be more playful (RQ2-31). Teachers also perceive the "digital divide" associated with online teaching as problematic, i.e. the effect that high-achieving students benefit more from digital teaching than lower-achieving students, who tend to be disadvantaged by the use of online teaching (RQ2-53). Interview partner 8 describes their experience as follows:

> *"I think that to those who are good didn't matter that much because they dealt with it well. But those who are not so good, you lost them to a certain extent because you couldn't nudge them directly." (IP08)*

The respondents attributed this effect to the fact that lower- performing students in particular were less motivated in online teaching (RQ2-10). Due to the lack of scheduled learning opportunities in presence as well as the lack of social exchange, students partly lose the structure for their daily study routine (RQ2-47) and learn less as well as less independently (RQ2-42).

3) Organizational and legal barriers

In addition to concerns about the didactic reservations of digital teaching, the interview partners also mention organizational and legal reservations about the increased use of virtual and hybrid teaching formats. Digital teaching is above all time-consuming (RQ2-5) and expensive (RQ2-32), as teachers sometimes have to familiarize themselves with new tools first (RQ2-45), must first create or prepare additional materials or provide additional online support. According to the interviewees, the additional workload then leads to work intensification and deadline pressure (RQ2-27). Teachers see it as particularly problematic that the amount of work they invest in producing and supporting additional digital courses is not remunerated (RQ2-37). Interview partner 6 said:

> *"Well, I'm basically doing face-to-face teaching, but I'm also doing a lot of nice digital stuff on top of it, a bit of personal commitment that you do because it's close to your heart. But the effort is somehow not compensated in a certain way." (IP06)*

In addition to the extra effort, respondents also raise legal concerns about the use of digital teaching. For example, Interview partner 3 argues that online is rarely compatible with legal regulations such as the licensing regulations for medical professions (RQ2-18):

> *"If we do not return to real practical content, we are not educating future doctors properly. That is a very clear fact. So we are in breach of the licensing regulations, so to speak, if we continue to keep them away from the hospital bed." (IP03)*

Last but not least, respondents also fear that their digital course material will be distributed uncontrolled and illegally on the web (RQ2-13).

4) Technical barriers

The implementation of digital teaching is inextricably linked to the use of different digital tools, systems and technologies. Thus, various reservations are also mentioned in the interviews that are closely related to the use of technology as well as the specific characteristics of the respective technologies used. In addition to infrastructural problems such as an inadequate WLAN connection (RQ2-54), the usability of the available digital systems is criticized as being inadequate, especially for "beginners" and digitally less inclined teachers (RQ2-9). Interview partner 10:

> *"Where the eLectures are recorded and where you can also upload things yourself as a user. [...] I also used that once, I have to say at the beginning, and then found it complicated after all." (IP10)*

It is often the university's own systems that do not work well (RQ2-46). Another reservation is the fact that some technological solutions (such as AR or VR applications) offer didactic advantages, but cannot be used properly on a broader scale at present (RQ2-19) as interview partner 3 argues:

> *"VR is indeed quite nice, but as I said, it is still a long way from being usable for all students. There are not enough devices." (IP03)*

In addition to these points, which relate more to the teachers themselves, the interviewees also bring up technical barriers on the part of the students that limit or even prevent their participation in digital teaching. First and foremost, an insufficient internet connection of the students is mentioned (RQ2-17) as well as a general uncertainty of the teachers due to the technical challenges on the part of the students (RQ2-41).

5) Personal reservations and lack of teaching skills

While the reservations about digital teaching described so far tended to be of an external nature, the respondents also mentioned internal reasons. These include, on the one hand, personal sensitivities and preferences of the teachers, but, on the other hand, also their own teaching competence levels, which are perceived as insufficient. The personal reservations mentioned include fear of the unknown (RQ2-49) or the uncomfortable feeling of communicating with students via camera and microphone (RQ2-40). For example, interview partner 12 reports that

> *"the tiles were black, and speaking to a black screen, especially in the first semester, for example, was considered by many to be very unusual or difficult to get used to and not very advantageous." (IP12)*

