Do Students have the Means to Learn During the Coronavirus Pandemic?

Student Demands for Distance Learning in a Suddenly Digital Landscape

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Abstract

Across the globe, 2020 terms began under conditions incited by the corona pandemic. Within a relatively short amount of time, universities started to develop and implement online courses for distance learning. These changes in learning and teaching may well have been a challenge for students. The current study is about an online survey at a German full-scale university investigating the unique circumstances under which students began the digital 2020 summer term. Of approximately 38,500 students, $N = 5,563$ students from across all institutional faculties took part in the survey. Results indicate how well students are equipped with devices for digital learning; what kind of experiences they have already made with online learning; and how competent they reported feeling regarding digital learning. Moreover, group differences between faculties, degrees, and gender were investigated. The study provides important insights into digital higher education during the exceptional pandemic situation. The results are intended to feed into student counselling systems via support by way of access to devices or courses regarding digital key competences, or through counselling for students with special social burdens.

Keywords: higher education, E-Learning, ICT skills, corona pandemic

Theoretical Background

Digitalization, teaching and learning through digital media in particular, are becoming increasingly mainstream in universities. Formats and approaches such as the flipped classroom strategy (O'Flaherty & Phillips, 2015), lecture recordings, mobile learning, and the use of e-portfolios (e.g., Händel et al., 2020; Nguyen & Ikeda, 2015) complement (face-to-face) teaching, and are also employed to varying degrees in the process of learning (Blaj-Ward and Winter 2019). However, the often assumed advantages as well as the possible added value that could result from the use of digital media for universities and especially for students can only be achieved if digital media are fundamentally accepted and effectively employed by all users (Bond et al., 2018; Iivari & Ervasti, 1994; Martínez-Torres et al., 2008).

The corona pandemic led to an ad-hoc changeover at universities across the globe from predominantly face-to-face teaching to exclusively digitally supported teaching formats. This required the university implementation of digital learning platforms and (a)synchronous teaching formats within a very short time. In the context of this digital transformation, lecturers of differing experience with digital teaching formats are facing educational demands for strictly digital teaching (Surma & Kirschner, 2020). As a result, students now have to cope with novel changes to their studies. Their (oftentimes mandatory) traditional courses were marked by the physical presence of lecturers and classmates, and have since changed to distance education bolstered by e-learning formats (Guri-Rosenblit, 2005; “emergency remote teaching”; Hodges et al., 2020). Studies on remote learning provide important insights into student equipment and engagement. However, those studies do not transfer to the current situation of distance learning in a suddenly digital landscape. Hence, the current study investigates student technical equipment for participation in digitally supported teaching, student digital skills and behavior relevant to media, and further possible individual and contextual challenges at a German full-scale university.

Technical Equipment and Media Use

Studies on technical equipment and media use by students suggest that higher education students have a range of digital end-devices at their disposal (e.g. Dolch & Zawacki-Richter, 2018). For example, the United States ECAR Study revealed that, in 2018, 95% of the participating students owned a smartphone and 91% owned a laptop (Galanek et al., 2018). Surveys in the German context revealed similar numbers (Sailer et al., 2018) suggesting that students should be technically well equipped to participate in digital teaching—although inter-individual differences are to be expected.

Several studies on media use by students have been conducted that identified different user types via cluster analysis approaches (see Brandtzaeg, 2010 for a meta-analytic approach to media user types). Based on data from the CHE University Ranking 2014/15 ($N = 27,473$), Persike and Friedrich (2016) used a k-means cluster analysis to develop four distinct user clusters, which they describe as "PDF users", "e-testers", "video learners", and "digital all-rounders." Within the sample studied, about one-fifth of the students fell into the group of "digital all-rounders," while the vast majority of the remaining students showed a rather conservative use of digital media during their studies. Unequal distributions in the choice of study subjects suggest that young women, in terms of their anticipated role as working academics, attribute less importance to digital media than students in courses with a high proportion of men.