Furthermore, some teachers have the opinion that a majority of their colleagues would prefer face-to-face teaching to online teaching (RQ2-34) or they themselves could not imagine teaching online (RQ2-48). However, there were also complaints about the lack of support from the university, especially with technical problems (RQ2-51), which prevented them from incorporating more digital elements into teaching. Interview partner 11 is disillusioned, given that

> *"the technical support was rather poor and we had to work out a lot on our own." (IP11)*

Last but not least, the teachers also surveyed a lack of competences as a reason for not offering more digital teaching. The main reason cited here is the lack of digital skills among teachers (RQ2-4), which made it difficult to deal with the tools needed, as interview partner 5 explains:

> *"Of course, there were enormous difficulties in dealing with a digital format, for example. So how do I actually do an online session or something?" (IP05)*

Similar problems in the use of technologies for digital teaching are described by interview partner 2:

> *"But I have no idea how to create these videos in a visually different way and maybe put them on another page. [...] Or what is a Scorm learning content. These are all things that you normally have no idea about" (IP02),*

and interview partner 13

> *"How does zooming work? What is the best way to do it? [...] There was a lot of uncertainty on all sides." (IP13)*

A lack of didactic skills is also cited as a further obstacle to the more extensive use of digital teaching (RQ2-20). Interview partner 5 recognizes the greater deficit here.

> *"For me, it was relatively clear that the know-how was still lacking on the part of the teachers, both from a didactic and a technical point of view. Above all from a didactic point of view." (IP05)*

In addition to the competence deficit, the interviewees also mention the problems caused by the introduction of new technologies (RQ2-6) and insufficient guidance and

instruction on new digital systems as further barriers to the use of digital teaching (RQ2-52).

TABLE II.
RESERVATIONS ABOUT DIGITAL TEACHING (RQ2)

CATEGORY ID	CATEGORY NAME	ABSOLUT COUNT
Lack of contact with the subject matter		**32**
RQ2-3	Blackboard notes difficult to transfer into digital format	3
RQ2-7	Experiments and practicals not transferable to digital	13
RQ2-8	Lack of haptics, lack of contact with real-world objects	10
RQ2-15	certain course is not suitable for digital teaching	4
RQ2-56	Teaching at the bedside not transferable to digital	2
Missing competencies		**35**
RQ2-4	Lack of digital competence of teachers	15
RQ2-6	Introduction of new technology causes problems	8
RQ2-20	Teachers lack didactic competencies for digital teaching	4
RQ2-21	Available tools are too complicated	6
RQ2-52	Insufficient guidance/instruction for new digital systems	2
Lack of social contact		**56**
RQ2-1	Lack of direct contact/social contact	23
RQ2-2	Online no dialogue/no argumentation/no interaction possible	24
RQ2-22	Organizational questions can be clarified faster and easier in presence	1
RQ2-23	In the digital world, "small talk" is missing / events end abruptly	1
RQ2-24	Without e.g., walking together to the place of learning, there are no opportunities for discussion and reflection of the contents	4
RQ2-25	Lack of exchange with colleagues	1
RQ2-39	Communication between students suffers in the digital world in comparison to the presence.	1
RQ2-50	Lack of body language in video conferences	1
Organizational reservations		**29**
RQ2-5	Organizational reservations	13
RQ2-14	Digital teaching is time-consuming	3
RQ2-27	Infrastructure operated in parallel causes additional effort	1
RQ2-29	Digital teaching leads to increased workload and time pressure	2
RQ2-32	Digital teaching must be well prepared	2
RQ2-37	Good digital teaching is expensive	7
RQ2-45	(Additional) digital teaching offers cause unpaid additional work for the teachers	1
Technical reservations		**25**
RQ2-9	Usability of systems for "beginners" insufficient	8
RQ2-17	Insufficient Internet connection for students	5
RQ2-19	Technical solutions not widely applicable (e.g., VR)	2
RQ2-28	Affinity for digital teaching / digital technologies among teachers very heterogeneous	1
RQ2-33	Lack of system freedom (e.g., when using an LMS)	1
RQ2-41	Uncertainty due to technical challenges on the part of students	2
RQ2-46	University's own solutions do not work so well	2
RQ2-54	Technical hurdles	4
Motivation & learning success		**18**
RQ2-10	Lack of motivation of (lower-performing) students for online teaching	13
RQ2-16	Students put off digital teaching and do not manage to work it up	1
RQ2-42	Students learn less/do not learn as independently as before	2
RQ2-47	Students lose fixed structures for their daily study routine	2
Didactic reservations		**27**