The study by O'Brien and Verma (2018) investigated the use of traditional and digital learning resources for freshmen students. The study's cluster analysis revealed a heterogeneity of student lecture-engagement patterns. Students were categorized into "traditional", "digital", "minimum", and "phantom" groups; interestingly, female students seemed to prefer digital resources rather than lecture attendance. Similarly, the media-use study by Zawacki-Richter et al. (2016) revealed that female students use social networks more often during their studies than did male students. Differences are furthermore to be expected

between traditional and non-traditional students (e.g., those with children; see Paulsen & McCormick, 2020). Finally, the study by Weber et al. (2018) investigated information-seeking behavior (traditional and online search strategies) and detected typical behaviours relative to study subject (e.g. students of the humanities or social sciences more often consult libraries but less often use online resources for information seeking). That is, in regular higher education learning contexts, different subjects seem to require different information-seeking behavior. Finally, contrary to the narrative of "digital natives" (Prensky, 2001)—to which the majority of university students would belong (Middendorff et al., 2017)—Lei (2009) reports that there are differences between simple, leisure-related and advanced media use in studies.

Information and Computer Literacy

Digital competence is both an educational concept, and a construct that is scientifically derived (Spante et al., 2018). “It is underpinned by basic skills in ICT: the use of computers to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet” (European Commission, 2006).

Differences in competence are found between subject groups. For example, Senkbeil et al. (2019) show that among both prospective and advanced students, there is a clear difference in ICT literacy between students of different subject groups. While students of linguistic or cultural studies show the lowest competency level, engineering students show the highest. Partially but not exclusively due to gender-specific preferences in subject choice, there is an imbalance in ICT literacy between male and female students, to the disadvantage of the latter.

Self-assessments of students' digital literacy can shed light on the extent to which students have achieved proficiency. Inter alia, competencies regarding the use of digital tools as well as information seeking or information sharing behavior seem to be important (Hong & Kim, 2018; Rubach & Lazarides, 2019; Weber et al., 2018), especially with regard to social distancing enforcement exacerbated by the corona pandemic. In fact, a Muilenburg and Berge (2005) study underscores the importance of recording digital skills and its relationship to

other factors. More specifically, students in online courses with very high values for self-confidence in the use of digital technologies have significantly fewer barriers in social interaction or motivation.

Accordingly, the success of the switch to digital teaching in the summer semester of 2020 may depend on access to digital end devices, previous experience in media use, as well as the digital competence of the students (supposedly related to socio-economic status, as indicated by a meta-analysis; Scherer & Siddiq, 2019). In contrast to students purposefully enrolling in a course of study at a distance teaching university (cf. Stöter et al., 2014), students studying during the corona pandemic did not voluntarily choose to participate in a digital semester themselves but were exposed to it in the wake of the pandemic. Unlike previous university-level academic practice, which typically aims for a gradual and accompanied change to digitally supported teaching formats (e.g. Hetzner & Schmidt, 2018), students, teachers, and the institution itself had to adopt a quick and pragmatic approach precipitated by the pandemic (Kerres, 2020). In addition, due to contact restrictions in place at the start of the semester, students were more dependent than usual on the equipment available to them because access to computer rooms with software, etc. could no longer be provided at universities. Furthermore, students were less able to receive technical assistance through personal contact. Finally, subgroups of students with children might have faced further challenges due to a lack of childcare (daycare and school closures).

In sum, on the one hand, previous studies indicate that higher education students should be well equipped for digital learning. On the other hand, however, there seem to be considerable differences in equipment and learning behavior between groups of students. Due to the emergency remote teaching situation that applies to all students (and not only those who are especially interested in or self-selected digital or distance studying), it is important to keep pace with changing trends in order to identify possibly disadvantaged students or to inform university management, lecturers, and counselling centers.

Aims of the Study

The aim of the study is to assess how students are equipped for the 2020 digital semester immediately before it began by way of equipment with digital devices, e-learning experiences, and self-reported digital skills. The study aims to identify groups of students with digital learning accessibility difficulties. In line with previous study results, gender and subject specific differences can be assumed. Furthermore, differences among study experience and domestic condition are considered.

Hence, the study investigates the following two research questions:

RQ1: How ready (in terms of equipment and skills) are higher education students for a complete shift to digital distance learning?

RQ2: What are the specific preconditions of higher education students with respect to their expected degree, study subject, gender, or domestic conditions?

Method

The study reports the first measurement of an ongoing longitudinal study during the summer semester 2020. The study took place as an online survey with three assessments to which all students at a full university were invited.

Procedure

In the week before the start of the official lecture period, all students enrolled at the university were invited via an e-mail correspondence from the Vice President of Education to take part in a survey on the general conditions of digital teaching (via survey access link). Participation in the survey took place via the Questback platform and was activated for 10 days.

Instruments

The students were asked about their gender and age. With regard to university variables, their study semester, their faculty, their desired degree and the current average

grade were also assessed. In addition, due to the ordered restrictions on social distancing and the lack of child care, the survey gauged the number of persons living in the household and the number of children that required care.

Furthermore, students were asked about their workplace equipment (availability and average use). For each of the ten specified equipment features (quiet workplace, desktop PC, notebook, tablet PC, smartphone, cell phone, wearables, scanner, printer, and Internet), students indicated whether features were available. If they were available, participants estimated frequency of use on a five-level scale: (almost) never, 1-2 times/month, 1-2 times/week, almost every day, and daily. An aggregated value for availability was calculated for all characteristics (min = 0, max = 10), as well as for PC devices (desktop, tablet, notebook, min = 0, max = 3). Furthermore, experiences with e-learning offerings at the university were recorded. For nine university e-learning offerings, students indicated whether they had used or were already using them. Again, values were formed into aggregated values (min = 0, max = 9). The students were also asked whether the number of planned courses was influenced by the switch to digital teaching formats (less/equal/more).

Two subscales (digital tool application—DTA and information-sharing behavior—ISB) from the Digital Readiness for Academic Engagement questionnaire were used to measure digital competencies (DRAE, Hong & Kim, 2018). Those scales are assumed to be most relevant in the sudden switch to digital learning, including webinars. The items were all translated to German and had to be answered on a six-point Likert scale (not at all correct to completely correct). Both subscales consisted of four items and were internally consistent: DTA: $\alpha = .76$, e.g. "I can use software or apps on a computer or mobile device;" and ISB: $\alpha = .83$, e.g. "I can interact with fellow students using real-time communication media, e.g. video conferencing tools or messenger services."

Sample

Of about 38,500 students who were enrolled at the university, 5,563 students (which corresponds to 15% of all students) took part in the survey. In order to obtain an inventory that was as uninfluenced as possible, students who took part in the survey after the start of the official lecture period and who stated that they had already attended digital courses in the current semester were excluded from the data analysis (this corresponds to 45 students and thus, less than 1% of the respondents). In the current sample, 62% of the respondents were female, 38% male, 0.3% non-binary; 14% did not provide any information on gender. The participating students were on average 23.2 years old ($SD = 4.5$) and were enrolled in their 4.5 semester ($SD = 2.8$).

Table 1 shows the absolute and relative frequencies in the surveyed sample, as well as the respective share of the total university student population for classification purposes. The table indicates that students participated in the survey across all five faculties and that the participation distribution corresponds well with the distribution within the university (e.g. 27.6% of the participating students were enrolled at the Faculty of Humanities, Social Sciences, and Theology, and 24.6% of the students of the full-scale university are enrolled in this faculty). The proportions are also comparable to the distribution within the total number of students with regard to desired degree.

Table 1.

Sample Separately Reported by Faculty and Expected Degree

	Frequency	% of participating students	Relative amount of students per faculty of all students
Faculty			
Faculty of Humanities, Social Sciences, and Theology	1516	27.6	24.6

Faculty of Sciences	705	12.8	14.0
Faculty of Business, Economics, and Law	1134	20.7	25.1
Faculty of Engineering	1300	23.7	26.0
Faculty of Medicine	836	15.2	10.3
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Expected degree			
Bachelor	2029	37.2	39.6
Master	1328	24.3	24.4
State exam	1930	35.4	30.1
Doctoral exam	97	1.8	3.9
Others	75	1.4	-
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Approximately 15% of the respondents lived alone at the beginning of the semester. While the majority of the students had no children to look after, just under 5% of the respondents had at least one child to look after in the household. The shares correspond to the distribution of students in Germany (Middendorff et al., 2017). For the following analyses, the variables displayed in Table 2 (number of household members and number of children) were transformed to dichotomized variables: living alone (0) versus living together with other people (1), and no children requiring care (0) versus at least one child requiring care (1).

Data Analysis

Descriptive statistics are reported to illustrate the current pandemic situation in higher education with regard to student digital equipment, relevant experience and skills. Digital competence was correlated with (a) equipment and (b) e-learning experience. Finally, multivariate (co-)variance analyses were calculated to investigate possible group differences between subject cultures (operationalized via the respective faculty), gender, and living conditions at home (persons in the household, children requiring care).

Results

First, we report on the descriptive statistics and correlations regarding the measured variables.