RQ2-11	Digital formats have shortcomings/do not correspond to ideas of good teaching	9
RQ2-12	Performance of average students decreases with online teaching	5
RQ2-30	Teachers no longer teach but just recycle their old screencasts/slides	2
RQ2-31	Systems and tools could be more playful	2
RQ2-36	digital teaching is less effective than face-to-face teaching	1
RQ2-38	digital teaching (especially videos) hinders engagement with texts	2
RQ2-43	Students have inhibitions to participate	2
RQ2-44	Digital teaching is dull/boring	1
RQ2-53	Digital teaching favors high-achieving students and disadvantages low-achieving students	3
Legal reservations		**5**
RQ2-13	Content from digital events ends up on the web	1
RQ2-18	Digital teaching violates legal regulations (e.g., licensing regulations for medical professions)	4
Absence		**9**
RQ2-26	Character of the university as a presence university is lost	1
RQ2-35	Students no longer come to face-to-face courses with digital offerings	7
RQ2-55	Students have become accustomed to online teaching and stay away	1
Personal reservations		**10**
RQ2-34	A majority of lecturers prefer face-to-face teaching to online teaching	1
RQ2-40	Uncomfortable feeling of communicating via camera and microphone	2
RQ2-48	Teachers can't imagine teaching online	0
RQ2-49	Fear of the unknown	1
RQ2-51	Lack of support from the university for technical problems	6

C. Advantages of digital teaching (RQ3)

In addition to the reservations, the teachers were also asked in the interviews about the advantages of digital teaching. In their experiences, teachers report on the pedagogical-didactical and technical-organizational advantages of digital teaching as well as positively perceived effects on students' motivation and learning success. In addition, they talk about advantages that compensate for individual disadvantages, as well as about increasing their own digital skills. The statements of the teachers were assigned to a total of 26 different categories, which in turn can be summarized in six main categories (See Tab. III).

1) Pedagogical-didactical, motivational and performance- related advantages

The temporal and spatial flexibility of digital, asynchronous teaching (RQ3-7) in connection with the possibilities of uncomplicated repetition of the learning materials at one's own learning pace (RQ3-8), also for the preparation and follow-up of synchronous phases, are repeatedly mentioned in the interviews as advantages and a way to self-determined learning. The following two statements are representative of several statements about these advantages:

> *"So some like it, appreciate it very much, that they can schedule things themselves, that they can work independently at home, when they want to." (IP11)*

and

> *"Asynchronous elements, especially now, when students are supposed to work on their own, alone or in study groups or so, you can design that well or even better with virtual tools." (IP12)*

Teachers also perceive that digital teaching is popular with students (RQ3-4), motivates students (RQ3-22), and contributes to learning success (RQ3-3). Students' desire to have digital teaching as a choice is reported several times. Representative of this apparently frequently expressed wish are the following two statements:

> *"Can't we also have the material virtually as well?" (IP01)*

and

> *"With students you also hear more often that they really want to have a*

choice, face-to-face or digital. For different reasons, personal reasons." (IP09)

In addition, the high motivational effect of digital teaching was also reported during the pandemic:

"They all turned on their cameras and they had a very intense exchange that 30 minutes were usually not enough for because everyone was so engaged in it." (IP05)

And they also perceived an increase in performance among some students, as interview partner 4, among others, states:

"We've made the observation that high-performing students actually show performance improvement from online teaching." (IP04)

For the future design of teaching, teachers take with them the insight from pandemic times that the mixture of digital and face-to-face offers is important, (RQ3-23) as the following quote of interview partner 9 illustrates:

"We cannot replace face-to-face teaching with digital offers, but only expand and supplement it. That's something that was a clear takeaway." (IP09)

In this context, the development of one's own competencies (RQ3-14) and the further development of one's own teaching (RQ3-1) were also perceived as positive effects of the pandemic, as described by interview partner 10 and 2 as representative of several statements in this direction:

"But I have now become acquainted with many more opportunities and possibilities. In this respect, the attitude has changed a little. I think so, because now I will also use blended learning formats more readily. And in this respect, it has changed somewhat, because I now take the opportunity more easily or more frequently, even in a seminar that does not take place virtually, but to incorporate real work phases that use virtual tools." (IP10).

"So the bottom line after the three semesters, I would say, among the colleagues the vast majority or a great majority have found this to be an enrichment. And as yes [...] now looking back at the possibility to develop one's teaching further." (IP02)

With regard to the further development of their own teaching, teachers also emphasize that the analysis of data generated by digital teaching could be used for a more precise didactic evaluation (RQ3-16).

2) Organizational advantages

In the interviews, a whole series of arguments for digital teaching came up, which concern advantages for the organization of teaching. Emphasis is placed on the easier and increased provision of learning content (RQ3-18) and recordings (RQ3-6), temporal and spatial independence (RQ3-13), and the reusability of digital materials (RQ3-2). For some programs, such as teacher education, these organizational advantages are of particular importance, as interviewee 05 makes clear:

"I have a lot of teacher trainees who have a lot of problems with overlap in their curriculum. For them, of course, it was a blessing that now in the lecture, that they can also participate asynchronously." (IP05)

In addition to making it easier for students to organize their studies, teachers also see advantages of digital asynchronous teaching for their own work (RQ3-24):

"Yes, because of course it gives teachers the opportunity to create new freedom for themselves through the asynchronous offers." (IP09)

The initially high effort to produce digital materials is now, after the creation seen as an advantage for students and as a relief for themselves, as interviewee 08 states:

"And I now have digital materials for all three semesters. If I teach this course again, then in principle I could profit from it or I would profit from it, then I could make all the digital things that I already have, I could then make them accessible again. And then, of course, that's very luxurious for the students." (IP08).

3) Advantages of digital teaching that compensate for individual disadvantages

Two interviewees also describe aspects of digital teaching that can reduce individual disadvantages for both students and teachers. With the help of digital teaching, teachers with health risks due to the pandemic were still able to offer and conduct courses (RQ3-25). In addition, one interviewee also perceives benefits for students whose personality traits allow

them to overcome disadvantages of face-to-face formats through digital teaching (RQ3-26):

> *"And yes, there are students who find it convenient when they can turn off their camera and then speak quasi-anonymously." (IP12)*

TABLE III.
ADVANTAGES OF DIGITAL TEACHING (RQ3)

CATEGORY ID	CATEGORY NAME	ABSOLUT COUNT
Didactic advantages of digital learning		**27**
RQ3-1	Digital revision leads to improvement	5
RQ3-7	Time independence of students (asynchronous participation)	8
RQ3-8	Repetition of the material is possible in an uncomplicated way (e.g., multiple viewing)	2
RQ3-9	Observation/monitoring of students more easily	1
RQ3-10	Virtual simulation enables new learning experiences	2
RQ3-16	Digital evaluation enables more accurate didactic evaluation	1
RQ3-17	New didactic possibilities	8
Organizational advantages of digital learning		**41**
RQ3-2	Reusability of digital material	13
RQ3-6	Lectures can be made available later	5
RQ3-11	Division into small groups enables intensive collaboration	4
RQ3-12	Asynchronous lectures prevent overlapping schedules	1
RQ3-13	Digital teaching enables spatial independence	11
RQ3-18	Increased provision of content	3
RQ3-20	Basic courses would not need to be held permanently	1
RQ3-21	Organization of courses becomes easier with digital tools (e.g., LMS)	1
RQ3-24	Asynchronous possibilities create freedom	2
Motivation and learning success		**29**
RQ3-3	Contributes to learning success	8
RQ3-4	Is popular among students	10
RQ3-5	Good online offers are used and replace face-to-face offerings	3
RQ3-15	Continued use through hybrid offerings ("The mix makes the difference!")	5
RQ3-22	Motivation among students	1
RQ3-23	Mix of digital and face-to-face offerings are important	2
Increasing digital competencies		**3**
RQ3-14	Increase of the own digital competence of teachers	3
Advantages that lie in the technology itself		**1**
RQ3-19	Digital tools are easy to use	1
Advantages that compensate for individual disadvantages		**2**
RQ3-25	Digital teaching preferred for health problems	1
RQ3-26	Digital anonymity makes it easier for some students to participate	1