Descriptive Statistics

Table 2 illustrates the availability of each workstation element. Aggregated values for both equipment in the sense of the sum of all devices and for PCs (composed of the sum of desktop PC, tablet PC, and notebook) show that of the 10 equipment characteristics, there was a student availability average of 6.62 ($SD = 1.50$). Less than 1% had neither a notebook, nor a desktop/tablet PC available.

Table 2.

Availability and se of Work Area and Technical Devices

Ausstattung	availability (1 = yes)		N	use (1 = never – 5 = daily)	
	M	SD		M	SD
Work area	0.91	0.29	5014	4.01	1.06
Desktop-PC	0.31	0.46	1711	3.56	1.64
Notebook	0.91	0.29	5015	4.23	1.08
Tablet-PC	0.48	0.50	2656	3.78	1.38
Smartphone	0.98	0.13	5417	4.93	0.35
Cell phone	0.47	0.50	2580	4.76	0.83
Wearables	0.15	0.35	803	3.65	1.58
Scanner	0.65	0.48	3613	1.99	1.10
Printer	0.77	0.42	4231	2.51	1.07
Internet Access	1.00	0.07	5491	4.96	0.23

Table 2 also shows the frequency of use by those students that stated owning the respective device. While telecommunications media (cell phone, smartphone, Internet) was

used daily, the various computers (desktop, notebook, tablet) were used nearly every day; scanners and printers were only used approximately once or twice per month.

Table 3 shows whether students had already used available e-learning features. About half of the offerings ($M = 4.57$, $SD = 2.09$) had already been used by students. For example, over 90% of the students used downloadable scripts. However, only 6% of the students had already used live streams that might be typical for the semester in question. Other elements that might be important during the digital semester such as online learning modules and online communication, were already in use by more than half of the students. Comparative values from the university's 2019 summer semester student survey show that the present sample indicates similar or lesser experience in four e-learning offerings; in five of the e-learning offerings, students report more experience when compared to the 2019 students survey (see Table 3).

Table 3.

Previous Use of E-Learning (0 = no, 1 = yes) as Well as Comparative Values From the University's Student Survey From the Previous Summer Semester

E-Learning Offering	M	SD	M [regular student survey]
Downloadable lecture notes/literature	0.92	0.27	0.91
Lecture recordings	0.67	0.47	0.59
Live streams of lectures	0.06	0.24	0.08
Live media in courses	0.49	0.50	0.36
Online learning modules	0.52	0.50	0.39
Online communication and collaboration	0.63	0.48	0.66
Other online-supported learning opportunities	0.35	0.48	0.29
E-Tests	0.43	0.50	0.44

Online self-tests for self-control	0.53	0.50	0.42
No offers taken up so far	0.04	0.19	0.02

With regard to the assessed competence in handling digital media, it was found that, on a 6 point Likert scale, the students considered themselves to be rather competent in the use of digital tools ($M = 4.64$, $SD = 0.91$), as well as in the sharing of digital information ($M = 5.03$, $SD = 0.94$).

While 66.2% of students indicated that they did not change plans for the summer semester due to the digital teaching transition, 21.0% planned to participate in less courses, and 12.8% of students indicated that they plan to participate in more courses than originally scheduled.

Bivariate correlations indicate significant but weak correlations between equipment features and previous e-learning experiences with self-assessed competence ($.16 \leq r \leq .20$, $p < .001$).

Interindividual Differences in Equipment, Experience, and Self-Assessed Digital Literacy

In order to identify possible groups with more difficult access conditions or groups of students who may require targeted support, group comparisons were made using multivariate analyses of (co-)variance. Dependent variables were computer equipment, previous e-learning experience, and the two scales of self-assessed computer competence.

Differences Relative to Desired Degree

First, this study explored whether the desired degree had an influence on both the handling of e-learning offers and assessed digital competence. Only a sub-sample of students who were aiming for Bachelor's (BA) and Master's (MA) degrees was included in the analysis, since these sub-groups are similar in size and can be more clearly differentiated into students with and without degrees, something that is not clear from the German state examination, for example.

As expected, MA students reported a higher experience with university e-learning offerings ($M = 4.83$, $SD = 1.84$) than did BA students ($M = 4.33$, $SD = 2.16$; $F(1, 3350) = 50.76$, $p < .001$, $\eta^2 = .02$). There were also significant, albeit weak, differences in both scales of digital literacy. Although both groups of students considered themselves relatively competent, the values among MA students were significantly higher (DTA: $M = 5.00$, $SD = 0.80$; ISB: $M = 5.30$, $SD = 0.86$) than among BA students (DTA: $M = 4.67$, $SD = 0.89$; ISB: $M = 5.03$, $SD = 0.92$; $F(1, 3350) = 116.26$, $p < .001$, $\eta^2 = .03$ and $F(1, 3350) = 72.14$, $p < .001$, $\eta^2 = .02$). No significant differences were found with respect to computer equipment ($F(1, 3350) = 1.72$, $p = .19$).

Gender Differences

In order to investigate possible gender differences, students of non-binary genders were excluded due to the small number of persons identifying as such ($n = 13$ students). Male and female students significantly differed with regard to computer equipment; $F(1, 4707) = 71.40$, $p < .001$, $\eta^2 = .02$. Male students were slightly better equipped with digital devices ($M = 1.81$ devices, $SD = 0.73$) than were female students ($M = 1.63$ devices, $SD = 0.68$). There were no significant differences in the experience of university e-learning offerings ($F(1, 4707) = 1.97$, $p = .16$). However, remarkable differences were found with regard to self-assessed computer skills. Male students rated their digital information sharing skills higher ($M = 5.26$, $SD = 0.88$) than did female students ($M = 4.92$, $SD = 0.95$; $F(1, 4707) = 146.25$, $p < .001$, $\eta^2 = .03$). A strong effect was shown with regard to the use of digital tools in favor of male students ($M = 5.14$, $SD = 0.76$) when compared to female students ($M = 4.38$, $SD = 0.84$; $F(1, 4707) = 957.25$, $p < .001$, $\eta^2 = .17$).

Differences Relative to Subject Groups

To investigate possible subject differences (operationalized via enrolled faculty), a multivariate analysis of variance was performed with faculty affiliation as an independent variable. Across the four variables, significant differences of small effect size were found

(DTA: $F(4, 5481) = 136.14, p < .001, \eta^2 = .09$; ISB: $F(4, 5481) = 40.12, p < .001, \eta^2 = .03$; experience with university e-learning offerings: $F(4, 5481) = 25.40, p < .001, \eta^2 = .02$; computer equipment: $F(4, 5481) = 9.92, p < .001, \eta^2 = .01$). The descriptive values are given in Table 4. Tukey post-hoc tests indicate that for both scales of assessed computer literacy, students from the Faculty of Engineering have higher scores than all other students. Students from the Faculties of Humanities, Social Sciences, and Theology as well as from the Faculty of Medicine have lower scores than do other students ($ps < .01$). Students from the Faculties of Sciences and Business, Economics, and Law have similar self-assessed skills.

Similar effects can be seen regarding computer equipment. Students of the Faculty of Engineering are again best equipped, and significantly better than those of the Faculty of Humanities and the Faculty of Law and Economics ($ps < .05$). Finally, students of the Faculty of Humanities, Social Sciences, and Theology are worse equipped than those of the Faculty of Medicine ($p < .001$).

Deviating from this pattern, results concerning experiences with university e-learning offerings are highest in the Faculty of Business, Economics, and Law ($ps < .001$) and lower in the Faculty of Science than in all other faculties ($ps < .01$) – with the exception of the Faculty of Humanities, Social Sciences, and Theology, where students similarly reported less experience with e-learning.

Table 4.

Descriptive Values of Digital Literacy, Previous E-Learning Experience and Technical Equipment, Separately for the Students of Each Faculty

Faculty	DTA		ISB		E-Learning		Equipment	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Faculty of Humanities, Social Sciences, and Theology	4.43	0.90	4.88	0.97	4.38	2.11	1.62	0.70

Faculty of Sciences	4.68	0.90	5.03	0.93	4.25	1.87	1.69	0.70
Faculty of Business, Economics, and Law	4.61	0.86	5.08	0.92	5.10	1.97	1.69	0.72
Faculty of Engineering	5.09	0.80	5.28	0.88	4.67	1.98	1.77	0.71
Faculty of Medicine	4.34	0.91	4.86	0.93	4.63	2.47	1.77	0.67
Total	4.64	0.91	5.03	0.94	4.62	2.10	1.70	0.70

Due to proven gender differences and unequal gender distributions within the faculties, these analyses were again carried out taking gender into account. All main effects remained, although the effect strengths were somewhat smaller (DTA: $F(4, 4692) = 48.38, p < .001, \eta^2 = .04$; ISB: $F(4, 4692) = 17.90, p < .001, \eta^2 = .02$; experience with university e-learning offerings: $F(4, 4692) = 21.95, p < .001, \eta^2 = .02$; computer equipment: $F(4, 4692) = 8.06, p < .001, \eta^2 = .02$).