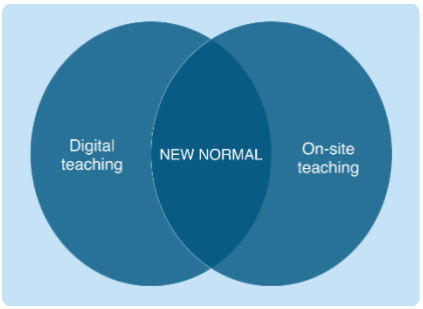

Fig. 1. The transformation toward a New Normal, with the interpenetration of digital media and methods of on-site teaching.

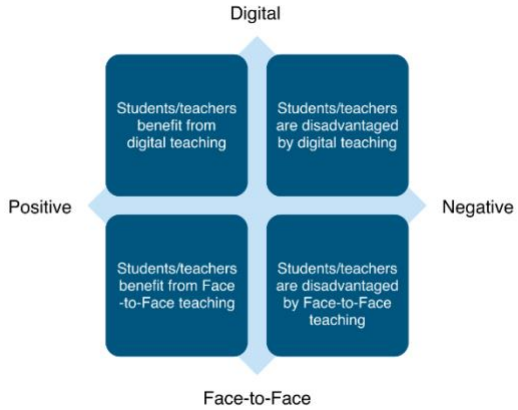

Fig. 2. The Tension field of digital and face-to-face teaching. The four positions of a teacher's view on the benefits and disadvantages regarding both settings.

IV. DISCUSSION

The results for RQ1 show that teachers perceive changes in their own teaching practices as well as in those of their colleagues, which they attribute to their experiences during the pandemic. These changes can be interpreted as an incipient digital culture change. Thus, the teachers observe a stronger anchoring of digital media in teaching. The use of digital tools in planning and conducting teaching is also becoming more natural. Instructors describe how they are changing their previous teaching strategies by incorporating lessons learned during the pandemic and incorporating their newly acquired digital teaching skills. The transformation toward this New Normal, with the interpenetration of digital media and methods of on-site teaching (Figure 1), means that the disadvantages of one or the other form of teaching (on-site versus online) can be offset to some extent. If teaching is thus set up more broadly in terms of methods (e.g., synchronous and asynchronous) and media (e.g., LMS, eLectures, videoconferencing), the needs of a heterogeneous student body are much more likely to be met. The balance act then shifts more to the question of how much resources teachers want to or can invest in differentiated teaching. The teachers interviewed also recognize changes in the learning actions of students in the sense of a cultural shift. Students are adapting their previous learning habits and are increasingly demanding the integration of digital elements and the provision of digital content. It remains to be said, however, that although digital cultural change can already be observed in various places, the process of change toward post-digital university teaching is far from complete. In their assessment of the pandemic experience, teachers come to very different conclusions. By no means all teachers are convinced of the didactic possibilities and the effectiveness of digital teaching and are prepared to change their teaching practices. This mixed picture is also reflected in the statements of the teachers regarding the advantages as well as the concerns about the use of digital media in university teaching (RQ2 and RQ3).