Domestic Conditions

With regard to the domestic conditions, it was found that students with at least one additional person in the household also had access to more digital end devices ($M = 6.74, SD = 1.50$ versus $M = 5.99, SD = 1.62$; $F(1, 5500) = 178.68, p < .001, \eta^2 = .03$). For further clarification, the individual equipment characteristics were examined as dependent variables. Here, advantages of multi-person households were shown for terminal devices that can usually be used by several persons like scanners ($F(1, 5516) = 185.52, p < .001, \eta^2 = .03$), printers ($F(1, 5516) = 247.91, p < .001, \eta^2 = .04$) and internet availability ($F(1, 5516) = 72.94, p < .001, \eta^2 = .01$). For all other features, either no significant effects were observed or effects with negligible effect strengths $\eta^2 < .005$ were apparent.

Students with children may face particular challenges due to corona-related school and daycare closures. Significant differences were found with regard to the workplace. While 92% of the students without children had a quiet workplace, this was true for only 64% of the

students with children ($F(1, 5500) = 217.46, p < .001, \eta^2 = .04$). No significant differences were found in PC equipment ($F(1, 5500) < 1$) or in experience with university e-learning offerings, $F(1, 5500) = 2.29, p = .13$. However, students with children considered themselves less digitally competent (DTA: $M = 4.64, SD = 0.91$, ISB: $M = 5.05, SD = 0.93$) than students without children (DTA: $M = 4.49, SD = 0.96$, ISB: $M = 4.69, SD = 1.18$), although these differences were very small; DTA: $F(1, 5500) = 7.32, p = .01, \eta^2 = .00$; ISB: $F(1, 5500) = 33.10, p < .001, \eta^2 = .01$.

Discussion

The present study arose in the context of the radical switch to digital teaching formats exacerbated by the corona pandemic and is of particular relevance due to the very exceptionality of the situation (cf. Kerres, 2020). An important feature of the survey is that, to obtain an inventory that was as unbiased as possible, the study was carried out before the onset of digital classes in the 2020 summer semester. For example, consider that successful or unsuccessful participation in webinars could lead to a change in self-assessed computer skills.

The exhaustion rate of an online survey of approximately 15% is comparable to that of the annual student survey at the university (which is 16.6%; Froebus & Bender, 2019), and to international online surveys in higher education (17.1%; Sax, Gilmartin, & Bryant, 2003). Since the survey is an *additional* survey, the usage rate is satisfactory. For many areas, the sample is comparable to that of the university-wide annual student survey and seems not to be a highly selective sample of students.

Consistent with previous surveys (e.g. Sailer et al., 2018; Zawacki-Richter et al., 2016), almost all students appear to have access to a computer (desktop PC, notebook or tablet PC) and were using it almost every day, even before the onset of the digital semester. These are promising preconditions for the start of a digital semester (RQ1). Still, universities should not leave any student behind, and take account of students without access to technology for participating in an ad-hoc digital semester. Individual computer skills were

rated as rather high, with the ability to share digital information more pronounced than the ability to use different programs (see Rubach & Lazarides, 2019). In addition, the digital semester seems to have implications regarding the number of courses students aim to participate in. Albeit the majority of student plans remain unaltered, some students do seem to reduce while others appear to increase their number of scheduled courses. This indicates that students handle the pandemic and subsequent digital and distance learning situation quite differently.

The correlative analyses indicate an interrelation between equipment features and previous e-learning experiences with self-assessed competence. Although both constructs were surveyed simultaneously and thus, no causal conclusions can be drawn, this can still be interpreted as a possible indication that both the use of technical equipment and the experience gained lead to higher competences (Senkbeil et al., 2019).

Finally, group comparisons were made based on existing subject groups, study experience, gender, and domestic conditions to identify which groups of students start the digital semester well equipped and well prepared (RQ2). Regarding technical equipment, differences were found in line with expectations. Students who lived alone at the start of the semester were not as well equipped as students of multi-person households; this was particularly true for printer, scanner, and internet access. Furthermore, male students seemed to be better equipped with computers than were female students. This may also support the significant faculties differences. Hence, university management and deans of the faculties need to be aware that some groups of students might need to be equipped with devices for digital learning in order to achieve equity in digital distance learning. When comparing the student groups with and without children in need of care, no differences in computer equipment were found. However, students with children were less likely to have an available and quiet workplace, i.e. these students face more difficult study conditions not exclusively attributable to digital teaching (because this is precisely where digital teaching formats could

also have advantages for students with children; see Zawacki-Richter et al., 2016), but rather due to a lack of childcare facilities. This means that even the provision of computer workstations on-site would likely not be of help for these students.

Significant differences regarding student experience with university e-learning offerings were found. Master's students reported more experience than did Bachelor's students; nonetheless, these effects were only of a small size. Male and female students did not differ in terms of their e-learning experience. That is, female and male students were used to the same amount of e-learning applications provided by the university (e.g. live votings, e-exams). However, it appears that there have been different subject cultures in the provision of digital courses thus far; for example, students from the Faculty of Business, Economics, and Law reported more experience. This finding is in line with Weber et al.'s (2018) study showing that students of the humanities especially, display traditional information behavior (i.e., going to the library).

Furthermore, significant differences in self-assessed digital competencies were found. Master's students attributed to themselves higher competencies compared to Bachelor's students, which is consistent with the pattern of results of *actual* measured competencies (Senkbeil et al., 2019). That is, the completion of a Bachelor degree seems to go in line with the acquisition of skills for digital learning as key competencies. Furthermore, students of the Faculty of Engineering reported higher computer skills compared to other subject groups. Hence, assuming that self-reported skills correlate with actual competencies, students enrolled in specific faculties might need training to achieve ICT literacy. Particularly with regard to the use of digital applications, considerable gender differences were found to the disadvantage of female students, which is in agreement with results regarding computer self-concept (Lim, 2001). The course of the semester will show to what extent digital competences or a lack thereof will affect the experience of online learning with regard to social interaction with fellow students (Muilenburg & Berge, 2005).

Limitations

Although the composition of the sample does reflect the university faculties well and is similar to that of the annual student survey, it cannot be completely ruled out that the participants represent a selective sample. Furthermore, even if this should only be the case for a few students, it should also be taken into account that students without home internet access likely had no opportunity to participate in the survey due to inaugural restrictions. Finally, the results refer to only one university and do not provide detailed information on individual courses of study, migration background (allegedly, about 14% of students in Germany are students with migration background; see Statistisches Bundesamt, 2019), or socioeconomic status.

With regard to the questions and measuring instruments used, the survey was planned as economical as possible (Saleh & Bista, 2017). Accordingly, digital competences were not recorded on the basis of a detailed competence test (cf. Senkbeil et al., 2019), but rather on two selected scales of self-assessed digital competence. Furthermore, the acceptance of digital media as a possibly important variable for the use of digital media had not been assessed and might produce different results across faculties (Stephan et al., 2019; Venkatesh & Bala, 2008).

Conclusion

The current study provides important insight into study conditions and skills for digital learning in the onset of an ad-hoc digital semester and in the context of the corona pandemic. The study is of relevance because it underscores the circumstances imposed upon students at the beginning of the 2020 summer semester. The survey provides important observations of student groups that need special support, in particular—either through courses on the use of digital media or through the consideration of their individual study situation, like one in which supplemental childcare is lacking or altogether absent.

In addition to this stocktaking, a continuous and process-oriented investigation of the study conditions in this exceptional semester is required. That is, what (additional) resources are used by students during the semester; how do students develop computer skills; and what are the consequences of (sudden) digitalization in terms of student engagement (Bond et al., 2020) or student achievement. Hence, in addition to the reported survey taking place before the semester began, we will implement further online questionnaires that investigate digital learning during and after the semester.

When interpreting results, consider that the starting position of students enrolled in a university level, 2020 summer semester is completely different than that of students who have consciously chosen digital (distance) studies. Similarly, digital teaching formats that were developed within a few weeks cannot be compared with established digital or blended learning formats that have been planned by expert committees for the long term (cf. Hetzner & Schmidt, 2018; Kerres, 2020; Moskal et al., 2013). Nonetheless, the distance learning experiences brought about by the corona pandemic might contribute to a stronger and more equitable foundation for digital learning services in the long term.

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