The results show that, after the experience of the pandemic, some teachers emphasize the desire for on-site teaching and the associated direct contact with students and colleagues. This goes hand in hand with teachers' concerns and reservations about digital teaching. Besides the pedagogical and didactic difficulties of digital teaching, they also see motivational and performance-related problems. In addition, there are personal reservations in connection with their own lack of competence and perceived organizational, technical or legal hurdles. On the other hand, however, some advantages of digital teaching are also perceived, for example with regard to motivation, pedagogical-didactical possibilities and potentials, and organizational facilitation. These different perceptions are not necessarily contradictory, but rather reflect the individual situation and perspective of teachers and students. There is a tension between the advantages and disadvantages of face-to-face and digital teaching, which poses a dilemma for the design of teaching (as illustrated in Figure 1). Advantages of a format for some may represent disadvantages for others.

A. The Tension field of digital and face-to-face teaching

In addition to aspects of isolation and loneliness or difficulties for lower-performing students, the perceived disadvantages of digital teaching relate primarily to the lack of direct exchange and dialog with students. This perception leads to a strong desire on the part of some teachers to return to the former face-to-face teaching formats rather than to maintain digital ones. This reaction risks overlooking the fact that "back to face-to-face" may well be associated with disadvantages for some students and teachers. Assuming a broad understanding of heterogeneity, respectively diversity [12], in which heterogeneous (learning) starting points are acknowledged, with different prior knowledge, interests, cognitive, motoric and sensory abilities, motivations as well as social and cultural backgrounds of students, digital elements play an eminently important role with regard to diversity-sensitive, inclusive teaching. Disadvantages of a purely verbal and fluid face-to-face teaching offer arise, for example, for students who have difficulties following due to auditory perception disorders, physical hearing impairments, reading/spelling difficulties, grief or ADHD/ADS [9] or have problems actively participating in presence due to shyness or anxiety. Advantages of digital teaching can provide significant support. A continuous asynchronous learning offer or the possibility to make use of it in addition to face-to-face teaching would be very helpful for these students. For example, students with reading and spelling difficulties have enough time to read texts, use reading programs and apps for written assignments, and enter their own written submissions, e.g., using text-to-speech software, and have them automatically checked for spelling and grammar. In the case of concentration difficulties or simply different discussion and learning speeds, an asynchronous learning offer can provide relief by allowing contributions and tasks or asynchronously conducted discussions to be worked on autonomously at one's own pace or in smaller units, so that the working memory is less burdened. In addition, for some students in special life situations, e.g., when they are prevented from attending due to illness, parenthood or other care work, a continuous asynchronous learning offer makes it possible to maintain their studies in the first place.

V. CONCLUSION AND FUTURE WORK

The qualitative study identified four positions that can be used to describe the tension between the perspectives with which teachers view the specific opportunities and threats of digital teaching and face-to-face teaching (see Figure 2). In the future, these different perspectives must be considered on two levels when designing contemporary teaching. For one, on the institutional level, in strategic decisions about the goals and orientation of academic teaching at the university. For another, on the individual level of the single teachers, in the planning and realization of their own teaching, but also in the reflection of their own teaching activities. In this context, it will be crucial to always have different possible solutions in mind in a multiperspective sense and to choose solutions that take several of these positions into account and lead to a

synthesis through dialogue [16]. Interview partner 9 also argues in favor of such an approach by speaking out against thinking in either/or categories:

> *"So it's neither a demonization of digital possibilities, but also not a clear prioritization of face-to-face presence. Yes, perhaps not just prioritization, but really the mix, it's the mix that makes it. Both have their place, digital teaching, face-to-face teaching, and you can't replace one with the other."*

In the future more research is needed to further explore this tension field of digital teaching. On the one hand, the perspective of the students is important, whose needs and wishes must be taken into account when designing digital teaching. On the other hand, the group of persons with special needs due to e.g., visual, hearing or motor impairments or with care work is interesting. Even if all students (and teachers) benefit from digital accessibility in principle, it is this group whose needs should be given special attention. Further work will focus on the question of how university teaching can become more inclusive by incorporating the possibilities of digitization [2] and in what form the multi-perspective approach described can support this process. One approach could be the creation, systematic preparation, and distribution of learning designs for inclusive, digital teaching. These patterns, which require both individual teachers (individual level) and institutes for academic development (institutional level) to create, would provide teachers with a valuable source of inspiration for designing contemporary teaching.

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